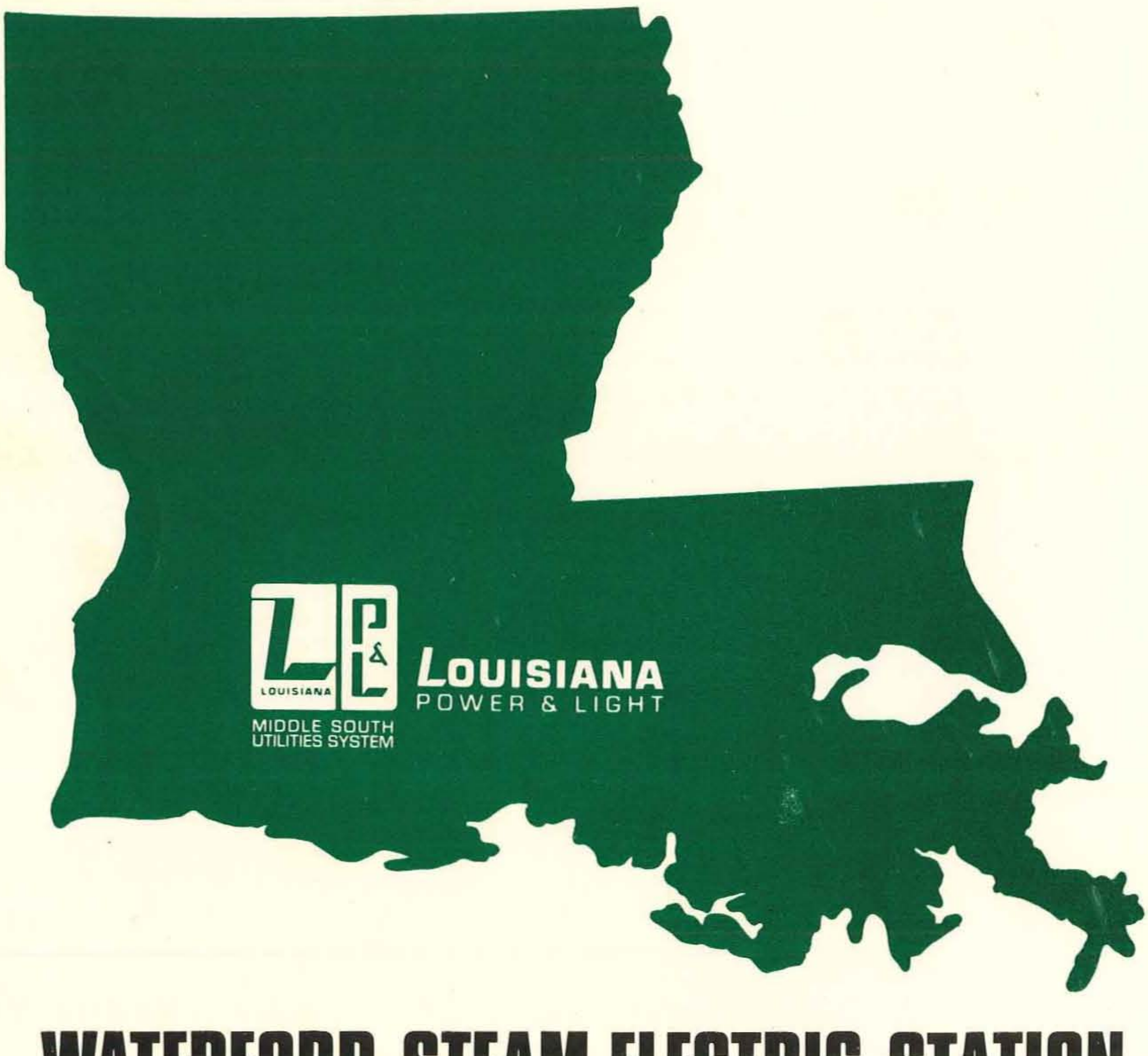
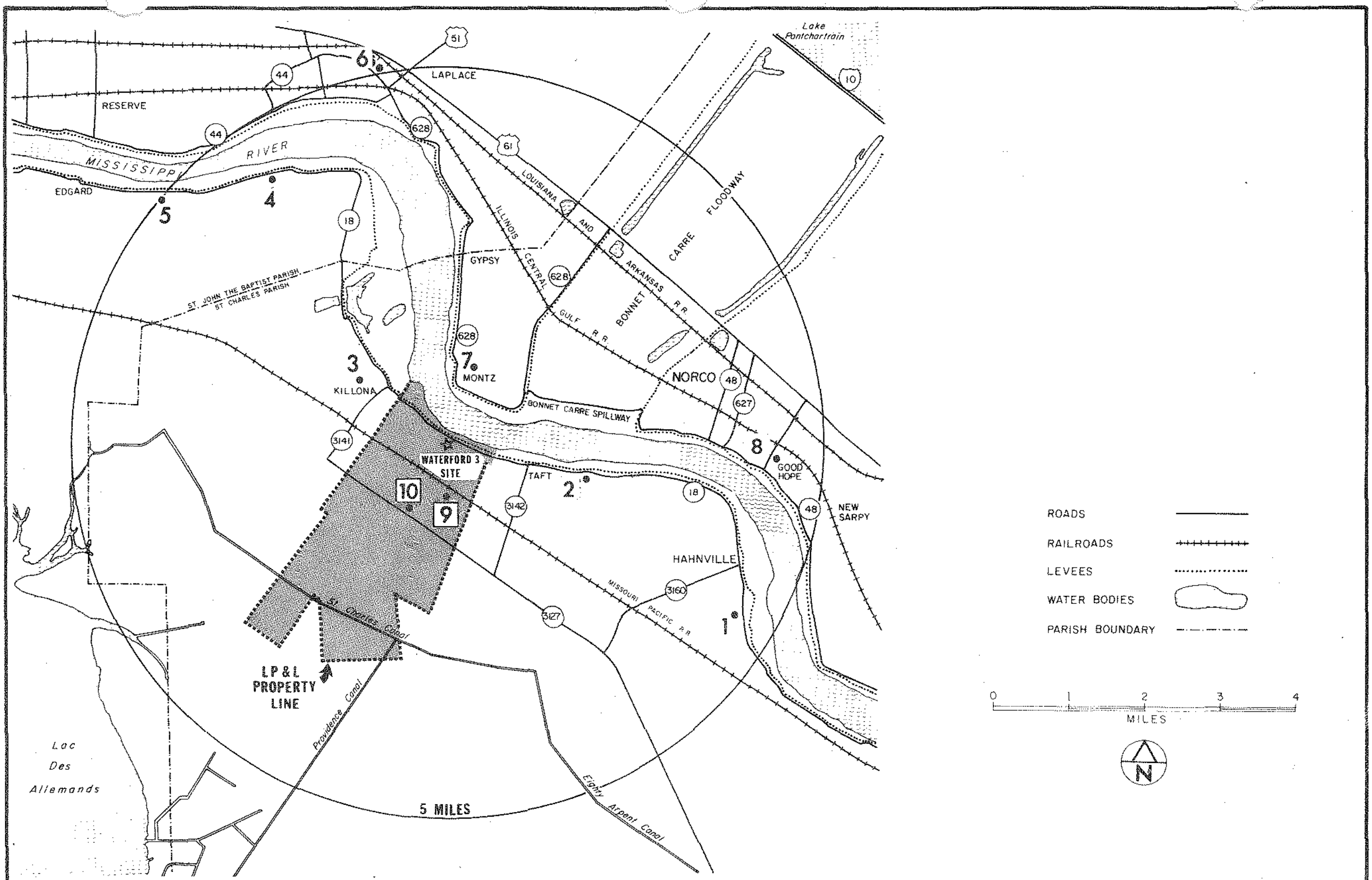
LOUISIANA POWER & LIGHT

Environmental Report
Operating License Stage



WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

VOLUME 1



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LOUISIANA POWER & LIGHT

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WATERFORD STEAM ELECTRIC STATION

UNIT NO. 3

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1.1 SYSTEM DEMAND AND RELIABILITY

1.1.1 INTRODUCTION

In 1970, the applicant, Louisiana Power & Light Company (LP&L), determined that additional electric generating capacity would be needed to meet its forecast 1977 peak system load. In order to satisfy this need, LP&L announced plans, in September 1970, to construct a nuclear generating station. The station, named Waterford Steam Electric Generating Station Unit No. 3, and called Waterford 3 in this report, is located on the Mississippi River in St Charles Parish, near Taft Louisiana. In 1972 LP&L prepared a Construction Permit Environmental Report (CP-ER) as part of its application to the Nuclear Regulatory Commission for the construction permit. NRC granted LP&L a construction permit (NRC Docket No. 50-382) for Waterford 3 in November, 1974. 2

LP&L has now prepared this Environmental Report as part of an application to the Nuclear Regulatory Commission for an Operating License for Waterford 3. The granting of a Construction Permit approved both the site location and the basic station design, on the basis of safety criteria and environmental considerations and granted permission to proceed with construction, which LP&L promptly did. In comparison, the analysis conducted for the operating license, contained in this report, recognizes the completion of these earlier decisions. Therefore, at this stage of construction (more than 80% complete), the analysis herein addresses only the need for a timely operation of Waterford 3.

1.1.1.1 Louisiana Power & Light Company

LP&L is an investor-owned utility serving large portions of Northern and Southeastern Louisiana. LP&L supplies electric service to meet the needs of its approximately 500,000 customers (approximately 1,345,000 people as of January 1, 1978) within an area of approximately 19,500 square miles located in 46 of Louisiana's 64 parishes (counties). Figure 1.1-1 shows the area served by LP&L.

LP&L is an operating subsidiary of Middle South Utilities, Inc. (MSU), a
holding company which owns three other operating companies; a service company, 3
Middle South Services, Inc. (MSS); and an electric generating company, Middle South Energy, Inc. (MSEI). MSEI owns the Grand Gulf Nuclear Station (NRC Docket Nos. 50-416 and 50-417). The four operating companies are Arkansas Power & Light Company (AP&L), Louisiana Power & Light Company (LP&L) Mississippi Power & Light Company (MP&L), and New Orleans Public Service Inc. (NOPSI). Figure 1.1-2 shows a map of the MSU System.

The four operating companies have provided power generation and transmission 3
facilities as an integrated electrical system for more than forty years. These four companies also own a fuel management company, System Fuels, Inc.

Louisiana Power & Light Company, together with the other three Middle South 3
operating companies, are members of the Southwest Power Pool (SWPP).

Figure 1.1-3 shows the SWPP facilities. The forty-one entities who are members of the SWPP are listed in Table 1.1-1. The SWPP is one of the councils of the National Electric Reliability Council and provides for coordination and planning among its members and for the setting of minimum standards to assure a high degree of reliability of electric service. LP&L is also a member of the South Central Electric Companies (SCEC), an eleven member utility group organized for the purpose of exchanging diversity power with the Tennessee Valley Authority (TVA).

1.1.2 DEMAND PROJECTIONS

1.1.2.1 Background

The late 1960's and the early 1970's was the period during which LP&L undertook the planning for the construction and operation of Waterford 3. Over this period - culminating in the receipt of the Construction Permit in November, 1974 - the planning bases used were substantially different than towards the end of the 1970's.

Prior to the recession period of the early 1970's, the load growth in the LP&L system exceeded 10 percent per year. The primary boiler fuel in LP&L's system was natural gas and long term natural gas contracts were negotiated for each new power generating unit. During this period, the construction time for large generating units was typically less than 5 years.

These planning factors were such that in Amendment No. 2 to the Waterford 3 Construction Permit Environmental Report, dated August, 1972, LP&L noted that "Waterford 3 was scheduled for commercial operation in January, 1977 to provide the generating capacity to meet the projected increase in demand". 2

During the intervening years of construction since this demand projection was made, much has changed with respect to the availability and prices of fuels employed in the production of electricity, the growth in power demand, the prevailing economic conditions and the construction period for new power generating stations. For example, during the period 1973 to 1975, the annual growth in power demand decreased to 6 percent. This decrease was probably due to the economic recession in the area which LP&L serves and the nation as a whole. For the years 1976 and 1977, the annual growth in demand within the LP&L system was once again 10 percent. In addition, during these years the construction period for large power plants jumped to approximately 10 years and long term natural gas contracts were very difficult to obtain. Over the same period, the price of fuel oil increased at a very rapid pace. These factors became increasingly influential to predictions of power demand, and consequently to the method LP&L and MSU used to forecast demand.

1.1.2.2 Former Methodology for Demand Forecast

During the period in which LP&L was initially planning Waterford 3's construction and operation, LP&L's methodology for developing the peak forecast included the following steps: An energy forecast was developed from the individual forecasts of the industrial, residential, and commercial sections of LP&L's Consumer Service Department. The energy forecasts were

developed by the managers of each of these sections based on their knowledge of past history and their judgement of the growth potential of the area LP&L serves. To their forecasts were added system losses in order to project a total internal kWh sales for LP&L. An estimate of the future annual load factors for LP&L was then developed based on LP&L's judgment of the potential in the area it serves and the social and economic conditions which would prevail during the period being estimated. These load factors were then used to convert the energy forecasts into peak demand estimates. The estimates were based on average weather conditions with the assumption that if normal weather conditions prevailed, the estimate would be accurate. Table 1.1-2 compares the forecast estimate with the actual maximum load which occurred in the years 1966-1978. In general, this forecasting methodology proved to be 3
very effective in predicting future load energy requirements for LP&L during this period, particularly during more stable economic conditions.

At the time of the initial submittal of this OLER i.e. September 1978, the peak power demand was again forecasted. This forecast utilized the methodology described above taking into consideration the economic recession of the mid-1970's and indicated that there existed a need for the power generating capacity to be supplied by Waterford 3 in the summer of 1982. (As a result of NRC licensing delays and construction schedule modifications, Waterford 3 is now planned to be available for the summer peak power demand period of 1983).

It was becoming clear to LP&L and MSU that this forecasting methodology was quite limited in its ability to incorporate an increasingly complex economic and social environment in the prediction of electrical energy requirements. Developments such as the 1974 and 1979 oil price increases and ensuing economic downturns indicated that other forecasting methodologies would be necessary to predict future energy requirements under unstable conditions. In order to account for these conditions, LP&L developed jointly with Data Resources Incorporated and Middle South Services a new econometric based load 2
forecasting system. This forecasting system is described in detail in the following section.

1.1.2.3 Present Methodology for Demand Projection

In order to accurately forecast peak power demands for the economic conditions which have evolved since the mid-1970's, LP&L has refined their forecast methodology and developed an econometric model. The model is comprised of a set of analytical and structural models designed to provide a forecast of megawatt hour (MWH) consumption by class of service and megawatt peak demand. Three models comprise the system. The first is an economic and demographic model of the area LP&L services; the product of this model is an outlook for the local economy. The second is a set of model components that translate the outlook for the economy, assumptions concerning local weather conditions, energy prices, energy supply constraints and technological factors, into the expected future consumption of electricity by the major user classes: residential, commercial, industrial and other. The third model within the system calculates the expected peak demand based on the contribution to peak demand of the weather sensitive components and the base load requirements of the user classes.

The parameters of these structural models are determined both through the use of econometric techniques and by incorporating the results of engineering studies and surveys of the different customer classes. The predominant econometric technique utilized is ordinary least squares regression.

A forecast is obtained from the LP&L Load Forecasting System in the following manner: First, the necessary input assumptions on the U.S. macro-economic outlook, local weather conditons, energy prices, energy supply and technological factors are developed. These assumptions are reviewed for consistency. Second, the load forecasting system is solved based upon these inputs. Next the output of each of the model components is reviewed. Finally, the output is adjusted to account for effects to the model's equations from factors not having sufficient historic information to form a basis to mathematically project their future influence. In all cases, judgement and information available through field surveys, engineering studies, and other exongenous studies are incorporated into the final forecast. Thus the forecast is not simply an extrapolation of the econometric equations in the system. The forecast is based on all relevant information at hand.

The system is designed to provide LP&L with the necessary means to undertake a structural analysis of the area it serves and its future load requirements. The structural approach is considered crucial in analyzing these future requirements. It allows the forecaster to identify the underlying determinants and assess their future impact on load within a consistent and systematic framework. For example, the model identifies the current and future saturation of major residential appliances within the service area. It identifies the impact of the growth in per capita income, prices, etc. on these saturations. At the same time the system realizes that a maximum saturation (100%) exists. Thus by explicitly identifying these end-uses and 2
their growth limits, the model properly accounts for the fact that once saturated, the impact of these applicances on residential usage per customer is limited. It is this structural design that provides the user with a well defined tool for forecasting analysis.

A detailed description of the model is contained in Appendix 1-2 of this document.

1.1.2.3 Other Considerations in Assessing Demand Forecasts and the Scheduling of Commercial Operation

Information concerning the demand projection methodology and its forecast has been included in this document for purposes of information and to satisfy the format requirements of NRC Regulatory Guide 4.2, Revision 2. In the case of Waterford 3, the demand forecast done in the early 1970's was the basis of scheduling construction and operation.

Once the Construction Permit was approved in 1974 and construction initiated, the feasibility and economics of the construction schedule and process, as well as the external influence of procedures for operating license approval, are the significant factors affecting the date of commercial operation. Therefore, in this Operating License Environmental Report, the focus of the analysis in this chapter is the benefits that would be derived from the timely operation of Waterford 3.

1.1.3 BENEFITS OF THE OPERATION OF WATERFORD 3

This section describes the advantages that will accrue to LP&L's customers by the timely operation of Waterford 3. These result directly from the provision of 1104 MWe (net) to the areas served by LP&L and MSU from this nuclear fueled station, and can be categorized into two types: cost savings to LP&L ratepayers, and an increase in the system reliability through generating capacity availability from using an alternative fuel.

1.1.3.1 Economic Advantages of the Operation of Waterford 3

Since all of LP&L's presently available generating capacity utilizes either oil or natural gas and because the cost of these fuels has increased significantly since Waterford 3 was first planned, and is expected to continue to increase into the 1980's and beyond, it can be shown that a primary benefit of a 1983 commercial operation date of Waterford 3 will be a very substantial economic gain to LP&L's customers in the form of reduced fuel expense. LP&L, as a part of the MSU System, operates under economic dispatch, so that the delivered incremental cost of all energy sources, whether generated or purchased, is as low as posible for each hour. This policy will allow a reduction of the use of generation dependent on high cost gas and fuel oil, by relying on the nuclear-fueled Waterford 3.

The resultant cost savings to LP&L's customers is a benefit of Waterford 3 which can be quantified over the first ten years of operation. This period is considered a sufficient time period for the complete impact on customer bills to take effect. 2

LP&L has performed a revenue requirements analysis which deomonstrates this savings to their customers. This analysis also demonstrates the change in revenue requirements (i.e. the amount of money LP&L's customers must pay through their monthly bills) under various scenarios of the commercial operation date for Waterford 3. This unit is expected to be operational in 1983. An economic analysis of all the costs and benefits associated with a forced rescheduling of this operational date has three components which would impact customer bills. These components are as follows:

1) Capacity equalization charges which LP&L pays to other MSU companies;

2) The reduction in fuel expense by utilizing the nuclear-fueled Waterford 3 in lieu of more costly gas and oil resources; and

3) The revenue requirement to provide a rate of return on the Waterford 3 plant when it enters LP&L's rate base.

The revenue requirement component is a cost increase to LP&L's customers; however, this is greatly offset by savings in capacity equalization charges and fuel expenses. If the plant is delayed from operating for 24 months, the following economic benefit of the net effect of the three components on revenue requirements cannot be realized:

Capacity equalization charge savings:	$102,496,000
Fuel cost savings:	450,488,000
Return on rate base	-20,120,000
TOTAL CUSTOMER SAVINGS:	$532,864,000

Thus, over the ten year period, LP&L's customers would save $532,864,000 if the plant were in commercial operation in early 1983 instead of early 1985. 3

If the operation of Waterford 3 were delayed six months (i.e. until later in 1983) the additional revenue requirements for the ten year period (1983 to 1992) would be $201,635,000. If the operation of Waterford 3 was delayed by one year, (i.e. until early 1984) the additional revenue requirements would be $245,130,000. Both of these estimates are based on an analysis of the impact of the three components on revenue requirements discussed previously.

The origin of this savings can be shown in more detail by comparison of the cost of fuels that LP&L and MSU will utilize for each kilowatt-hour of electricity generated.

In the past, LP&L has been able to obtain long term natural gas contracts at relatively low cost because natural gas supplies were more abundant and the cost for this fuel was relatively low. Such long term contracts are no longer available to LP&L. In addition, since most of the contracts which LP&L presently holds are going to expire in the 1980's, gas will no longer be the cheap energy source that it was previously. Additional gas is sometimes available under short term contracts, but this gas is priced at the oil equivalent price and cannot be considered a reliable supply. This is emphasized by noting that, based on present contracts from 1980 through 1985, 2
1600 MW of capacity will be fueled by long term gas contracts. In 1986 this capacity drops to 750 MW and in 1988 it further diminishes to 650 MW. This decreasing capacity must be replaced by capacity using another fuel, or natural gas under short term contract, if it is available for the interim until 1990. After 1990, use of natural gas in these power stations will be prohibited pursuant to the Power Plant and Industrial Fuel Use Act of 1978.

Due to the limited availability of natural gas at costs other than the oil equivalent costs, a forecast of fuel costs at LP&L's stations during the

1980's would essentially be limited to the cost of oil and nuclear fuel as follows:

ESTIMATED FUEL COST TO LP&L (MILLS/KWH)

YEAR	#6 Oil	Nuclear Fuel
1980	30.74	-
1983	63.7	10.0
1986	94.4	7.7
1989	141.0	12.5

The fuel cost savings of nuclear fuel over oil (or natural gas at the oil equivalent price) are obvious from this analysis. The timely commercial operation of Waterford 3 will greatly reduce the need for costly oil and natural gas generation and allow for substantial economic benefits to the LP&L ratepayers. It is this difference in fuel costs which, if a 24-month delay in operation is avoided, will accumulate into a $450 million savings over the 10 year period 1983 to 1992. 3

1.1.3.2 System Reliability Advantages of the Operation of Waterford 3

During the 1977 peak demand period, 92 percent of the MSU System generating capacity was fueled by natural gas and/or fuel oil. By the 1983 peak period, the MSU System and LP&L will have approximately 67 percent and 80 percent, respectively, of their generating capacity fueled by natural gas or oil. The latter figure of 80 percent utilization of gas or oil by LP&L includes the contribution of the nuclear-fueled Waterford 3 to the LP&L system, showing that Waterford 3 is the first generating capacity to be added to the LP&L system which is not fueled by natural gas or oil.

The capacities of the oil- and gas-fired units will, in the future, become increasingly more suitable for intermediate and peaking operation and less suitable for base load operation, due to fuel supply curtailment and rapidly escalating costs. The growing severity of this situation requires the addition of Waterford 3, as base load capacity, to the LP&L's system as soon as it is available and licensed for commercial operation. 2

The timely operation of Waterford 3 would thus not only provide for this more efficient and reliable fuel mixture, but also a reduction in the use of scarce natural gas as encouraged by the Power Plant and Industrial Fuel Use Act of 1978. Furthermore, this act also includes statutory prohibitions against the use of natural gas by existing generating stations as a primary energy source after January 1, 1990. This prohibition, in addition to the continually diminishing ability (throughout the 1980's) of LP&L to secure long term contractual purchases of natural gas, adds to the demonstration that Waterford 3 will bring to the LP&L system a fuel type for base load capacity which is clearly needed. Therefore, the addition of Waterford 3 to LP&L's system as soon as it is available for commercial operation will be a substantial improvement in the fuel mix which now exists, and, consequently, will be a significant improvement to the reliability of the service to LP&L's customers.

The operation of Waterford 3 will also provide an advantage through the addition of substantial capacity to the LP&L system, and, consequently a substantial increase in the reserve capacity within the system. As the requirements for system planning have changed through the 1970's - as reflected, for example, in the development of a new forecasting methodology, explained in Section 1.1.2 above - several factors have encouraged the increasing of system reserves thereby improving system operating economies through the development of large reserve margins than traditionally needed. The operation of Waterford 3 on schedule will offer this advantage to the LP&L and MSU Systems.

1.1.4 RESERVE MARGINS

1.1.4.1 Introduction

Ensuring a reliable electric supply requires that an adequate amount of generation is provided, that an adequate supply of fuel exists, and that sufficiently strong interconnections are made with other utilities. An adequate amount of generation consists of: 1) the amount necessary to supply the peak load, 2) a margin of reserve above the peak to offset generating unit forced outages and deratings, unit maintenance, and load forecast error and 3) a diversification of generating units. The assurance of an adequate fuel supply depends on provision of a mix of generation sufficiently diversified by fuel type to ensure minimal discontinuance of service if the supply of any fuel is interrupted, unavailable, or excessively expensive for a period of time. Addition of the nuclear fueled Waterford 3 to LP&L's system will add approximately 20 percent capacity of a new fuel type to the system. Section 1.1.3.2 describes this advantage in detail. 2

1.1.4.2 Changes in Reserve Margin Criteria

The uncertainties associated with the accurage predictions oif the factors used in the demand forecast and planning process has impacted LP&L's ability to forecast the electrical requirements of its customers. This uncertainty is composed of both statistical variance associated with econometric models, as well as uncertainty regarding the future prices and availability of fossil fuels.

In a recently prepared report for the Electric Power Reserarch Institute (1) (EPRI) it was concluded that:

- "Low reserve margins are usually more costly than high reserve margins"

- "Demand uncertainty justifies higher planning reserve margins for many utilities"

- "A utility that needs to replace uneconomic capacity should use a relatively high planning reserve margin"

These three conclusions (among others in the study) were based on a case study of three utilities to determine the impact on cost of various levels of capacity.

The first conclusion from the study regarding the higher cost of low reserve margins is a result of the fact that the lower the reserve margin the greater the probability of an outage and also the greater the probability of using high cost generation. It was estimated that the combined costs of outages and the increased use of high cost oil or gas generation "resulting from insufficient capacity tends to outweigh smaller increases in the cost of electricity that results from the fixed costs of excess capacity".

The second conclusion of this study, that demand uncertainty justifies higher reserve margins, comes about as a result of the finding that low reserve margins are more costly to consumers than higher reserve margins. Demand uncertainty results in a potential for reserve margins to be higher or lower than those forecasted as needed. Therefore, it is prudent to plan for higher reserve margins because this can result in lower costs. Since the economic factors which influence energy demand have been highly unpredictable in recent 2
years, it is warranted to assume that forecasts will also possess a similar degree of uncertainty. Thus LP&L is prudent to plan for higher reserve margins as long as demand uncertainty is likely to be great.

Similarly, the last point also applies to LP&L. Study findings suggested that for utilities with a high percentage of "gas- or oil-fired base and intermediate load capacity, the installation of coal or nuclear baseload capacity will decrease greatly total future costs". The conclusion goes on to suggest that these utilities should consider increasing their planning reserve margins in the short term if, by doing so, it permits an accelerated replacement of uneconomic gas and oil fired capacity in base load operations.

This situation is identical to the current generation environment at LP&L. A timely commercial operation of Waterford 3 will greatly reduce future cost and ensure greater system reliability.

Based on the three test cases, the EPRI study found that least cost reserve margins could range from 20 to 40 percent, depending on fuel cost escalation rates and the percentage of oil- and gas-fired generation. Both of these factors are relevant to LP&L, as discussed above.

MSU, with the participation of LP&L, is presently assessing the adequacy and effectiveness of the reserve margin criteria, now in place, which has historically been utilized for the last two decades. To overcome some of the problems discussed in the EPRI study, as well as the accounting for the increasingly lengthy lead time needed for constructing and licensing new generating stations, it has been recommended to MSU that the presently used reserve margin criteria be substantially increased.

Nevertheless, for format compliance to Regulatory Guide 4.2 Revision 2, the presently utilized reserve margin criteria is included herein. 2

1.1.4.3 LP&L's Present Reserve Margin Criteria

LP&L, along with the three other operating companies of the MSU System, plan 3
their generation and transmission jointly, according to the "Criteria for Planning, Operation and Designing" of the MSU System. Criteria pertinent to generation planning are as follows:

1) Generation Capacity

"Planning of capacity additions must provide that the total generating capacity available to the Middle South System shall be such as to exceed the predicted annual peak load responsibility by an amount equal to the largest of:

(a) 25 percent of the annual peak responsiblity, or 3

(b) The sum of the capability of the largest generating unit and one-half of the capability of the next larger unit".

The method used is further described in Section II, page 3 of the same publication as follows:

"1) The loss of load probability method of calculating the probability of load exceeding available capacity shall be used as a guide for the comparison of the reliability of alternative expansion plans. The method shall include consideration of uncertainty in prediction of load and shall employ the best available statistical data on generator characteristics, including forced outage rates. The method will also consider hour-by-hour characterisitics of the load, availability of quick-start generation and effects of interconnections and agreement with neighboring systems.

2) The maximum capability assigned to any generating unit shall be that which has been demonstrated by actual test under the most adverse conditions that might exist during the loading period being considered. And further, there shall be no greater dependence upon interconnections with adjacent areas that is agreed to by said areas or is deemed prudent by good engineering judgment."

1.1.4.4 Method of Scheduling Maintenance Outages

Planned and unplanned outages of generating units are factors that must be considered in the planning for system reliability through adequate reserve margins. Planned outages for unit maintenance can be properly scheduled to minimize adverse effects to system reliability. 2

LP&L has a planned maintenance schedule well into the future for each of its generating units. These planned schedules are based on manufacturers' recommendations, unit history, and State of Louisiana requirements for inspection of fired pressure vessels. They could occur concurrently with unit modifications. LP&L, as well as the MSU System, experiences a drop in peak demand during the fall, winter, and spring months, while the largest peak demand occurs in the summer. At present, the scheduled outages occur in the fall, winter and spring months as based on the MSU System generating capacity requirements and reserve margins and as reflected by the load requirements of LP&L customers.

The procedure for preparing a planned maintenance schedule for the MSU System for a particular year is as follows: during the summer, LP&L proposes outage schedules for the fall of the same year through the spring of the following year for each of the generating units in LP&L's system. Similar schedules are proposed by each of the other operating companies of the MSU Systems and are submitted to the MSU System's Operations Center for review and coordination. Any changes to the proposed LP&L schedule are coordinated by LP&L with the superintendents of the generating stations involved. The MSU System's proposed scheule is then coordinated with the other members of SWPP. A final approved schedule for the entire MSU System is then sent to each of the MSU System operating companies by the MSU System's Operations Center.

It should be noted that the planning of maintenance is a dynamic activity and any planned schedule must be flexible enough to account for unplanned occurrences as much as it is possible to do so.

1.1.4.5 Effect of Interconnections of Reserves

The primary effect of interconnections is to maintain a high degree of bulk power system reliability by providing stability during transitory conditions and emergency assistance during capacity shortages. This allows LP&L and the MSU System to optimize its reserves and intall less capacity than would be required if there were no interconnections. Future interconnections will be made when required and when they are mutually advantageous to both parties.

1.1.4.6 Additional Factors Affecting Reserves

1.1.4.6.1 Increased Forced Outage Rates and Reduced Unit Capability

Several additional factors, whose aggregate effects cannot be entirely known, could also limit the availability of installed capacity, thus further affecting the reserve margin and the cost of electricity to LP&L's customers. In addition to these factors discussed in Section 1.1.1.2, the following points must be considered.

1) Increased Outage Rates

a) Increased forced outage rates are experienced when using oil in generating plants designed primarily for natural gas fuel;

b) Forced outage rates are generally higher on newly installed units. Because of the number of large units going on line in the MSU System in the early 1980's, this factor could become important; and

c) Increased forced outage rates are experienced when operating gas turbines continuously at outputs near maximum ratings.

2) Reduced Unit Capability

a) Because of the original design for natural gas, the capability of many boiler units is reduced when burning oil;

b) Even if fuel is available, its quality and grade may not be that for which the unit was designed to best utilize. This could have a deleterious effect on unit efficiency and capacity; and

c) Reductions to conform to environmental restrictions

1.1.4.6.2 Effects of Energy Conservation

The effects of energy conservation by LP&L customers are becoming increasingly important factors to incorporate into future peak demand and energy need forecasting and are therefore important in the consideration of the available system reserve. LP&L is active in both conserving energy and promoting energy conservation by its customers. 2

The LP&L efforts include, but are not limited to, curtailment of nonessential loads within generating plants and offices, appeals to the general public to use electricity in a wise and efficient manner, and encouragement of the use of efficiciency-promoting techniques and programs.

1) Efficiency of Production

With regard to efficiency of production, LP&L, as part of the MSU System, operates under economic dispatch so that the delivered incremental cost of all energy sources, whether generated or purchased, is as low as possible for each hour. The MSU System continually strives to operate in the most efficient manner. For 2 example, the exchange of capacity (diversity exchange) between the MSU System and the Tennessee Valley Authority (TVA) allows the MSU System to provide capacity and energy to TVA in the winter, which TVA returns in the summer. The MSU System and TVA are summer and winter peaking systems, respectively.

2) Consumer Education and Promotion of Conservation

Appeals to the general public to conserve energy have been conducted by LP&L for many years through its advertising and consumer education programs. Long before there was general recognition of the value of energy conservation, LP&L was promoting home insulation standards which exceeded both the generally accepted residential construction standards for the time and the requirements of the Veterans Administration and Federal Housing Administration.

LP&L promotes conservation through advertisements on television weather shows, radio commercials, newspaper advertisements, monthly bill insert messages, truck posters on LP&L vehicles, the Consumer Energy Team (from LP&L's Spleaker Bureau), and brochures for customer distribution and the "Energy Today & Tomorrow" program.

LP&L's Consumer Energy Team was formed in 1974 to help bring the importance of energy conservation to its customers. Team members speak to community organizations on a variety of subjects, including the necessity for, and various means of, conserving energy. Company promotion of the Energy Efficient Electric Home informs customers that through improved thermal control, cooling and heating requirements can be reduced as much as 50 percent. LP&L has prepared and distributed to customers many brochures dealing with tips on saving energy. Conservation is emphasized in the "Energy Today & Tommorrow" program which is presented to high school students throughout the area. This program, which has gained significant local - and some national - press coverage, is sponsored by LP&L and other utilities in Louisiana, and is administered through the University of New Orleans. LP&L's home economists work on energy conservation topics with high school economics teachers and students, homemakers' clubs and individual consumers in an effort to help customers use electric energy more efficiently. Company representatives who contact commercial and industrial customers encourage these customers to implement energy management programs.

Appendix 1-1 is a copy of the report supplied on November 29, 1973 to the Federal Power Commission in accordance with FPC Order 496. This report contains specific steps undertaken by LP&L to effect reduction in the consumption of electric energy.

3) Load Management for Conservation

LP&L utilizes a two-tier approach to load management and conservation. At the system level, a task force, composed of representatives of all companies, has been active for nearly two years in studying methods of load management to effect conservation. One basic premise is improving the efficiency of utilization of electric energy.

The second tier approach is conducted by LP&L, which is actively promoting the heat pumps and the energy efficient home for all new construction in the area LP&L serves. LP&L has engaged Tulane University to make a comprehensive study on heat pumps. A test program involving ten installations utilizing the waste heat from air conditioning to help in water heating is underway and a retrofit insulation program has been introduced. Furthermore, as part of this approach, LP&L consumer service representatives are continually counseling residential, commericial and industrial customers on methods to more efficiently use electric service.

1.1.4.7 Conclusion

The commercial operation of Waterford 3 at the start of 1983 will bring several advantages to LP&L's customers through system reliability and economic benefits. Waterford 3's operation follows a period when there have been numerous factors afecting the traditional bases for system reliability planning including the establishment of reserve margin criteria. These factors originating from fuel mix, unit size, economics, interconnections, and energy conservation, have caused increasing uncertainty in the accuracy of system planning and the adequacy of the established reserve margins. The substantial increase in the reserve margin by the addition of Waterford 3 to the LP&L and MSU system, as described in the following section, will be of great importance in assuring a sufficiently large reserve margin to ensure that these uncertainties are overcome. 2

1.1.5 LOAD CHARACTERISTICS AND SYSTEM CAPACITY

1.1.5.1 Load Characteristics

1.1.5.1.1 Louisiana Power & Light's System

A summary of LP&L's maximum hourly loads, net energy requirements and owned capabilities for the years 1965 through 1980 is shown in Table 1.1-3. During these years, LP&L's peak hourly load, growing at an average annual rate of approximately 10.4 percent, has risen from 942 megawatts to 4078 megawatts. The peak hourly loads for 1980 include the loss of 300 megawatts in Rural Electric Cooperative peak load. Table 1.1-4 presents LP&L's projected maximum hourly load and energy requirements for the period 1981 through 1986. Projections of future customer peak demands, as of May, 1981, indicate peak demand in 1982 of 4356 megawatts. The average projected increase in peak demand is approximately 4.7 percent per year for the period 1981-1986. 3

It should be noted that peak hourly load must be adjusted by firm purchases and sales to determine peak load responsibility, upon which reserve margins are calculated. The net adjustment, however, is generally small. The projected annual increase in net energy requirements is approximately 5.2 percent for the period 1981-1986.

1.1.5.1.2 Middle South Utilities' System

A summary of the MSU System's maximum hourly loads, net energy requirements and owned capabilities for the year 1965 through 1980 is shown in Table 1.1-5. During this period, the maximum hourly load for the entire MSU System has grown at an average annual rate of approximately 8.0 percent. The net energy requirements for the MSU System have grown at an average annual rate of approximately 7.8 percent during the same fifteen year period. Table 1.1-6 presents the MSU System's projected maximum hourly load and energy requirements for the period 1981-1986. Through 1986 the MSU System's net energy requirements are expected to grow at an average annual rate of approximately 4.3 percent. 3

The owned capabilities and maximum hourly loads for both LP&L and the MSU System are graphically depicted in Figure 1.1-4, which indicates the relationship of the MSU System reserve margin to the timely operation of Waterford 3. This relationship is also shown in Table 1.1-6. With Waterford 3 and the Grand Gulf Nuclear Station (scheduled to start operation in November 1982) operating, the reserve margins for LP&L and the MSU System would be 47.8 percent in 1983, 38.7 percent in 1984 and 36.1 percent in 1985. Should Waterford 3's and Grand Gulf's capacity not be available, reserve margins would fall to 27.4 percent in 1983, 19.3 percent in 1984, and 17.5 percent in 1985.

1.1.5.1.3 Southwest Power Pool's System

The average annual percentage growth in maximum hourly load for the Southwest Power Pool has been approximately 8.0 percent for the yers 1965 through 1979. Future maximum hourly load growth is projected at 4.1 percent annually from 1981 through 1986. A summary of SWPP's historical and projected load and capability is shown in Table 1.1-7.

1.1.5.1.4 Monthly Load Analysis

Tables 1.1-8 and 1.1-9 contain the forecasts of LP&L's and the MSU System's monthly loads and capability, respectively, for the period 1982-1984. This period includes the first year of operation for Waterford 3. Monthly information is not available for the year 1982 from the Southwest Power Pool; however, the historical monthly patterns for this group are similar to those experienced by the LP&L and the MSU System. This has been particularly true during times of extreme maximum loads, thus precluding plans for exchange of diversity power within the group during peak periods. For example, during the years 1969 through 1973, diversity between non-coincident and coincident peak loads in the Southwest Power Pool averaged less than 1.7 percent, varying from 0.3 percent to 3.6 percent (2).

1.1.5.1.5 Load Duration

The load duration curves for 1983, the initial year of operation of Waterford 3, are presented in Figures 1.1-5 and 1.1-6 for LP&L and the MSU System, respectively. The load duration curves for the two years following 1983 are not expected to vary significantly from the 1983 load duration curves. (Projected load duration curves are not published by SWPP). For the past twelve years, LP&L's annual load factor has been increasing steadily from 57.3 percent in 1967 to 65.7 percent in 1980. A comparison of Figures 1.1-5 and 1.1-6 indicates that the load factor for LP&L is slightly greater than that of MSU.

1.1.5.2 System Capacity

1.1.5.2.1 Introduction

The generation and transmission capabilities of LP&L and the three other operating companies of the MSU System are coordinating through the Operating Committee in accordance with the System Agreement, LP&L FERC Filing #48. Reserves of the five operating companies are shared through the System Agreement. Through this arrangement, each company is able to install larger and more economical generating units than would otherwise be feasible if each company operated independently. In other words, when the installation of a company generating unit gives one company in the MSU System a temporary excess in capacity, the excess and its cost is shared by the other MSU System operating companies. In this manner, each company either owns or has under contract its appropriate portion of the total MSU System capacity.

1.1.5.2.2 Power Exchanges

The power exchanges or firm purchase which LP&L expects to exist during the early years of Waterford 3's operation are shown on Table 1.1-4. The major portion of this power exchange is LP&L's portion of the diversity interchange with the Tennessee Valley Authority. The remaining portion is the exchange which occurs between LP&L and the other operating companies in the MSU System. Table 1.1-6 shows the firm purchases which the MSU System expects to exist during the period 1981-1986. Firm capacity purchases and sales during expected peak hour demand periods are considered in establishing the schedule of generating capacity additions and retirements.

1.1.5.2.3 Generating Capacity Changes 2

LP&L and the MSU System are planning to meet projected demand increases through a series of additons to their bulk power supply capacity. Table 1.1-10 lists each unit operable at the time of the annual peak of 1970 for the MSU System, including LP&L's units. It should be noted that the Arkansas-Missouri Power Company did not become a member until 1971 and, therefore, their contribution to the MSU System is not included in Table 1.1-10. Table 1.1-11 contains a summary of actual capacity changes for the MSU System, including LP&L's, for the period April 1970 through 1980. Table 3
1.1-12 contains the MSU System's planned capacity additions and retirements for the period 1981 through 1986.

1.1.6 EXTERNAL SUPPORTING STUDIES

1.1.6.1 Relationship to Power Pool Reserve Criterion 2

LP&L is a member of the Southwest Power Pool (SWPP) as described in Section 1.1.1.1, which has minimum reserve criteria. Since LP&L is a member of the MSU System, it must comply with the MSU System reliability criteria. The MSU System criteria for the minimum reserve margin meet or exceed all similar criteria recommended by SWPP(3).

1.1.6.2 Studies of Area Power Supply for 1983 2

Load and capability studies of the SWPP region are conducted annually using inputs from the member utilities. Reference 3 is a current report of the SWPP. 3

1.1.6.3 Regional Reserves for 1983

As given in Table 1.1-7, SWPP will have 31.0 percent reserve margin in excess 3
of peak load responsibility in 1983, provided all the units scheduled for operation that year do go into operation. In addition reserve capacity within SWPP, if operable, is available to member companies for sale but its availability cannot be guaranteed.

REFERENCES

1. Electric Power Research Institute, Costs and Benefits of Over/Under Capacity in Electric Power System Planning, EPRI EA-927, Project 1107 Final Report, October 1978. 2

2. Wolf Creek Generating Station, Environmental Report, Section 1.1-4, Revison 3 dated February 14, 1975.

3. Southwest Power Pool Coordination Council, Report to the Federal Power Commission under Order No. 383-4, 1980.

TABLE 1.1-1

SOUTHWEST POWER POOL

MEMBER SYSTEMS -- JAN. 1, 1981

SYSTEM
City of Alexandria
Arkansas Electric Cooperative Corp.
Arkansas Power & Light Company
Associated Electric Cooperative, Inc.
Cajun Electric Power Cooperative, Inc.
Central Kansas Power Company, Inc.
Central Louisiana Electric Company, inc.
Chanute Municipal Utilities
City of Clarksdale
Coffeyville Municipal Water & Light
Western Power Div., Central Telephone & Utilities Corp.
Empire District Electric Co.
Grand River Dam Authority 3
City of Greenwood
Gulf States Utilities Co.
City Power & Light, Independence, MO.
Kansas City Power & Light Co.
Kansas Gas & Electric Co.
Board of Public Utilities, Kansas City, KA.
KAMO Electric Cooperative, Inc.,
Kansas Power & Light Co.
City of Layfayette
Louisiana Power & Light Co.
Mississippi Power & Light Co.
Missouri Public Service Co.
New Orleans Public Service Inc.
Oklahoma Gas & Electric Co.
Public Service Company of Oklahoma
City of Ruston
St. Joseph Light & Power Co.
Southwestern Electric Power Co.
City Utilities, Springfield, MO.
Sunflower Electric Cooperative, Inc.
Southwestern Power Administration
Southwestern Public Service Co.
Western Farmers Electric Cooperative
Winfield Municipal Light & Power
West Texas Utilities Co.

TABLE 1.1-2

COMPARISON OF ANNUAL FORECASTED PEAKS VS. ACTUAL PEAKS FOR
LOUISIANA POWER & LIGHT COMPANY
(1966-1978) 3

Year	Forecasted Peak (Mw)	Actual Peak (Mw)	Deviation %	
1966	1150	1156	0.52	3
1967	1320	1284	2.73	
1968	1480	1498	-1.22	
1969	1710	1779	-4.04	
1970	2050	1872	8.68	
1971	2310	2096	9.26	3
1972	2500	2389	4.44	
1973	2770	2563	7.47	
1974	3070	2692	12.31	3
1975	3233	2883	10.83	
1976	3215	3180	1.09	
1977	3394	3515	-3.57	
1978	3994	3852	3.56	3

TABLE 1.1-3

LOUISIANA POWER & LIGHT COMPANY

ANNUAL CAPABILITY, LOAD, AND ENERGY HISTORY*

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980++	
1. Capability+ with Curtailment	939	1314	1346	1346	1892	1887	2644	2616	3432	3426	3904	4292	4240	4245	4245	4245	
2. Purchases without Reserves																	
a. MSU Pool	-48	-210	145	362	-16	194	-250	-130	-520	-584	-97	-314	-141	-166	202	447	
b. Other	7	7	7	7	44	89	45	249	103	145	30	30	91	220	234	288	
3. Total Capability (1+2)	898	1111	1498	1715	1920	2170	2439	2735	3015	2987	3837	4008	4190	4299	4681	4980	
4. Maximum Hourly Load	942	1148	1284	1498	1779	1872	2096	2389	2563	2692	2883	3180	3515	3852	4091	4078	
5. Firm Sales with Reserves	0	0	0	42	118	74	157	220	0	0	0	0	0	0	0	0	3
6. Firm Purchases with Reserves	122	168	109	140	175	185	246	143	147	148	150	157	158	165	174	236	
7. Load Responsibility (4+5-6)	820	980	1175	1400	1722	1761	2007	2466	2416	2544	2733	3023	3357	3687	3917	4314	
8. Reserve Margin (3-7)	78	131	323	315	198	409	432	269	599	443	1104	985	833	618	764	666	
9. Net Energy Requirements (gWh)	4695	5759	6844	7591	8796	9763	10739	12060	13417	13865	15046	17289	19438	21375	23097	23945	

* Units in megawatts unless otherwise noted

++ Loss of Rural Electric Cooperative's Load in Spring of 1980 resulted in a loss of about 300 Mw in peak load and 700 gWh in energy requirements

\+ Installed capability at time of system peak

TABLE 1.1-4

LOUISIANA POWER & LIGHT COMPANY
ANNUAL LOAD AND CAPABILITY FORECAST 1981-1986*

	1981	1982	1983	1984	1985	1986
1. Capability with Assumed Fuel Constraints	4245	4245	5349	5280	5240	5177
2. Purchases without Reserves						
a. MSU Pool	706	1006	1096	1016	1317	1319
b. Other	233	233	233	233	199	199
3. Total Capability (1+2)	5184	5483	6678	6529	6756	6695
4. Maximum Hourly Load	4130	4356	4605	4732	4989	5191
5. Firm Sales with Reserves	0	0	0	0	0	0
6. Firm Purchases with Reserves	80	85	87	25	25	25
7. Load Responsibility (4+5-6)	4050	4271	4518	4707	4964	5166
8. Reserve Margin (3-7)	1134	1213	2160	1822	1792	1529
9. Percent Reserve ([8-7]x 100)	28.0	28.4	47.8	38.7	36.1	29.6
10. Net Energy Requirements (gWh)	22611	24460	25978	26834	27963	29106

3

*Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

TABLE 1.1-5

MIDDLE SOUTH SYSTEM

ANNUAL CAPABILITY, LOAD AND ENERGY HISTORY*

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1. Capability** with Curtailment	3621	3955	5113	5582	6090	6643	7491	7775	8592	8586	10908	11201	11014	11094	11118	11969
2. Purchases without Reserves	7	18	18	41	126	276	251	706	509	631	305	305	355	467	715	832
3. Total Capability (1+2)	3628	3973	5131	5623	6216	6919	7742	8481	9101	9217	11213	11506	11369	11561	11832	12801
4. Maximum Hourly Load	3762	4343	4593	5110	5924	6148	6818	7622	7972	8532	8504	9345	9780	10648	10687	11769
5. Firm Sales with Reserves	0	0	0	150	406	250	520	738	25	37	196	34	34	0	33	0
6. Firm Purchases with Reserves	450	840	570	670	755	780	965	713	704	718	711	700	702	732	815	680
7. Load Responsibililty (4+5-6)	3312	3503	4023	4590	5575	5618	6373	7647	7293	7851	7989	8679	9112	9916	9905	11809
8. Reserve Margin (3-7)	316	470	1108	1033	641	1301	1369	834	1808	1366	3224	2827	2257	1645	1933	1712
9. Net Energy Requirements (gWh)	18538	20795	22645	22542	28208	30235	32246	37474	40025	40378	41171	45771	51111	54899	56937	55154

3

* Units in megawatts unless otherwise noted
** Installed capability at time of system peak

TABLE 1.1-6

MIDDLE SOUTH SYSTEM
ANNUAL LOAD AND CAPABILITY FORECAST 1981-1986

	1981	1982	1983	1984	1985	1986
1. Capability with Assumed Curtailment	12430	12842	15412	15288	15620	15396
2. Purchases without Reserves	873	446	470	470	498	453
3. Total Capability	13303	13288	15882	15758	16116	15849
4. System Maximum Hourly Load	10820	10746	11141	11461	11940	12325
5. Firm Sales with Reserves	150	0	0	0	0	0
6. Firm Purchases with Reserves	574	396	397	97	99	100
7. Load Responsibility	10396	10350	10744	11364	11841	12225
8. Reserve Margin	2907	2938	5138	4394	4277	3624
9. Percent Reserves	28.0	28.4	47.8	38.7	36.1	29.6
10. Net Energy Requirements (gWh)	52616	55584	58082	60111	62562	64864

3

TABLE 1.1-7
(Sheet 1 of 4)

SOUTHWEST POWER POOL (SWPP)
ANNUAL LOAD AND CAPABILITY FORECAST*
SUMMARY 1965-1984[1]

A. HISTORICAL (1965-1972)

	1965	1966	1967	1968	1969	1970	1971	1972
1. Committed Capability (MWe)	15286	16087	18589	19570	22133	24417	27754	28636
2. Purchases without Reserves	0	0	0	25	0	133	108	150
3. Sales without Reserves	240	180	180	180	675	725	1233	1078
4. Uncommitted Capacity	----	----	----	----	----	----	----	----
5. Scheduled Maintenance	----	----	----	----	----	----	----	----
6. Total Capacity (1+2-3+4-5)	15046	15907	18409	19415	21453	23825	26629	27708
7. Peak Load[2]	13196	15245	15978	17785	20008	21382	22936	25367
8. Firm Purchase	514	1167	1227	1979	1996	1601	1500	1500
9. Firm Sales	31	75	0	253	425	0	25	110
10. Load Responsibility (7-8+9)	12713	14153	14751	16059	18437	19781	21461	23977
11. Margin in Excess of Load (6-10)	2333	1754	3658	3356	3021	4044	5168	3731
12. Margin - % (100x11/10)[3]	18.4	12.4	24.8	20.9	16.4	20.4	24.1	15.6

Notes given on Sheet 4

TABLE 1.1-7 (Cont'd)
(Sheet 2 of 4)

SOUTHWEST POWER POOL
ANNUAL LOAD AND CAPABILITY FORECAST*
SUMMARY 1965-1984(1)

B. HISTORICAL (1973-1976)

	1973	1974	1975	1976
1. Committed Capability	34,938	36,198	40,644	42,014
2. Purchases without Reserves	2,151	2,306	270	495
3. Sales without Reserves	2,902	2,432	508	1,071
4. Uncommitted Capacity	--	--	--	--
5. Scheduled Maintenance	78	740	1,326	2,353
6. Total Capacity (1+2-3+4-5)	34,109	35,332	39,080	39,085
7. Peak Load (2)	29,367	32,078	32,200	33,764
8. Firm Purchases	3,575	3,900	1,814	1,969
9. Firm Sales	1,430	1,680	170	249
10. Peak Load Responsibility (7-8+9)	27,222	29,858	30,556	32,044
11. Margin - Mw (6-10)	6,887	5,474	8,524	7,041
12. Margin - % (100 x 11/10) (3)	25.3	18.3	27.9	22.0

Notes given on Sheet 4

3

TABLE 1.1-7 (Cont'd)
(Sheet 3 of 4)

SOUTHWEST POWER POOL
ANNUAL LOAD AND CAPABILITY FORECAST*
SUMMARY 1965-1986[1]

C. HISTORICAL (1977, 1978, 1979, 1980)

	1977	1978	1979
1. Net Dependable Capability	43739	46453	45651
2. All Scheduled Imports	7457	8688	5901
3. All Scheduled Exports	6258	4343	2543
4. Total Resources (1+2-3)	44938	50798	49009
5. Inoperable Capability	549	304	1777
6. Operable Resources (4-5)	44389	50494	47232
7. Peak Hour Demand[2]	36847	39191	38783
8. Interruptible Demand	35	0	124
9. Demand Requirements (7-8)	36812	39191	38659
10. Margin (6-9)	7577	11303	8573
11. Scheduled Outage	4558	5720	3385
12. Adjusted Margin (10-11)	3019	5583	5188
13. Net Energy (gWh)	179549	191530	193849*

* Estimated

** Data not available for 1980. 3

Notes given on Sheet 4

TABLE 1.1-7
(Sheet 4 of 4)

SOUTHWEST POWER POOL
ANNUAL LOAD AND CAPABILITY FORECAST*
SUMMARY 1981-1986[1]

D. Projected[4] (1981-1986)

	1981	1982	1983	1984	1985	1986
1. Net Dependable Capability	54309	58247	61794	63339	66423	67918
2. All Scheduled Imports	5334	4712	4923	4235	3819	3478
3. All Scheduled Exports	4454	3896	3982	3528	3379	3122
4. Total Resources (1+2-3)	55189	59063	62735	64046	66863	68274
5. Inoperable Capability	0	77	77	77	77	77
6. Operable Resources (4-5)	55189	58986	62658	63969	66786	68197
7. Peak Hour Demand[2]	44134	46132	47953	50012	51976	54033
8. Interruptible Demand	115	115	115	115	115	115
9. Demand Requirements (7-8)	44019	46017	47838	49897	51861	53918
10. Margin (6-9)	11170	12969	14820	14072	14925	14279
11. Scheduled Outage	0	0	0	0	0	0
12. Adjusted Margin (10-11)	11170	12969	14820	14072	14925	14279
13. Net Energy (gWh)	214935	224431	233248	243337	253376	264389

3

* Units in megawatts unless otherwise noted

(1) Actual load, capability, and energy data (1965-1972) are for the SWPP as reorganized in 1969, based on 34 member companies plus non-member companies. Data (1973-1986) are based on 38 member companies plus non-member companies, included in SWPP Coordination Council, Report to the Federal Power Commission, April 1, 1980. 3

(2) Peak loads (1965-1979) are actual simultaneous loads of SWPP member systems. Projected peak loads (1981-1986) are based upon non-simultaneous loads of SWPP member systems. 3

(3) Recommended SWPP minimum reserve levels: 12% for 1963-1969 and 15% thereafter.

(4) Data format (1977-1986) differs from format for previous years.

TABLE 1.1-8
(Sheet 1 of 3)

LOUISIANA POWER & LIGHT COMPANY

MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

A. 1982 FORECAST

	January	February	March	April	May	June	July	August	September	October	November	December	
1. System Capability													
a. Without Curtailment	4392	4392	4392	4392	4392	4392	4392	4392	4392	4392	4392	4392	
b. With Curtailment	4142	4142	4142	4245	4245	4245	4245	4245	4245	4245	4142	4142	
2. Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0	
3. Purchases without Reserves													
a. MSU Pool	991	991	994	934	930	1006	1006	1006	1006	1026	1548	1543	
b. Other	233	233	233	233	233	233	233	233	233	233	233	233	
4. Total Capability (1-2+3)	5366	5366	5369	5412	5408	5484	5484	5484	5484	5504	5923	5918	
5. System Maximum Hourly Load	3223	3136	2875	2962	3790	4356	4356	4356	4356	3528	3136	3223	
6. Firm Sales with Reserves	85	85	85	0	0	0	0	0	0	0	85	85	3
7. Firm Purchases with Reserves	0	0	0	0	0	85	85	85	85	0	0	0	
8. Load Responsibility (5+6-7)	3308	3221	2960	2962	3790	4271	4271	4271	4271	3528	3221	3308	
9. Margin in Excess of Load (4-8)	2058	2145	2409	2450	1618	1213	1213	1213	1213	1976	2702	2610	
10. Percent Margin in Excess of Load (9 ÷ 8 x 100)	62.2	66.6	81.4	82.7	42.7	28.4	28.4	28.4	28.4	56.0	83.9	78.9	

* Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

TABLE 1.1-8
(Sheet 2 of 3)

LOUISIANA POWER & LIGHT COMPANY

MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

A. 1983 FORECAST

	January	February	March	April	May	June	July	August	September	October	November	December	
1. System Capability													
a. Without Curtailment	4392	4392	4392	5496	5496	5496	5496	5496	5496	5496	5496	5496	
b. With Curtailment	4142	4142	4142	5349	5349	5349	5349	5349	5349	5349	5246	5246	
2. Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0	
3. Purchases without Reserves													
a. MSU Pool	1825	1829	1839	1144	1108	1096	1096	1096	1096	1121	1320	1312	
b. Other	233	233	233	233	233	233	233	233	233	233	233	233	
4. Total Capability (1-2+3)	6200	6204	6214	6726	6690	6678	6678	6678	6678	6703	6799	6791	
5. System Maximum Hourly Load	3408	3316	3039	3130	4006	4605	4605	4605	4605	3730	3316	3408	
6. Firm Sales with Reserves	87	87	87	0	0	0	0	0	0	0	87	87	
7. Firm Purchases with Reserves	0	0	0	0	0	87	87	87	87	0	0	0	3
8. Load Responsibility (5+6-7)	3495	3403	3126	3130	4006	4518	4518	4518	4518	3730	3403	3495	
9. Margin in Excess of Load (4-8)	2705	2801	3088	3596	2684	2160	2160	2160	2160	2973	3396	3296	
10. Percent Margin in Excess of Load (9 ÷ 8 x 100)	77.4	82.3	98.8	114.9	67.0	47.8	47.8	47.8	47.8	79.7	99.8	94.3	

* Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

TABLE 1.1-8
(Sheet 3 of 3)

LOUISIANA POWER & LIGHT COMPANY

MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

C. 1984 FORECAST

	January	February	March	April	May	June	July	August	September	October	November	December
1. System Capability												
a. Without Curtailment	5452	5452	5452	5452	5452	5452	5452	5452	5452	5452	5452	5452
b. With Curtailment	5202	5202	5202	5280	5280	5280	5280	5280	5280	5280	5202	5202
2. Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0
3. Purchases without Reserves												
a. MSU Pool	1065	1065	1069	1023	1017	1016	1016	1016	1016	1018	1065	1065
b. Other	233	233	233	233	233	233	233	233	233	233	233	233
4. Total Capability (1-2+3)	6500	6500	6504	6536	6530	6529	6529	6529	6529	6531	6500	6500
5. System Maximum Hourly Load	3502	3407	3123	3218	4117	4732	4732	4732	4732	3833	3407	3502
6. Firm Sales with Reserves	25	25	25	0	0	0	0	0	0	0	25	25
7. Firm Purchases with Reserves	0	0	0	0	0	25	25	25	25	0	0	0
8. Load Responsibility (5+6-7)	3527	3432	3148	3218	4117	4707	4707	4707	4707	3833	3432	3527
9. Margin in Excess of Load (4-8)	2973	3068	3356	3318	2413	1822	1822	1822	1822	2698	3068	2973
10. Percent Margin in Excess of Load (9 ÷ 8 x 100)	84.3	89.4	106.6	103.1	58.6	38.7	38.7	38.7	38.7	70.4	89.4	84.3

3

* Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

TABLE 1.1-9
(Sheet 1 of 3)

MIDDLE SOUTH SYSTEM
MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

A. 1982 FORECAST

	January	February	March	April	May	June	July	August	September	October	November	December	
1. System Capability (Note 1)													
a. Without Curtailment	13560	13560	13560	13560	13560	13560	13560	13560	13560	13560	14654	14654	
b. With Curtailment	12739	12739	12739	12842	12842	12842	12842	12842	12842	12842	13833	13833	
2. Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0	
3. Purchases without Reserves	446	446	446	446	446	446	446	446	446	446	446	446	
4. Total Capability (1-2+3)	13185	13185	13185	13288	13288	13288	13288	13288	13288	13288	14279	14279	
5. System Maximum Hourly Load	7952	7737	7092	7307	9349	10746	10746	10746	10746	8704	7737	7952	
6. Firm Sales with Reserves	362	362	362	150	150	0	0	0	0	0	212	212	
7. Firm Purchases with Reserves	184	184	184	184	184	396	396	396	396	184	184	184	3
8. Load Responsibility (5+6-7)	8130	7915	7270	7273	9315	10350	10350	10350	10350	8520	7765	7980	
9. Margin in Excess of Load (4-8)	5055	5270	5915	6015	3973	2938	2938	2938	2938	4768	6514	6299	
10. Percent Margin in Excess of Load (9÷8 x 100)	62.2	66.6	81.4	82.7	42.7	28.4	28.4	28.4	28.4	56.0	83.9	78.9	

*Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

Note (1) Grand Gulf 1, 1125 Mw Added in April
Market 11, 12, & 13 103 Mw Retired Dec. 31st.

TABLE 1.1-9
(Sheet 2 of 3)

MIDDLE SOUTH SYSTEM
MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

B. 1983 FORECAST

	January	February	March	April	May	June	July	August	September	October	November	December	
1. System Capability (Note 1)													
a. Without Curtailment	15012	15012	15012	16116	16116	16116	16116	16116	16116	16116	16116	16116	
b. With Curtailment	14205	14205	14205	15412	15412	15412	15412	15412	15412	15412	15309	15309	
2. Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0	
3. Purchases without Reserves	470	470	470	470	470	470	470	470	470	470	470	470	
4. Total Capability (1-2+3)	14675	14675	14675	15882	15882	15882	15882	15882	15882	15882	15779	15779	
5. System Maximum Hourly Load	8244	8022	7353	7576	9693	11141	11141	11141	11141	9024	8022	8244	
6. Firm Sales with Reserves	212	212	212	0	0	0	0	0	0	0	61	61	
7. Firm Purchases with Reserves	185	185	185	185	185	397	397	397	397	185	185	185	
8. Load Responsibility (5+6-7)	8271	8049	7380	7391	9508	10744	10744	10744	10744	8839	7898	8120	3
9. Margin in Excess of Load (4-8)	6404	6626	7295	8491	6374	5138	5138	5138	5138	7043	7881	7659	
10. Percent Margin in Excess of Load (9÷8x100)	77.4	82.3	98.8	114.9	67.0	47.8	47.8	47.8	47.8	79.7	99.8	94.3	

*Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

(Note 1) Ises 1, 461 Mw added in January
Lynch 2, 74 Mw retired Dec 31
Sterlington 5, 44 Mw retired Dec 31

Waterford 3, 1104Mw added in April

TABLE 1.1-9
(Sheet 3 of 3)

MIDDLE SOUTH SYSTEM
MONTHLY LOAD AND CAPABILITY FORECAST - 1982, 1983 and 1984*

C. 1984 FORECAST

		January	February	March	April	May	June	July	August	September	October	November	December	
1.	System Capability (Note 1)													
	a. Without Curtailment	15998	15998	15998	15998	15998	15998	15998	15998	15998	15998	15998	15998	
	b. With Curtailment	15210	15210	15210	15288	15288	15288	15288	15288	15288	15288	15210	15210	
2.	Sales without Reserves	0	0	0	0	0	0	0	0	0	0	0	0	
3.	Purchases without Reserves	470	470	470	470	470	470	470	470	470	470	470	470	
4.	Total Capability (1-2+3)	15680	15680	15680	15758	15758	15758	15758	15758	15758	15758	15680	15680	
5.	System Maximum Hourly Load	8481	8252	7564	7793	9971	11461	11461	11461	11461	9283	8252	8481	
6.	Firm Sales with Reserves	61	61	61	0	0	0	0	0	0	0	61	61	3
7.	Firm Purchases with Reserves	36	36	36	36	36	97	97	97	97	36	36	36	
8.	Load Responsibility (5+6-7)	8506	8277	7589	7757	9935	11364	11364	11362	11364	9247	8277	8506	
9.	Margin in Excess of Load (4-8)	7174	7403	8091	8001	5823	4394	4394	4394	4394	6511	8403	7174	
10.	Percent Margin in Excess of Load (9÷8 x 100)	84.3	89.4	106.6	103.1	58.6	38.7	38.7	38.7	38.7	70.4	89.4	84.3	

*Forecast as of June 10, 1981. Units in megawatts unless otherwise noted.

(Note 1) Lake Catherine 1, 52 Mw Retired Dec. 31st
Lake Catherine 2, 51 Mw Retired Dec. 31st

TABLE 1.1-10

COMPARISON OF ANNUAL FORECASTED PEAKS VS. ACTUAL PEAKS FOR LOUISIANA POWER & LIGHT COMPANY (1966-1977)

Year	Forecasted Peak (Mw)	Actual Peak (Mw)	Deviation %
1966	1150	1148	0.17
1967	1320	1284	2.73
1968	1480	1498	-1.22
1969	1710	1779	-4.04
1970	2050	1872	8.68
1971	2310	2084	9.78
1972	2500	2389	4.44
1973	2770	2563	7.47
1974	3070	2676	12.83
1975	3233	2883	10.83
1976	3215	3180	1.09
1977	3394	3515	-3.57

TABLE 1.1-11
(Sheet 1 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1980

3

Year	Company	Unit	Type	Function(1)	Commercial Operation Retirement Date	Net Mw Rating(2)
1970	AP&L	Ritchie #3	Gas/Oil	Peaking	October	18
	AP&L	Mabelvale #1 - #4	Gas/Oil	Peaking	December	73
1971	Ark-Mo	Jim Hill	Gas/Oil	Peaking	3	35
	Ark-Mo	Mammoth Springs	Hydro	Peaking	3	1
	LP&L	Buras #8	Gas/Oil	Peaking	January	19
	LP&L	Ninemile #4	Gas/Oil	Base	May	748
	MP&L	Baxter Wilson #2	Gas/Oil	Base	September 25	771
1972	NOPSI	Patterson #3	Gas/Oil	Peaking	April 3	+7(4)
	LP&L	Little Gypsy #3	Gas/Oil	Base	December 6	+24(5)
	LP&L	Sterlington #3 (Retired)	Gas/Oil	----	December 31	-32
	LP&L	Sterlington #4 (Retired)	Gas/Oil	----	December 31	-32
	LP&L	Buras #1 - #5 (Retired)	Gas/Oil	----	December 31	-10

Notes given on Sheet 3

TABLE 1.1-11
(Sheet 2 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1980 | 3

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1973	Ark-Mo	Mammoth Springs (Retired)	Hydro	----	January 1	-1
	LP&L	Sterlington #7A	Gas/Oil	Peaking	April 15	57
	LP&L	Sterlington #7B	Gas/Oil	Peaking	April 13	57
	LP&L	Ninemile #5	Gas/Oil	Base	June 12	763
1974	LP&L	Sterlington #7C	Gas/Oil	Base	August	88
	Ark-Mo	Blytheville #1/3	Oil	Peaking	October	188
	AP&L	Arkansas Nuclear #1	Nuclear	Base	December	836
1975	MP&L	Gerald Andrus	Gas/Oil	Base	January	750
	LP&L	Waterford #1	Gas/Oil	Peaking	June	411
	LP&L	Waterford #2	Gas/Oil	Peaking	September	411
1976	No capacity changes					
1977	No capacity changes					

2

Notes given on Sheet 3

TABLE 1.1-11
(Sheet 3 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1980

1978		No Capacity Changes				
1979		No Capacity Changes				
1980	AP&L	Arkansas Nuclear One #2	Nuclear	Base	April	851
1980	AP&L	White Bluff #1	Coal	Base	August	465
1980	AP&L	White Bluff #2	Coal	Base	August	465

3

(1) The unit's function as specified is for 1979 based upon the fuel available at that time.

(2) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

(3) Arkansas-Missouri Power (Ark-Mo) became a member of the MSU System in 1971. In 1981, Ark-Mo consolidated with AP&L. 3

(4) Increased rating of +7 Mw for Patterson #3. This increased rating was the result of rebuilding the turbine casing. Unit was originally rated at 49 Mw.

(5) Increased rating of +24 Mw for Little Gypsy No. 3. This increased rating was the result of rebuilding the high pressure rotor of the turbine. Unit was originally rated at 549 Mw.

TABLE 1.1-12
(Sheet 1 of 2)

MIDDLE SOUTH SYSTEM
GENERATING CAPACITY CHANGES
1981-1986 3

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1981	AP&L	Lynch #1 (Retired)	Gas/Oil	--	December 31	-35
	AP&L	Couch #1 (Retired)	Gas/Oil	--	December 31	-30
1982	NOPSI	Market Street #11-#13 (Retired)	Gas/Oil	--	December 31	-103
	MP&L	Grand Gulf #1[1]	Nuclear	Base	November	1094

2
3

(1) Grand Gulf Nuclear Units to be owned by Middle South Energy Incorporated and operated by Mississippi Power and Light.

(2) Some of the ratings of the units shown above reflect ratings based upon usage of a primary fuel. In the event of curtailment of the primary fuel, the ratings of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12 2
(Sheet 2 of 2)

MIDDLE SOUTH SYSTEM
GENERATING CAPACITY CHANGES
1981-1986

Year	Company	Unit	Type	Function	Commercial Operation Retirement Date	Net Mw Rating[2]	
1983	LP&L	Waterford 3	Nuclear	Base	April	1104	3
1983	AP&L	Independence #1	Coal	Base	January	461	
	AP&L	Lynch #2 (Retired)	Gas/Oil	--	December 31	-74	
	LP&L	Sterlington #5 (Retired)	Gas/Oil	--	December 31	-44	
1984	AP&L	Lake Catherine #1-#2 (Retired)	Coal	--	December 31	-103	
1985	AP&L	Independence #2	Coal	Base	January	461	
	AP&L	Moses 1 & 2 (Retired)	Gas/oil	--	December 31	-144	3
	AP&L	Jim Hill #1 (Retired)	Gas/Oil	--	December 31	-35	

(1) Grand Gulf Nuclear Unit to be owned by Middle South Energy Incorporated and operated by MP&L.

(2) Some of the rating of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12
(Sheet 1 of 5)

MIDDLE SOUTH SYSTEM
GENERATING CAPACITY AS OF APRIL, 1970

ARKANSAS POWER & LIGHT COMPANY (AP&L)(1)

Units	Type	Function(2)	Net Mw Rating(3)
Lynch #1	Gas/Oil	Peaking	35
Lynch #2	Gas/Oil	Peaking	74
Lynch #3	Gas/Oil	Peaking	130
Lynch #4	Oil	Peaking	6
Couch #1	Gas/Oil	Peaking	30
Couch #2	Gas/Oil	Peaking	131
Lake Catherine #1	Gas/Oil	Peaking	52
Lake Catherine #2	Gas/Oil	Peaking	51
Lake Catherine #3	Gas/Oil	Peaking	106
Lake Catherine #4	Gas/Oil	Base	547
Moses #1	Gas/Oil	Peaking	72
Moses #2	Gas/Oil	Peaking	72
Ritchie #1	Gas/Oil	Peaking	356
Ritchie #2	Gas/Oil	Base	544
Carpenter 1 & 2	Hydro	Peaking	59
Remmel 1 - 3	Hydro	Peaking	10

(1) Total AP&L Owned Capability - 2275 Mw

(2) The unit function as specified is for 1977 based upon the fuel available at that time.

(3) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12
(Sheet 2 of 5)

LOUISIANA POWER & LIGHT COMPANY (LP&L)[1]

Unit	Type	Function[2]	Net Mw Rating[3]
Sterlington #3	Gas/Oil	Peaking	32
Sterlington #4	Gas	Peaking	32
Sterlington #5	Gas/Oil	Peaking	44
Sterlington #6	Gas/Oil	Base	224
Ninemile #1	Gas/Oil	Base	74
Ninemile #2	Gas/Oil	Base	107
Ninemile #3	Gas/Oil	Base	135
Little Gypsy #1	Gas/Oil	Base	244
Little Gypsy #2	Gas/Oil	Base	436
Little Gypsy #3	Gas/Oil	Base	549
Buras #1 - #5	Gas/Oil	Peaking	10

(1) Total LP&L Owned Capability - 1887 Mw

(2) The unit function as specified is for 1977 based upon the fuel available at that time.

(3) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12
(Sheet 3 of 5)

MISSISSIPPI POWER & LIGHT COMPANY (MP&L)[(1)]

Unit	Type	Function[(2)]	Net Mw Rating[(3)]
Rex Brown #1	Gas	Peaking	36
Rex Brown #2	Gas	Peaking	47
Rex Brown #3	Gas/Oil	Peaking	76
Rex Brown #4	Gas/Oil	Base	231
Rex Brown #5	Oil	Peaking	11
Natchez #1	Gas/Oil	Peaking	73
Delta #1	Gas/Oil	Peaking	104
Delta #2	Gas/Oil	Peaking	103
Baxter Wilson #1	Gas/Oil	Base	550

(1) Total MP&L Owned Capability - 1231 Mw

(2) The unit function as specified is for 1977 based upon the fuel available at that time.

(3) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12
(Sheet 4 of 5)

NEW ORLEANS PUBLIC SERVICE, INC. (NOPSI)[(1)]

Units	Type	Function[(2)]	Net Mw Rating[(3)]
Michoud #1	Gas/Oil	Peaking	113
Michoud #2	Gas/Oil	Base	244
Michoud #3	Gas/Oil	Base	548
Paterson #1	Gas/Oil	Peaking	46
Paterson #2	Gas/Oil	Peaking	44
Paterson #3	Gas/Oil	Peaking	49
Paterson #4	Gas/Oil	Peaking	87
Paterson #5	Gas/Oil	Peaking	16
Market St. #11	Gas/Oil	Peaking	36
Market St. #12	Gas/Oil	Peaking	36
Market St. #13	Gas/Oil	Peaking	31

(1) Total NOPSI Owned Capability - 1250 Mw

(2) The unit function as specified is for 1977 based upon the fuel available at that time.

(3) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-12
(Sheet 5 of 5)

MSU OWNED CAPABILITY (Mw)

AP&L	2275
LP&L	1887
MP&L	1231
NOPSI	1251
Total MSU Owned Capability	6643

TABLE 1.1-13
(Sheet 1 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1977

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1970	AP&L	Ritchie #3	Gas/Oil	Peaking	October	18
	AP&L	Mabelvale #1 - #4	Gas/Oil	Peaking	December	73
1971	Ark-Mo	Jim Hill	Gas/Oil	Peaking	(3)	35
	Ark-Mo	Mammoth Springs	Hydro	Peaking	(3)	1
	LP&L	Buras #8	Gas/Oil	Peaking	January	19
	LP&L	Ninemile #4	Gas/Oil	Base	May	748
	MP&L	Baxter Wilson #2	Gas/Oil	Base	September 25	771
1972	NOPSI	Paterson #3	Gas/Oil	Peaking	April 3	+7[4]
	LP&L	Little Gypsy #3	Gas/Oil	Base	December 6	+24[5]
	LP&L	Sterlington #3 (Retired)	Gas/Oil	----	December 31	-32
	LP&L	Sterlington #4 (Retired)	Gas/Oil	----	December 31	-32
	LP&L	Buras #1 - #5 (Retired)	Gas/Oil	----	December 31	-10

Notes given on Sheet 3

TABLE 1.1-13
(Sheet 2 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1977

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1973	Ark-Mo	Mammoth Springs (Retired)	Hydro	----	January 1	-1
	LP&L	Sterlington #7A	Gas/Oil	Peaking	April 15	57
	LP&L	Sterlington #7B	Gas/Oil	Peaking	April 13	57
	LP&L	Ninemile #5	Gas/Oil	Base	June 12	763
1974	LP&L	Sterlington #7C	Gas/Oil	Base	August	88
	Ark-Mo	Blytheville #1/3	Oil	Peaking	October	188
	AP&L	Arkansas Nuclear #1	Nuclear	Base	December	836
1975	MP&L	Gerald Andrus	Gas/Oil	Base	January	750
	LP&L	Waterford #1	Gas/Oil	Peaking	June	411
	LP&L	Waterford #2	Gas/Oil	Peaking	September	411

Notes given on Sheet 3

TABLE 1.1-13
(Sheet 3 of 3)

MIDDLE SOUTH SYSTEM
ACTUAL GENERATING CAPACITY CHANGES
APRIL 1970-1977

1976	No Capacity Changes
1977	No Capacity Changes

(1) The unit's function as specified is for 1977 based upon the fuel available at that time.

(2) Some of the ratings of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

(3) Arkansas-Missouri Power (Ark-Mo) became a member of the MSU System in 1971.

(4) Increased rating of +7 Mw for Paterson #3. This increased rating was the result of rebuilding the turbine casing. Unit was originally rated at 49 Mw.

(5) Increased rating of +24 Mw for Little Gypsy No. 3. This increased rating was the result of rebuilding the high pressure rotor of the turbine. Unit was originally rated at 549 Mw.

TABLE 1.1-14
(Sheet 1 of 2)

MIDDLE SOUTH SYSTEM
GENERATING CAPACITY CHANGES
1978-1984

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1978	AP&L	Arkansas Nuclear One #2	Nuclear	Base	December	912
1980	AP&L	White Bluff #1	Coal	Base	June	420
1981	LP&L	Waterford #3	Nuclear	Base	October	1110
	MP&L	Grand Gulf #1[1]	Nuclear	Base	April	1250
	AP&L	White Bluff #2	Coal	Base	May	420
	AP&L	Lynch #1 (Retired)	Gas/Oil	--	December 31	-35
	AP&L	Couch #1 (Retired)	Gas/Oil	--	December 31	-30
1982	NOPSI	Market Street #11-#13 (Retired)	Gas/Oil	--	December 31	-103

(1) Grand Gulf Nuclear Units to be owned by Middle South Energy Incorporated and operated by Mississippi Power and Light.

(2) Some of the ratings of the units shown above reflect ratings based upon usage of a primary fuel. In the event of curtailment of the primary fuel, the ratings of these units utilizing secondary fuel will be lower than their primary fuel ratings.

TABLE 1.1-14
(Sheet 2 of 2)

MIDDLE SOUTH SYSTEM
GENERATING CAPACITY CHANGES
1978-1984

Year	Company	Unit	Type	Function[1]	Commercial Operation Retirement Date	Net Mw Rating[2]
1983	AP&L	Independence #1	Coal	Base	January	420
	AP&L	Peaking	Oil	Peaking	January	50
	LP&L	Peaking	Oil	Peaking	January	100
	MP&L	Peaking	Oil	Peaking	January	50
	AP&L	Lynch #2 (Retired)	Gas/Oil	--	December 31	-74
	LP&L	Sterlington #5 (Retired)	Gas/Oil	--	December 31	-44
1984	MP&L	Grand Gulf #2 (Note 1)	Nuclear	Base	January	1250
	AP&L	Peaking	Oil	Peaking	January	100
	LP&L	Peaking	Oil	Peaking	January	50
	MP&L	Peaking	Oil	Peaking	January	50
	NOPSI	Peaking	Oil	Peaking	January	50
	AP&L	Lake Catherine #1-#2 (Retired)	Gas/Oil	--	December 31	-103

(1) Grand Gulf Nuclear Units to be owned by Middle South Energy Incorporated and operated by MP&L.

(2) Some of the rating of the units shown above reflect ratings based upon usage of primary fuel. In the event of curtailment of the primary fuel, the rating of these units utilizing secondary fuel will be lower than their primary fuel ratings.

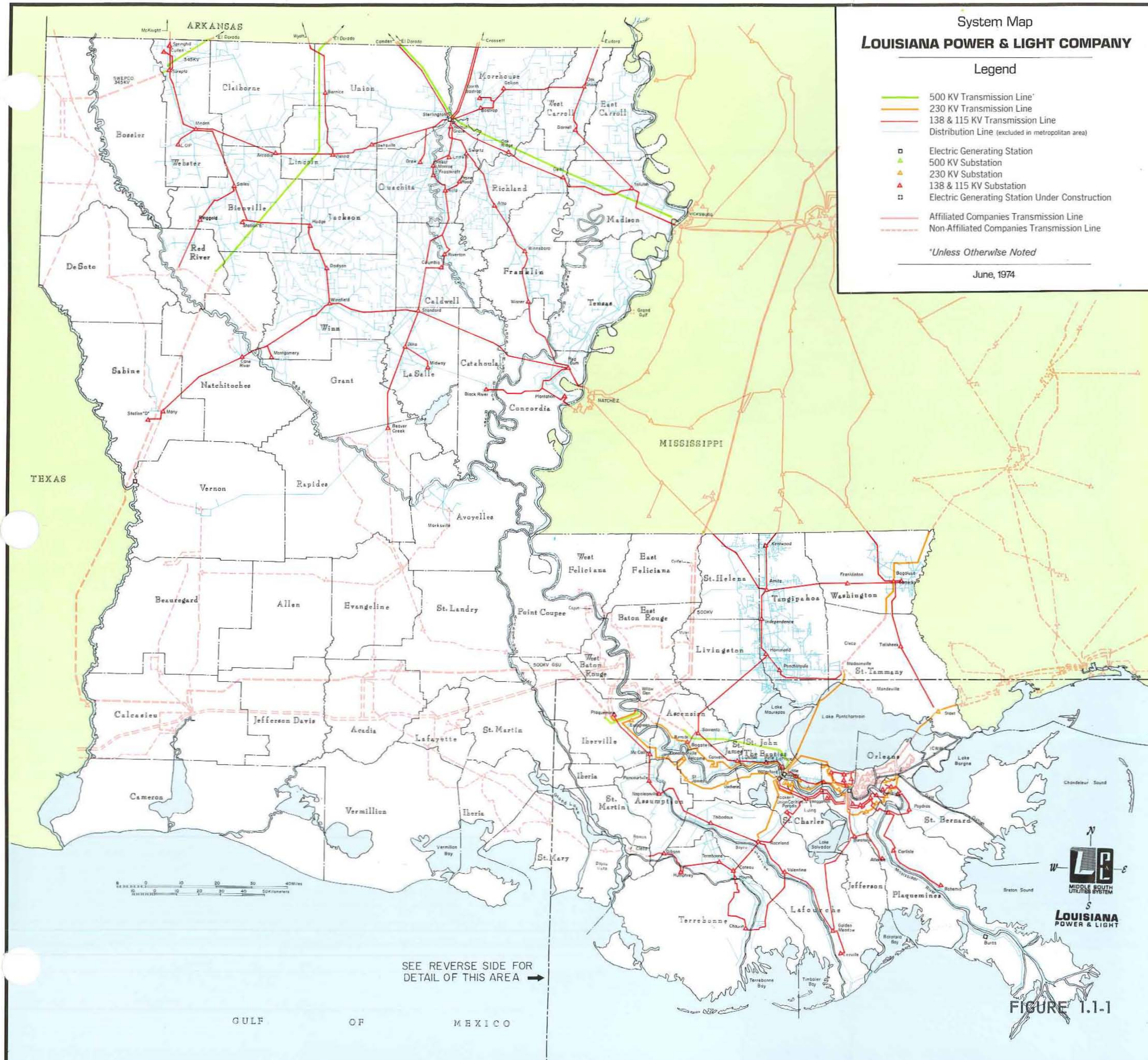
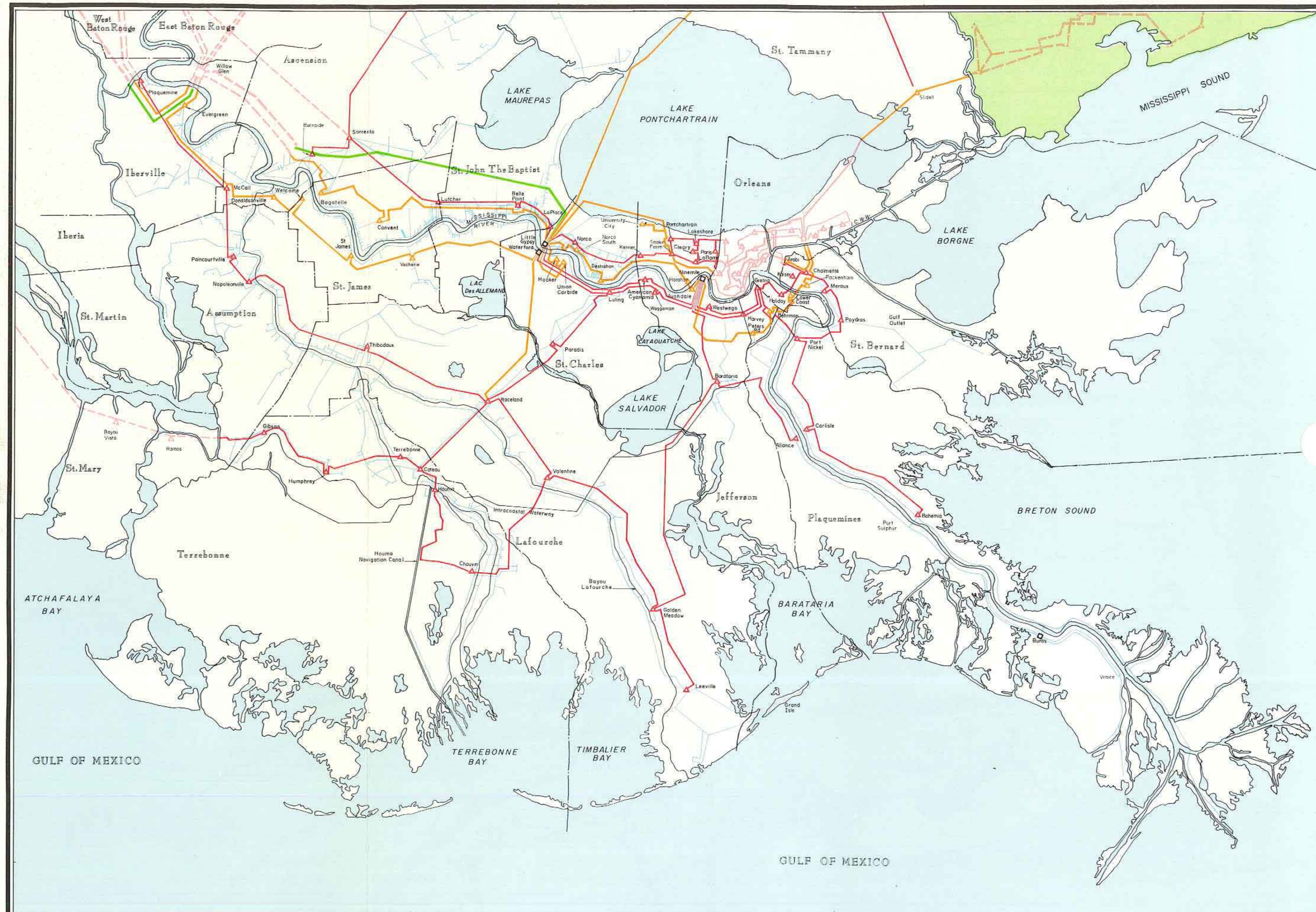
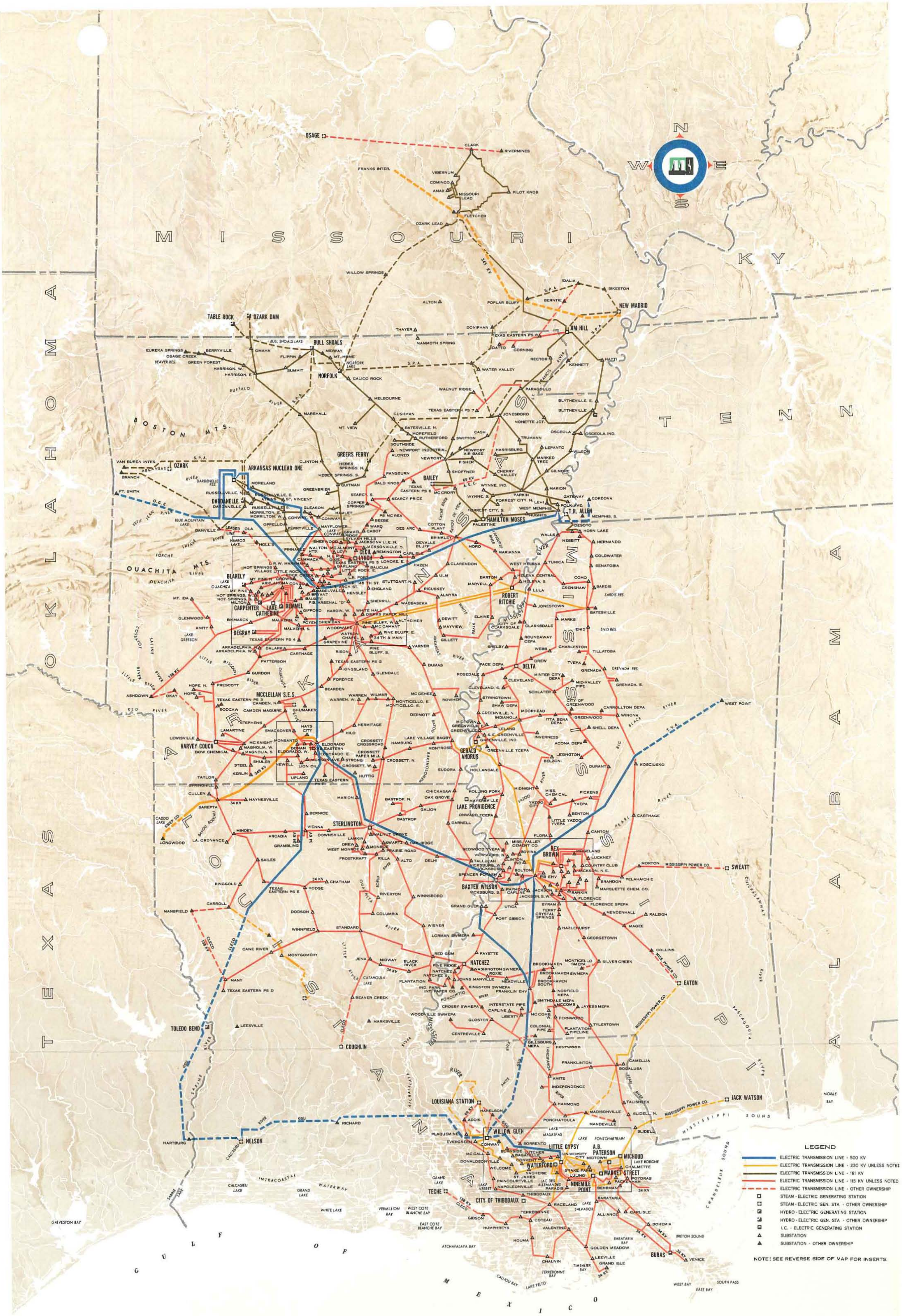

System Map
LOUISIANA POWER & LIGHT COMPANY
Legend
500 KV Transmission Line*
230 KV Transmission Line
138 & 115 KV Transmission Line
Distribution Line (excluded in metropolitan area)
Electric Generating Station
500 KV Substation
230 KV Substation
138 & 115 KV Substation
Electric Generating Station Under Construction
Affiliated Companies Transmission Line
Non-Affiliated Companies Transmission Line
*Unless Otherwise Noted
June, 1974
ARKANSAS
TEXAS
MISSISSIPPI
GULF OF MEXICO
SEE REVERSE SIDE FOR DETAIL OF THIS AREA
N
S
W
E
MIDDLE SOUTH UTILITIES SYSTEM
LOUISIANA POWER & LIGHT
Caddo
Bossier
Webster
Claiborne
Union
Lincoln
Morehouse
West Carroll
East Carroll
Ouachita
Richland
Madison
Bienville
Jackson
Red River
DeSoto
Franklin
Caldwell
Tensas
Winn
Sabine
Natchitoches
Grant
La Salle
Catahoula
Concordia
Vernon
Rapides
Avoyelles
Beauregard
Allen
Evangeline
St. Landry
West Feliciana
East Feliciana
St. Helena
Tangipahoa
Washington
Point Coupee
East Baton Rouge
Livingston
West Baton Rouge
St. Tammany
Calcasieu
Jefferson Davis
Acadia
Lafayette
St. Martin
Iberville
Ascension
St. John The Baptist
St. James
Orleans
Cameron
Vermillion
Iberia
St. Mary
Assumption
St. Charles
St. Bernard
Terrebonne
Lafourche
Jefferson
Plaquemines
Lake Pontchartrain
Lake Borgne
Chandeleur Sound
Breton Sound
Vermilion Bay
Terrebonne Bay
Timbalier Bay

FIGURE 1.1-1



West Baton Rouge
East Baton Rouge
Ascension
St. Tammany
LAKE MAUREPAS
LAKE PONTCHARTRAIN
MISSISSIPPI SOUND
Iberville
St. John The Baptist
Orleans
Iberia
LAKE BORGNE
St. James
Assumption
St. Martin
LAC DES ALLEMANDS
St. Charles
LAKE CATAOUATCHE
LAKE SALVADOR
St. Bernard
St. Mary
BRETON SOUND
Jefferson
Plaquemines
Terrebonne
Lafourche
ATCHAFALAYA BAY
BARATARIA BAY
GULF OF MEXICO
TERREBONNE BAY
TIMBALIER BAY
GULF OF MEXICO
Plaquemine
Evergreen
Burnside
Sorrento
McCall
Donaldsonville
Convent
Vacherie
Paincourtville
Napoleonville
Thibodaux
Paradis
Raceland
Gibson
Terrebonne
Humphrey
Houma
Valentine
Intracoastal Waterway
Houma Navigation Canal
Chauvin
Bayou Lafourche
Golden Meadow
Leeville
Grand Isle
Barataria
Alliance
Carlisle
Bohemia
Port Sulphur
Buras
Venice
Poydras
Gulf Outlet
Slidell
Chalmette
Luling
Norco
Bayou Vista
Ramos



THE MIDDLE SOUTH UTILITIES SYSTEM

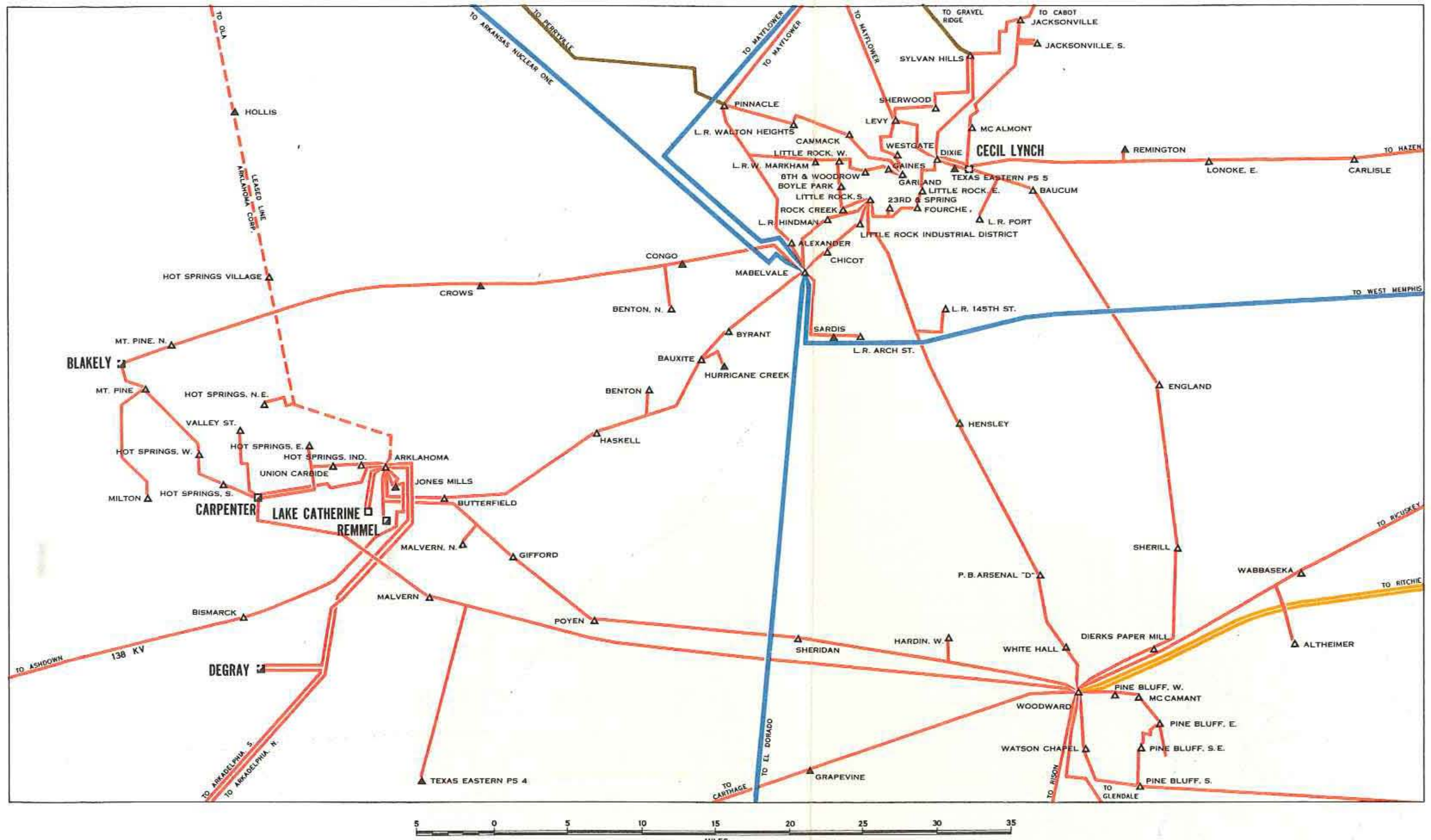
ARKANSAS POWER & LIGHT CO. • ARKANSAS-MISSOURI POWER CO. • LOUISANA POWER & LIGHT CO.
MISSISSIPPI POWER & LIGHT CO. • NEW ORLEANS PUBLIC SERVICE INC. • MIDDLE SOUTH SERVICES, INC.

10 0 10 20 30 40 50 60 70 80 90 100
MILES
JANUARY 1, 1978

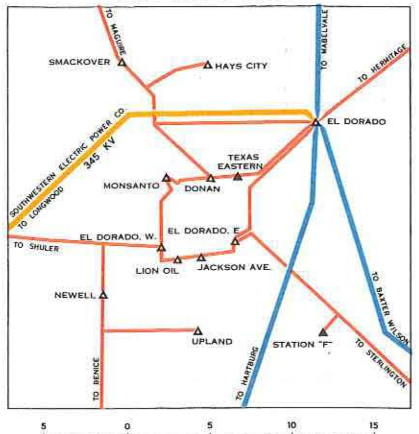
FIGURE 1.1-2

PREPARED BY MERCURY MAPS INC.

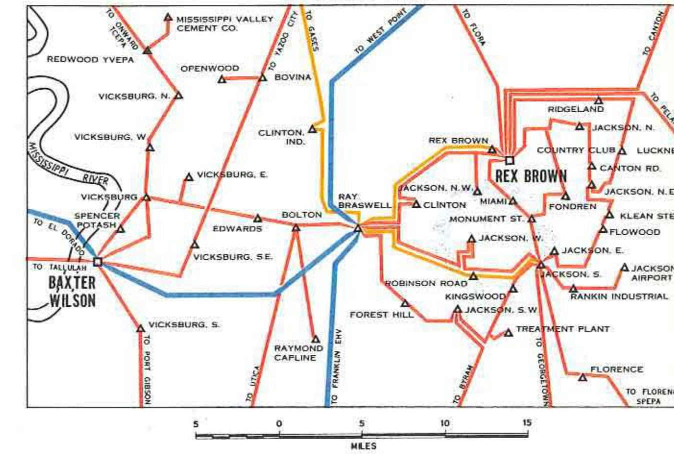
HOT SPRINGS - LITTLE ROCK - PINE BLUFF AREA



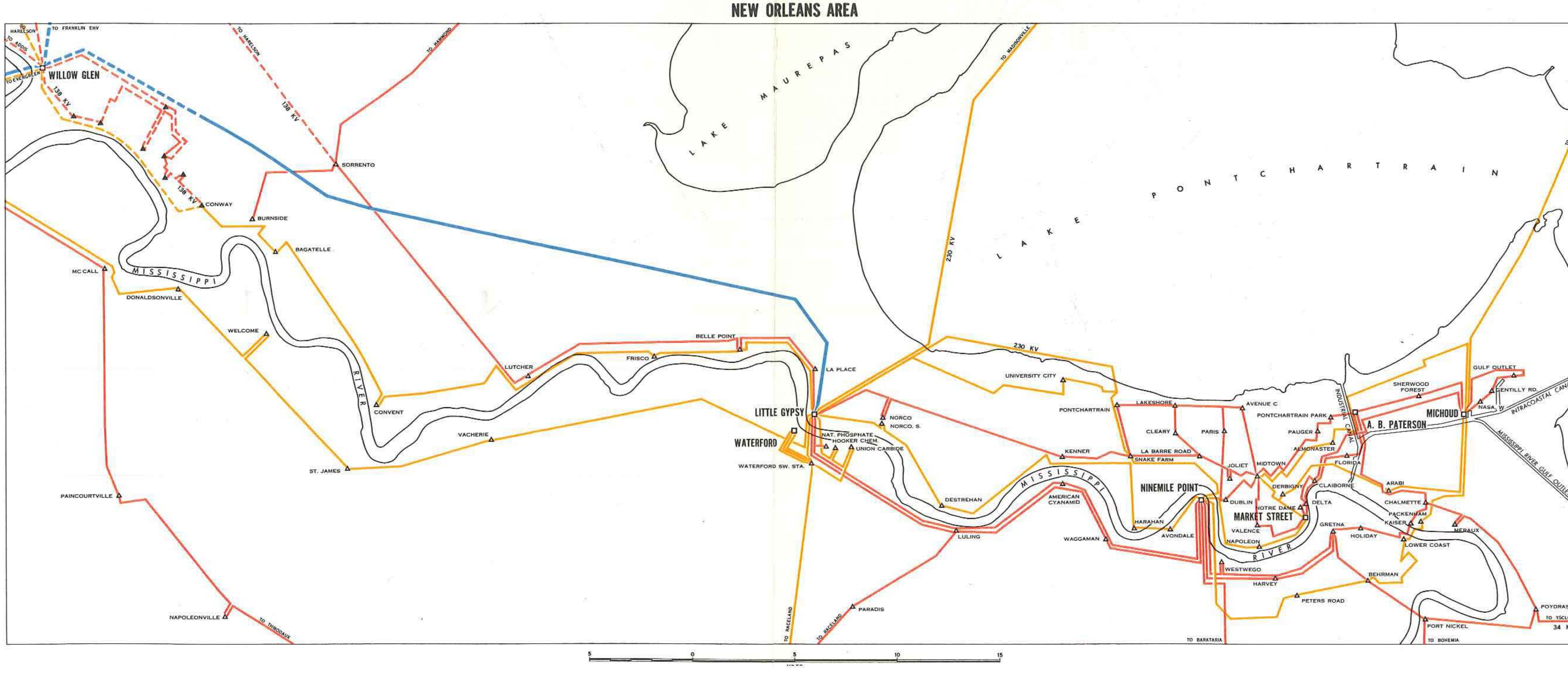
EL DORADO AREA

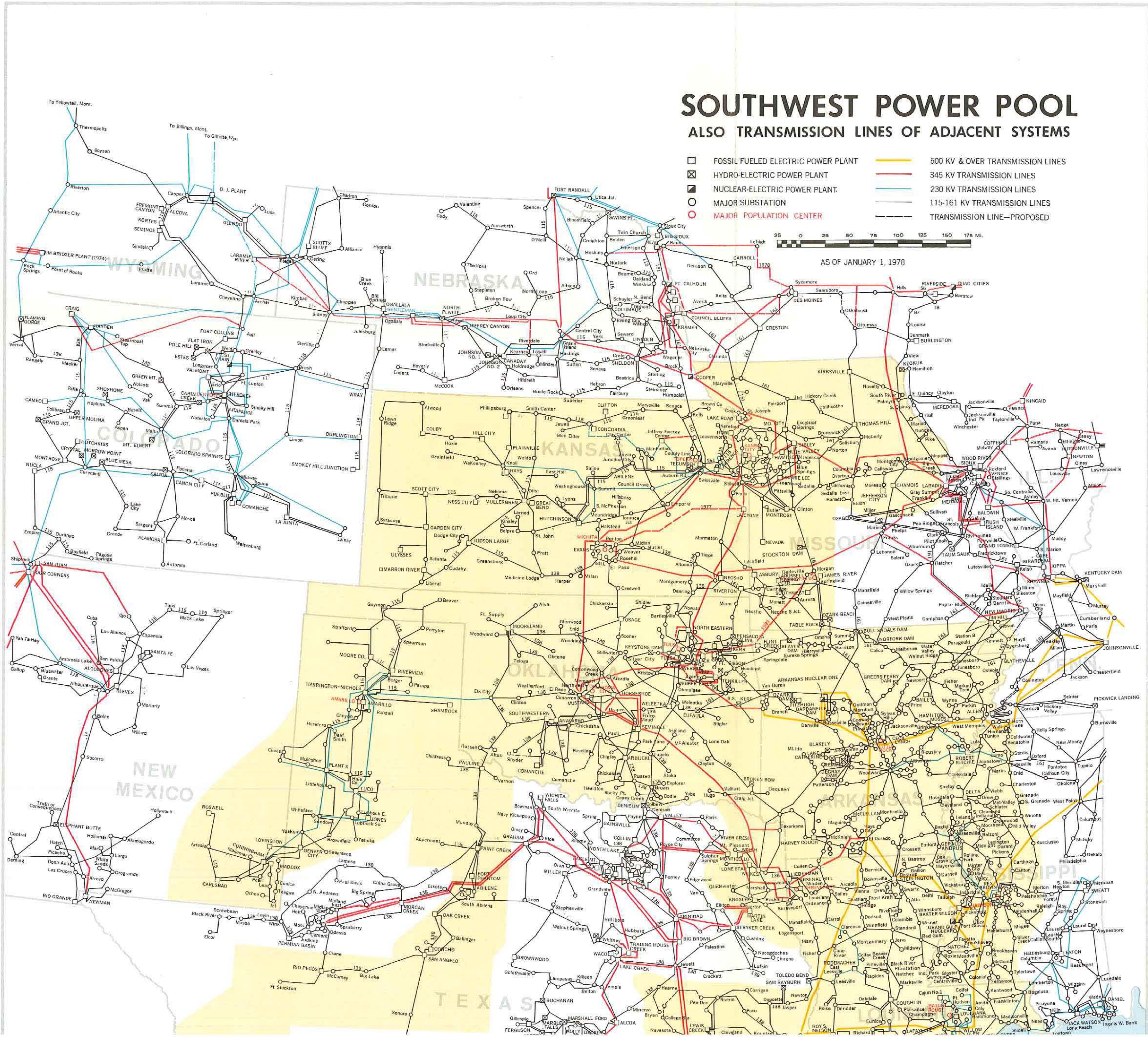


JACKSON AREA



NEW ORLEANS AREA




SOUTHWEST POWER POOL
ALSO TRANSMISSION LINES OF ADJACENT SYSTEMS
FOSSIL FUELED ELECTRIC POWER PLANT
HYDRO-ELECTRIC POWER PLANT
NUCLEAR-ELECTRIC POWER PLANT
MAJOR SUBSTATION
MAJOR POPULATION CENTER
500 KV & OVER TRANSMISSION LINES
345 KV TRANSMISSION LINES
230 KV TRANSMISSION LINES
115-161 KV TRANSMISSION LINES
TRANSMISSION LINE—PROPOSED
25 0 25 50 75 100 125 150 175 MI.
AS OF JANUARY 1, 1978
WYOMING
NEBRASKA
COLORADO
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
NEW MEXICO
TEXAS

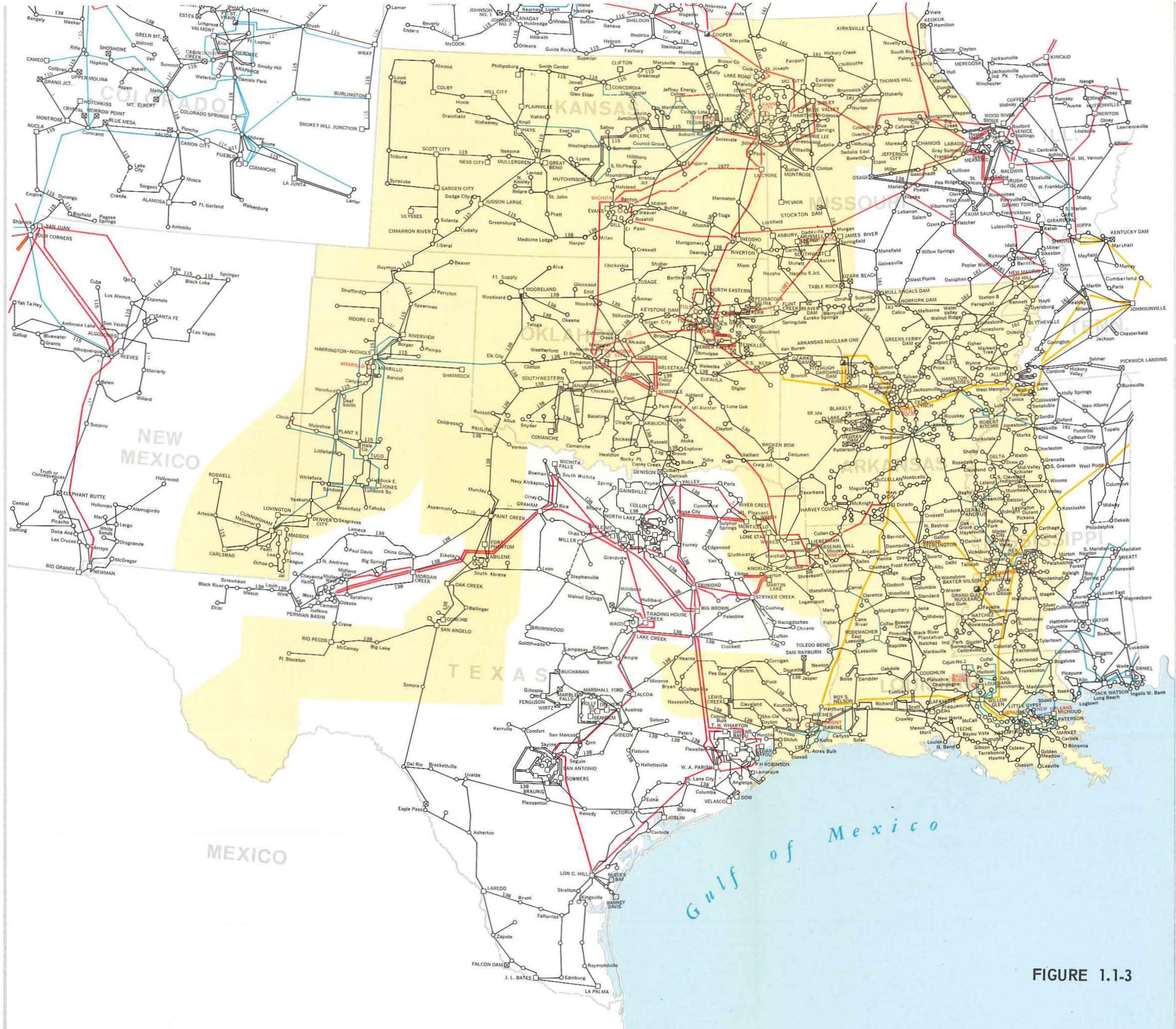
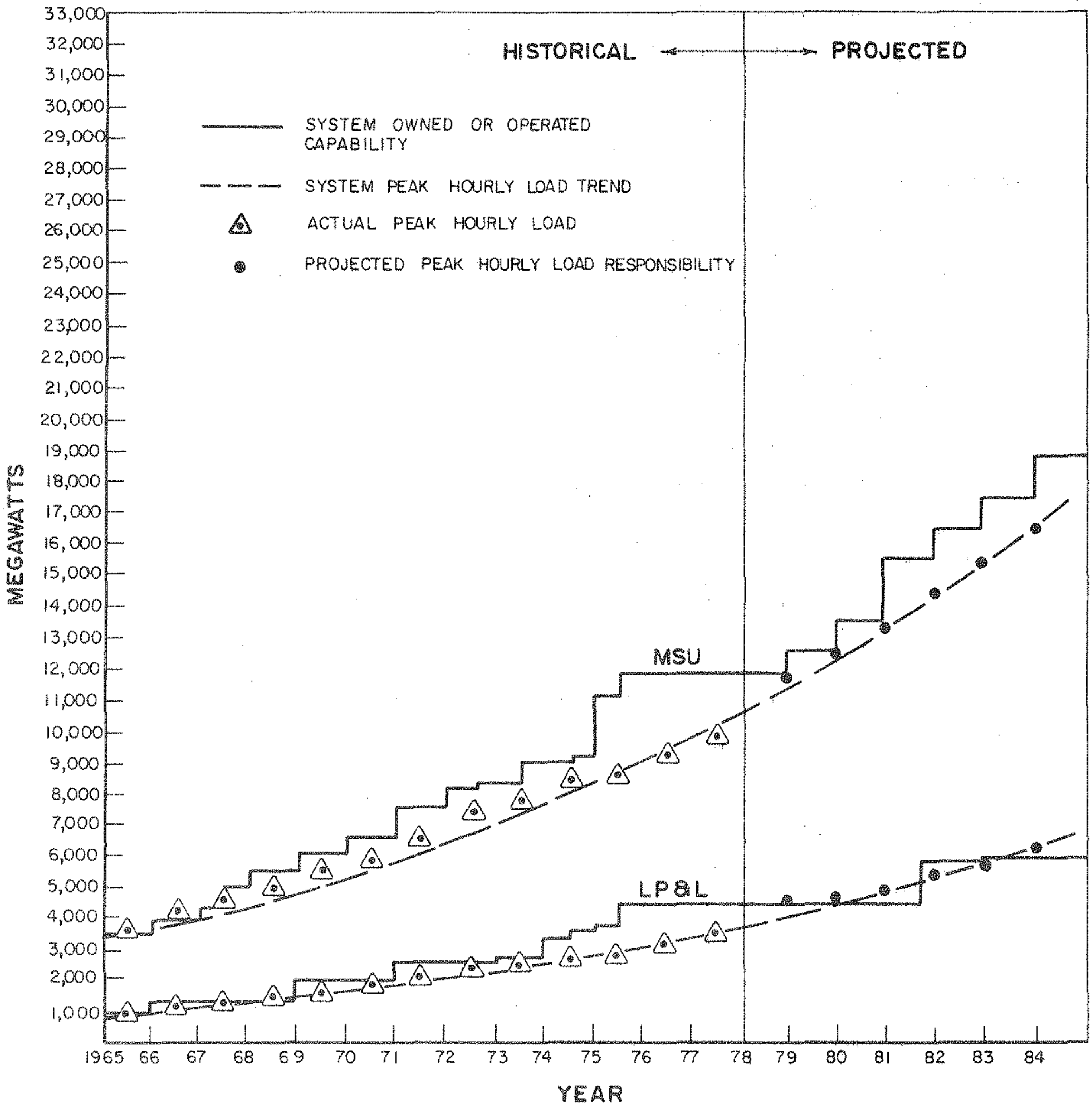
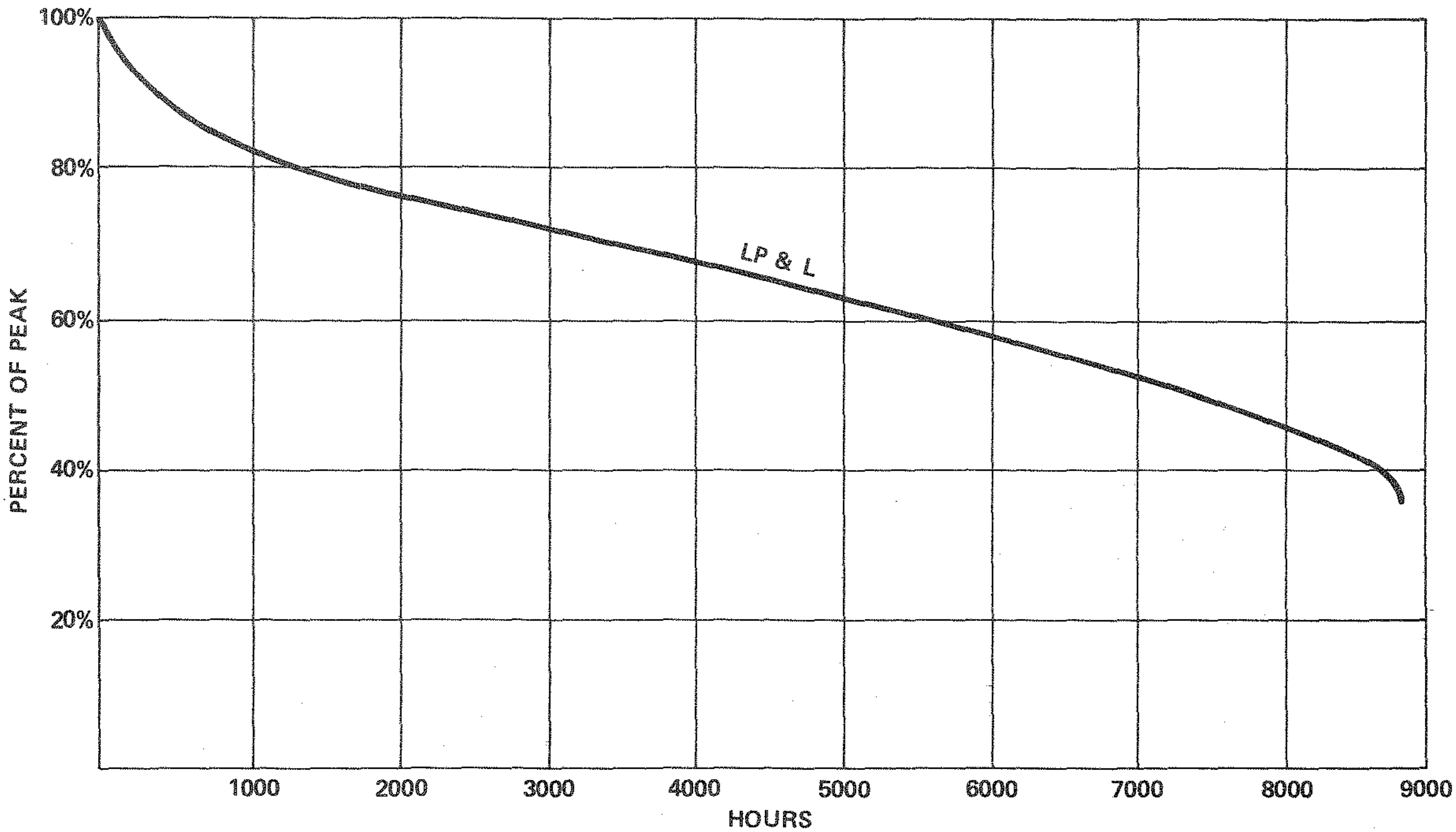

COLORADO
KANSAS
MISSOURI
OKLAHOMA
NEW MEXICO
TEXAS
ARKANSAS
MEXICO
Gulf of Mexico

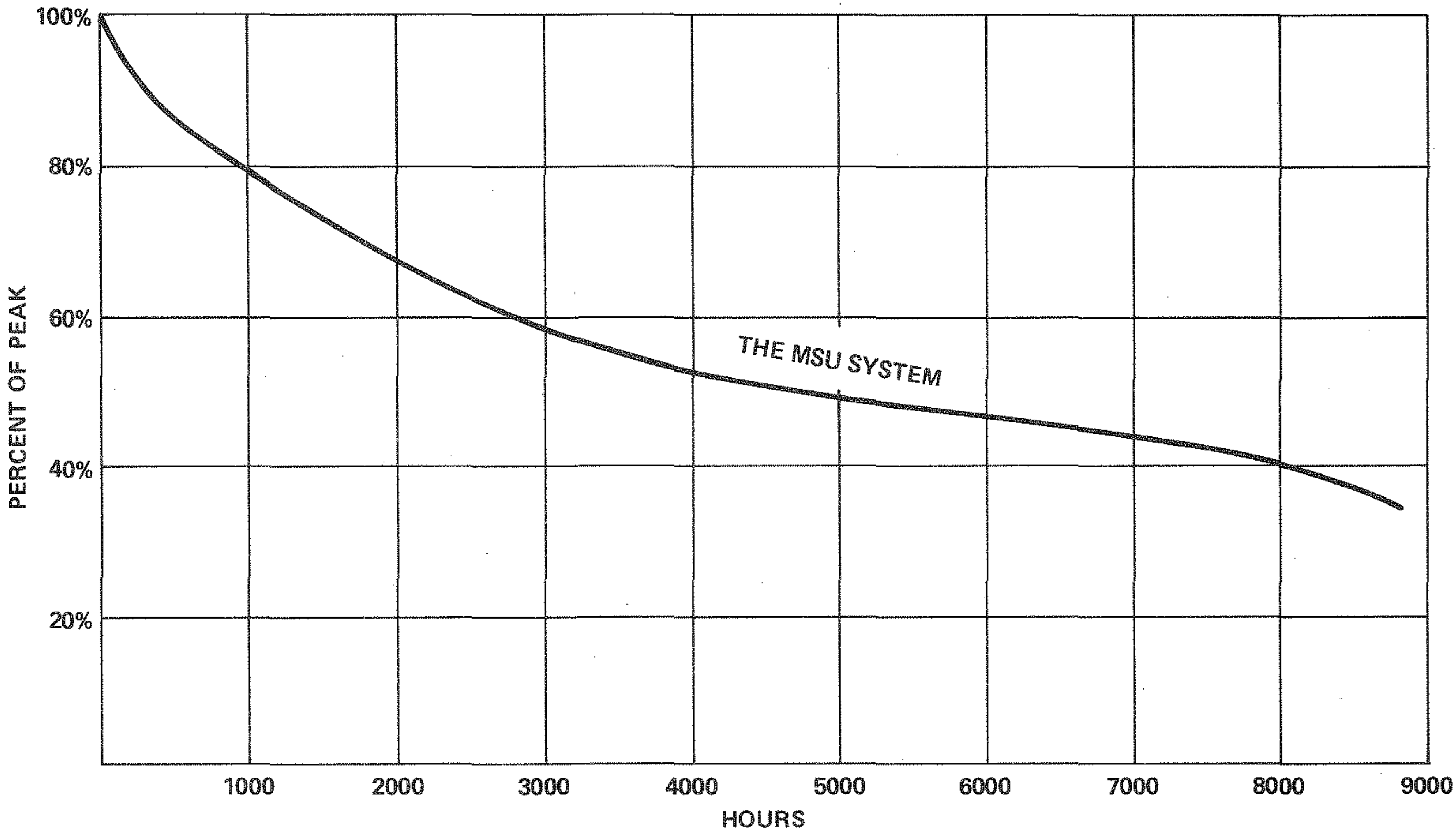
FIGURE 1.1-3



LOUISIANA POWER & LIGHT CO. WATERFORD STEAM ELECTRIC STATION	MSU AND LP&L LOAD AND CAPACITY	FIGURE 1.1-4



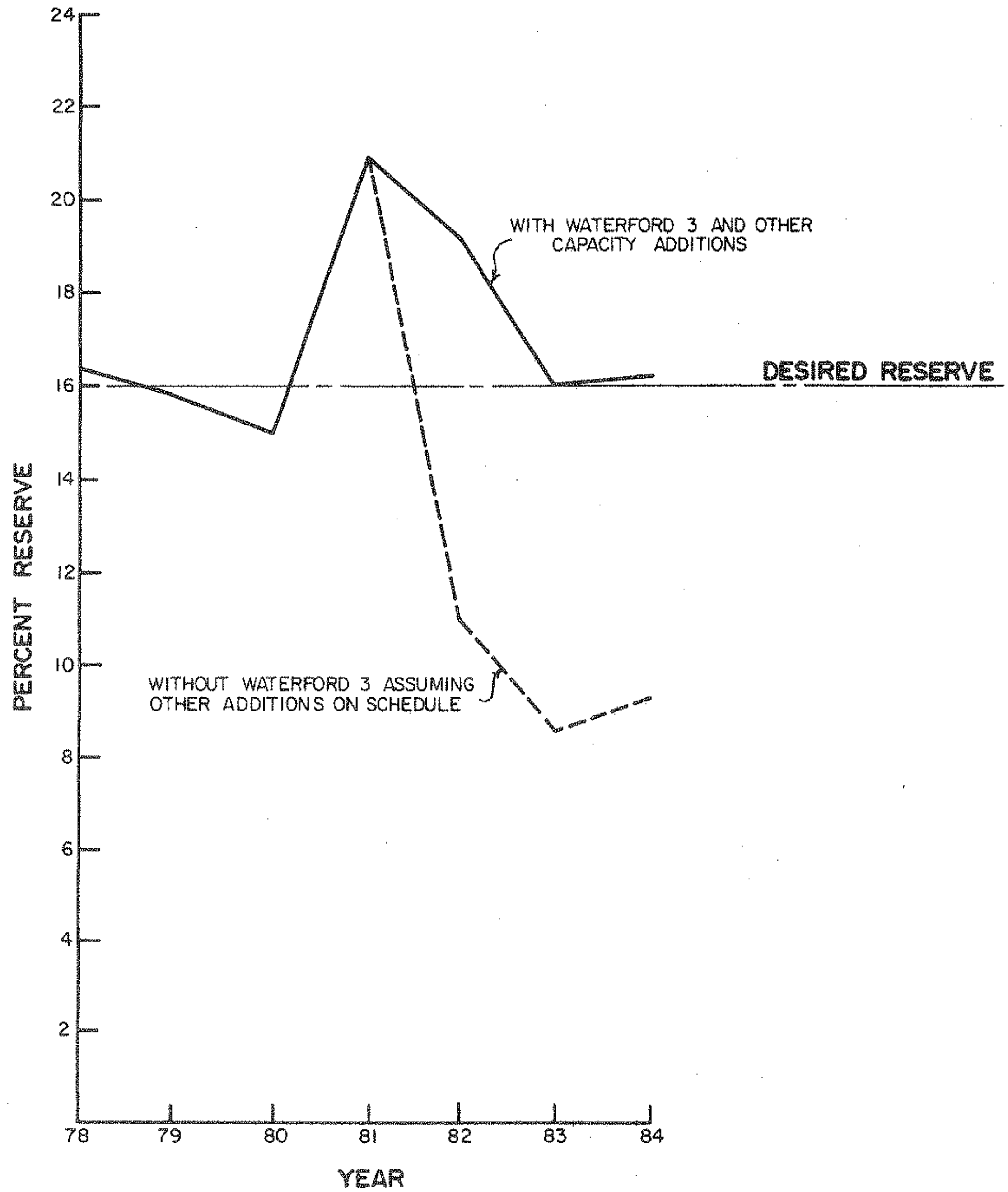
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	LP&L 1982 LOAD DURATION CURVE	Figure 1.1–5



LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

THE MSU SYSTEM 1982 LOAD DURATION CURVE

Figure 1.1-6



LOUISIANA POWER & LIGHT CO. WATERFORD STEAM ELECTRIC STATION	MIDDLE SOUTH SYSTEM RESERVE MARGIN	FIGURE 1.1 – 7

1.2 OTHER PRIMARY OBJECTIVES

The primary objective of the proposed facility is to help assure LP&L's ability to provide an adequate and low cost supply of electric energy to meet the needs of its customers. There are no other primary objectives.

1.3 CONSEQUENCES OF DELAY

The impact of delays in the operation of Waterford 3 beyond the peak of 1983 would be serious to LP&L, the MSU System and their customers. The impact would take the form of significant economic penalties and of reduced reliability. This fact has been discussed in detail in Section 1.1.3 and is summarized in their section.

1.3.1 ECONOMIC PENALTIES OF A DELAY

One obvious impact will be the very significant financial burden which will be placed upon LP&L, the MSU System and their customers in the event of delays. A large portion of the economic penalties would go toward additional expenses for the facility, such as interest, labor and cost escalations. In addition to these costs, the MSU System fuel costs would increase if operation of Waterford 3 is delayed, when substituted from internal sources.

The economic penalties that LP&L's customers would bear if there is a delay of one-half, one, or two years in the commercial operation date of Waterford 3 (assuming that Waterford 3 would have been operational in 1983, and that no other units in the MSU System have been delayed) are summarized in the following table:

ECONOMIC PENALTIES TO LP&L AND ITS CUSTOMERS

(Over Period 1983 to 1992)

Years of Delay	Total Cost	
0.5	$201,635,000	3
1.0	$245,130,000	
2.0	$532,864,000	

1.3 CONSEQUENCES OF DELAY

The impact of delays in the operation of Waterford 3 beyond the peak of 1982 would be serious to LP&L, the MSU System and their customers. The impact would take the form of significant economic penalties and of reduced reliability.

1.3.1 ECONOMIC PENALTIES OF A DELAY

One obvious impact will be the very significant financial burden which will be placed upon LP&L, the MSU System and their customers in the event of delays. A large portion of the economic penalties would go toward additional expenses for the facility, such as interest, labor and cost escalations. But an equally important cost would be the incremental cost of replacing electric energy (if it can be replaced) which Waterford 3 would have produced. In addition to these costs, the MSU System fuel costs would increase if operation of Waterford 3 is delayed, when replaced with internal sources.

The economic penalties that LP&L and its customers would bear it there is a delay of one, two, or three years in the commercial operation date of Waterford 3 (assuming that Waterford 3 would have been operational in 1982, and that no other units in the MSU System have been delayed) are summarized in the following table:

ECONOMIC PENALTIES TO LP&L AND ITS CUSTOMERS

($ Million in 1977 Dollars)

Years of Delay	Commercial Operation Date	Capacity Costs (1)	Fuel Costs	Finance Charges (2)	Total Cost (3)
1	October, 1982	120	13	121	254
2	October, 1983	218	30	242	490
3	October, 1984	309	44	363	716

Note: (1) Capacity cost is the cost for replacement capacity that LP&L becomes responsible for without Waterford 3.

(2) Finance charges are based on 10.9% of $1,109,000,000.

(3) This is based on purchases from other MSU System companies. No attempt has been made to determine costs of emergency power from outside the MSU System which will increase costs appreciably.

As can be seen from the above table, the economic penalties for delaying the project one, two or three years would be $254 million, $490 million, and $716 million, respectively. A three year delay in the commercial operation date for Waterford 3 would increase by 65 percent the total cost of the project, which is $1,109,000,000 in addition to the costs of land.

The economic penalties that the MSU System and its customers would bear if Waterford 3 is delayed are given in the following table:

ECONOMIC PENALTIES TO THE MSU SYSTEM AND ITS CUSTOMERS

($ Million in 1977 Dollars)

Years of Delay	Commercial Operation Date	Fuel Costs(1)	Finance Charges(2)	Total Cost(3)
1	October, 1982	104	121	225
2	October, 1983	226	242	468
3	October, 1984	368	363	731

Note: (1) Fuel costs to the MSU System include those to LP&L and its customers. The remainder are the costs to the other MSU System operating companies.

(2) Finance charges are based on 10.9% of $1,109,000,000. These costs are the finance charges borne by LP&L.

(3) This is based on replacement energy coming from higher cost MSU System sources. No attempt has been made to determine costs of emergency power from outside the MSU System which will increase costs appreciably.

As shown in the above table, the economic penalties for delaying the project one, two or three years would be $225 million, $468 million, and $731 million.

The costs in the two tables presented in this section are based on variable capacity factors for the first years of start-up and operation of Waterford 3 and on the assumption that the nuclear energy lost as a result of delay would be replaced by oil generation.

1.3.2 REDUCED SYSTEM RELIABILITY

System continuity is particularly important in the area served by LP&L. Due to the heavy concentration of industrial plants in this area an exceptionally heavy economic burden would be inflicted on the area in the event that curtailment of electrical power disrupted these industries. In addition, LP&L is in a region where most of the interconnecting systems have coincident peak electrical power demands which makes it extremely unlikely that there would be available large blocks of power and transmission capability to offset the potential effects of such a low reserve margin without Waterford 3, as discussed in Section 1.1.3.

Utilization of a new electrical generating unit, such as Waterford 3, in 1982 would provide a more reliable system than attempting to increase the capacity of the older existing units. Increasing the present capacity of the older units of the MSU System would reduce their overall operating efficiency and increase operating and maintenance costs. Furthermore, as part of LP&L and the MSU System's planning process, loss-of-load probability values were calculated. According to these calculations, with Waterford 3 on line in 1982, the loss-of-load probability would be 0.100 days per year (i.e., equal to one day in ten years), and without Waterford 3 in operation in 1982, the probability of a loss-of-load would increase to 0.526 days per year.

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CHAPTER 2: THE SITE AND ENVIRONMENTAL INTERFACES

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 Specification of Location

Waterford 3 is located on the west (right descending) bank of the Mississippi River at River Mile 129.6 between Baton Rouge, Louisiana, and New Orleans, Louisiana. The site is in the northwestern section of St Charles Parish, Louisiana, near the towns of Killona and Taft. Figure 2.1-1 shows the site in relation to the region within 50 miles; Figure 2.1-2 shows the region within 10 miles of the site. Figure 2.1-3 shows the area within 5 miles of Waterford 3.

The geographic coordinates for the reactor of Waterford 3 are Latitude 29° 59' 42" North, and Longitude 90° 28' 16" West. Based on the Universal Transverse Mercator (UTM) Zone 15, the UTM coordinates are Northing 3,320,743 meters and Easting 743,962 meters.

The Mississippi River is the closest prominent natural feature to Waterford 3, while other important natural features include Lac des Allemands, about 5.5 miles southwest of the site, and Lake Pontchartrain, about 7 miles northeast of the site. The land slopes gently from its high points near the Mississippi (10-15 ft above mean sea level) to extensive wetlands located about 1.5-2.5 miles inland from the river.

Most of the man-made features are located on the narrow strip of dry land between the Mississippi River and the wetlands. Near the Waterford site are several large industrial facilities, including Waterford 1 and 2 (0.4 miles west-northwest of the site), Little Gypsy Steam Electric Station (0.8 miles north-northwest of the site, across the river from Waterford 3), Baker Industries, a fertilizer manufacturer (0.6 miles east-southeast), Hooker Chemical Company (0.8 miles east-southeast), and Union Carbide, a chemical manufacturer (1.2 miles east-southeast). Louisiana Power & Light Company (LP&L) owns and operates the above-mentioned steam electric stations.

Transportation facilities near the Waterford site include the Mississippi River (0.2 miles north-northeast of the site), Louisiana Highway 18 (0.1 miles north-northeast), Louisiana Highway 3127 (1.1 miles to the south-southwest of the site), Louisiana Highway 628 (0.7 miles north-northeast, across the river) and the Missouri-Pacific Railroad (0.5 miles south-southwest).

Major urban centers in the region of the site include New Orleans (approximately 25 miles east of the site) and Baton Rouge (approximately 50 miles west-northwest). Communities in St Charles Parish near the site include Killona (0.9 miles west-northwest), Montz (1.0 miles north), Norco (1.9 miles east), and Hahnville (3.7 miles east-southeast). Laplace (4.7 miles north) is located in St John the Baptist Parish. Waterford 3 is located approximately 3 miles southeast of the St John the Baptist Parish boundary.

Other prominent man-made features include the Mississippi River levee system which, at its closest point, is 0.1 miles from Waterford 3, and the Bonnet Carre Spillway, a flood control structure 1.3 miles east-northeast of the site.

2.1.1.2 Site Area

The Waterford property is shown on Figure 2.1-3. The property is owned by LP&L and includes 3,561.3 acres. The plant area is about 48 acres and is defined as including the fenced in area immediately adjacent to Waterford 3. This site area is shown on Figure 2.1-4, along with principal station structures and nearby features. The site includes only station structures, and will not include any residential, recreational, or other industrial structures. There are no plans for a visitor center or other recreational facilities either within the site area or on the LP&L property.

The exclusion area and low population zone are shown on Figure 2.1-3. The radius of the exclusion area from the center of the reactor is about 3,000 feet (914 meters). The low population zone includes that area within approximately 2 miles (3300 meters) of the reactor.

2.1.1.3 Boundaries For Establishing Effluent Release Limits

The restricted area, defined for the purpose of controlling ingress into and egress from the site, coincides with the plant area which is enclosed by the plant perimeter fence.

For the purpose of establishing effluent release limits in accordance with 10 CFR 20 and Appendix I to 10 CFR 50, the concept of the restricted area, as defined above for the purpose of ingress and egress control, is not applicable. The effluent release limits are established in order to ensure that: (1) the concentrations of the radionuclides in gaseous effluent at the point of discharge from the plant stack and exhaust systems do not exceed the limits set forth in Table II, Column 1 of Appendix B to 10 CFR 20, (2) the concentration of radionuclides in liquid effluent at the point of discharge from the Circulating Water System discharge structure does not exceed the limits set forth in Table II, Column 2 of Appendix B to 10 CFR 20, and (3) the cumulative liquid and gaseous radionuclide releases do not result in exposures to individuals outside the site boundary in excess of the limits set forth in Appendix I to 10 CFR 50.

Radioactive effluent release points and nearest distances to the boundary line are shown in Figure 2.1-5. As described in Section 3.5, the primary source of liquid radioactive waste release is the Circulating Water System discharge canal. The concentration of effluents in this discharge will be well below the 10 CFR Part 20 limits.

Gaseous radioactive effluent releases to the atmosphere are located at the plant stack, the Turbine Building ventilation exhaust and the Fuel Handling Building exhaust. The Main Condenser Evacuation System exhaust and the Turbine Gland Sealing System exhaust are not normally radioactive, with the release point being as indicated in Figure 2.1-5. However, in the event they become radioactive they can be treated and released through the plant stack.

The radioactive releases are lower than the limits set forth in 10 CFR 20.

2.1.2 POPULATION DISTRIBUTION

Existing and projected populations by annular sectors are given in Table 2.1-1, which shows both the population within 10 miles of Waterford 3 and the population between 10 and 50 miles from the plant. Population was estimated for 1977, and then projected for the years 1980, 1981 (scheduled date of plant start-up), 1990, 2000, 2010, 2020, and 2030. The methodologies for estimating and projecting population are described in detail in Section 6.1.4.2.

2.1.2.1 Population Within 10 Miles

Figure 2.1-6 shows the distribution of present and projected population within 10 miles of Waterford 3. The estimated 1977 population within 10 miles of the plant is 50,970 persons, concentrated mostly in towns along the Mississippi River (Section 6.1.4.2 describes how the 1977 estimates were obtained). The area within 10 miles of Waterford 3 includes St Charles Parish, which had an estimated 1977 population of 34,125 persons, and St John the Baptist Parish, with a 1977 population of 26,026.

2.1.2.1.1 Towns Within 10 Miles

Table 2.1-2 lists the towns larger than 1000 persons within 10 miles of the plant and gives their 1960, 1970, and estimated 1977 populations. The location of these towns in relation to Waterford 3 is shown on Figure 2.1-2. The closest town to Waterford 3 is Killona, 0.9 miles west-northwest. Other towns near the plant include Norco, 1.9 miles east; Hahnville, 3.7 miles east-southeast; and Laplace, 4.7 miles north. The largest town within 10 miles of the plant is Reserve, 6 miles to the northwest. Other towns within 10 miles include Luling, 7 miles southeast of the plant; Mimosa Park, 9 miles southeast; St Rose, 9 miles east-southeast; and Garyville, 9 miles west-northwest. There are also many smaller settlements and individual homes along both banks of the river. The nearest such place to Waterford 3 is Montz, 1 mile north of the plant on the east bank of the Mississippi River.

2.1.2.1.2 Population by Annular Sectors

A map of the area within 10 miles of Waterford 3 was overlaid with annular sectors formed by drawing concentric circles (annuli) every mile to a distance of 5 miles from the plant and at 10 miles from the plant. Sectors were constructed by centering on the 16 cardinal compass points. The most heavily populated annular sectors within 10 miles of the plant are those which cover the towns named in Section 2.1.2.1.1. The most populous annular sector is in the east-southeast sector between annuli 5 and 10 miles from Waterford 3 (abbreviated as ESE 5-10) with a 1977 population of 7,350, which includes St Rose, part of Luling, and the riverbank settlement of Destrehan.

2.1.2.1.3 Population by Annuli

The area within five miles of the plant is more densely populated than the 5 to 10 mile annulus, primarily because the 0-5 mile area includes a higher ratio of usable land to wetlands than does the farther annulus. The population density within 5 miles of the plant is 225 persons per square mile (1977 population 17,268) compared with a density of 143 persons per square mile in the 5 to 10 mile annulus (1977 population 33,702).

The area within 2 miles of the plant is considerably less densely populated than the 3 to 5 mile annuli. The 0 to 2 mile annuli have a total 1977 population density of 141 persons per square mile (1977 population 1,774), while the 3 to 5 mile annuli have a total 1977 density of 235 persons per square mile (1977 population 15,494). The inner area consists mostly of the LP&L property and other industrial properties, with residential areas only at Killona and Montz. The outer area between 3 and 5 miles from the plant includes the towns of Norco and Hahnville, parts of Laplace, and settlements at Good Hope, New Sarpy, Gypsy, and Lucy.

2.1.2.1.4 Population by Sectors

The most populous sectors within 10 miles of Waterford 3 are east-southeast (ESE), northwest (NW), and north (N). The ESE direction includes Hahnville, part of Luling, St Rose, Destrehan, parts of New Sarpy, and numerous smaller settled areas along the Mississippi River. The NW direction includes Killona, Edgard and Reserve. The N sector includes Montz and Laplace.

2.1.2.1.5 Projected Population

Population within 10 miles of Waterford 3 is expected to more than double during the life of Waterford 3, from 50,970 persons in 1977 to 109,396 persons in 2030. The area should grow more rapidly in its eastern portion, closer to New Orleans. St Charles Parish is expected to grow from its 1977 population of 34,125 persons to 84,286 by 2030, a 147 percent increase, amounting to a 1.8 percent annual growth rate. To the west of Waterford 3, St John the Baptist Parish's population is projected to increase from 26,086 in 1977 to 46,564 in 2030, which is a 78.5 percent increase, or 1.1 percent per year.

The principal growth influences within 10 miles of the plant are expected to be the spread of population growth outward from the New Orleans area and the completion in 1981 of a new regional highway network, including I-410 from I-10 to Luling, and Louisiana Highway 3127 from Killona westward [1, 2, 3]. The resulting improvement in accessibility of the Lucy-Edgard-Wallace area, the Hahnville-Luling-Mimosa Park area, and the Destrehan-St Rose area should bring sufficient growth pressure to bear on those towns and nearby land. Examples of expected growth are the NW 3-4 annular sector near Edgard and Lucy, with no population in 1977 and a projected 2030 population of 1405 persons; the SE 4-5 annular sector between Hahnville and Luling, with a 1977 population of 429 and a projected population of 3062 in 2030; and the ESE 5-10 annular sector including St Rose and Destrehan, with a population of 7350 in 1977 and an expected 2030 population of 18,155. These three annular sectors are directly in the path of the new regional highway network.

While population increases in Louisiana are expected to average 0.8 percent per year from 1975 to 2000[4], and, in the U S, the average growth rate between 1977 and 2000 is expected to be 1.2 percent per year[5, 6], the population within 2 miles of the plant is expected to grow only from 1,774 persons in 1977 to 2,317 persons in 2030. This is an increase of only 30.6 percent over 52 years, or only 0.5 percent per year. The population growth rates of the area between 2 and 10 miles from the plant are expected to be somewhat higher than statewide or national growth rates. The 3 to 5 mile annulus is expected to grow from 15,494 persons in 1977 to 36,384 in 2030, a 134.8 percent increase, amounting to 1.7 percent per year. The 5 to 10 mile annulus is projected to grow from a population of 33,702 in 1977 to 70,695 in 2030, an increase of 109.8 percent, or 1.4 percent per year.

2.1.2.2 Population Between 10 and 50 Miles

Figure 2.1-7 shows the distribution of present and projected population in the area between 10 and 50 miles from Waterford 3. The estimated 1977 population living between 10 and 50 miles from the plant is 1,592,676 persons, or 96.9 percent of the 1,643,646 persons residing within 50 miles of the plant. The bulk of this population is concentrated in and around New Orleans, the region's major city. The New Orleans Standard Metropolitan Statistical Area (SMSA), consisting of Jefferson, Orleans, St Bernard, and St Tammany Parishes, has an estimated 1977 population of 1,131,472, or 68.1 percent of the total population within 50 miles of the plant. East Baton Rouge Parish, which includes the state capital city of Baton Rouge, has an estimated 1977 population of 321,647. Much of East Baton Rouge Parish is farther than 50 miles from Waterford 3.

The population within the region's remaining 17 parishes consists of towns and settlements along the natural levees of rivers flowing through the Mississippi delta, and along the land transportation routes of the upland parishes north and west of Lake Pontchartrain.

2.1.2.2.1 Cities and Towns Within 50 Miles

Table 2.1-3 lists towns with estimated 1977 populations of over 10,000 persons within 50 miles of Waterford 3. The largest, of course, is New Orleans (1977 population 562,560), followed by Baton Rouge (1977 population 187,194). Jefferson Parish, immediately to the west of New Orleans, includes several major cities and towns, the largest of which are Metairie, Kenner, Marrero, and Gretna. Slidell is the major city in St Tammany Parish immediately north of New Orleans. Other important regional cities not in the New Orleans or Baton Rouge areas include Houma in Terrebonne Parish, Morgan City in St Mary Parish, and Thibodaux in Lafourche Parish. The locations of these cities are shown on Figure 2.1-1.

2.1.2.2.2 Population by Annular Sectors

The most heavily populated annular sectors in the area between 10 and 50 miles from Waterford 3 are those which cover the major population centers. The east (E 20-30) annular sector contains most of the City of New Orleans. The annular sector's 1977 population is estimated at 555,731. The two next largest annular sectors cover areas adjacent to New Orleans. They are E 10-20 (Jefferson and St Charles Parishes) having a 1977 population of 215,564 persons, and ESE 20-30 (Orleans and Jefferson Parishes) having 170,248. These three annular sectors alone account for 59.1 percent of the population between 10 and 50 miles from the plant. The next most populous annular sector is NW 40-50, with 86,743 persons. This annular sector covers the Baton Rouge area.

2.1.2.2.3 Population by Annuli

The most densely populated annulus is that between 20 and 30 miles from the plant, with an estimated 1977 population of 812,017 persons, which averages 517 people per square mile. This annulus covers New Orleans and areas to the north and south. The 10-20 mile annulus has a population density of 301 persons per square mile (1977 population 283,823). This annulus includes a large part of Jefferson Parish. The outer annuli (30-40 miles and 40-50 miles from the plant) are considerably less densely populated because they include large areas of wetlands and rural areas. The 30-40 mile annulus has a 1977 population density of 126 persons per square mile (1977 population 276,593), while the 40-50 mile annulus has a density of only 78 people per square mile (1977 population 220,242).

2.1.2.2.4 Population by Sectors

The most populous sectors between 10 and 50 miles from the plant are also those which cover the New Orleans area. Sectors E and ESE have estimated 1977 populations of 828,672 and 220,437, and densities of 1758 and 468 persons per square mile, respectively. Sector NW, extending to Baton Rouge, has a 1977 population of 101,886, and a density of 216 persons per square mile.

2.1.2.2.5 Projected Population

The population between 10 and 50 miles from Waterford 3 is expected to grow by 76.4 percent between 1977 and 2030, or from 1,592,675 to 2,809,833. That translates into a 1.1 percent annual growth rate, compared to 0.8 percent for Louisiana (1975 to 2000)[4] and 1.2 percent for the U S (1977 to 2000)[5, 6]. The principal area of growth is expected to include the parishes near New Orleans, especially St Tammany Parish, which is the nearest upland area to the city. Any expansion of the New Orleans area without further impact on wetland areas would have to take place in St Tammany Parish[7]. St Tammany Parish is expected to grow from 77,348 persons in 1977 to 265,505 in 2030, an increase of 231.6 percent or 2.3 percent per year. Other parishes near New Orleans, including Jefferson, St Bernard and St Charles (partly within 10 miles of the plant) should also experience considerable growth from 1977 to 2030, ranging from 138 percent for St Bernard (1.7 percent annual growth rate) to 155.4 percent for Jefferson (1.8 percent annual growth rate). However, Orleans Parish, which consists entirely of the City of New Orleans, is expected to decline in population from 562,560 in 1970 to 502,823 in 2030. Other parishes in the region expecting rapid growth include Ascension and Livingston Parishes, both near Baton Rouge. Ascension Parish lies along the Mississippi River southeast of Baton Rouge. Its population is expected to grow from 43,104 in 1977 to 115,740 in 2030, an increase of 169.5 percent (1.9 percent per year). Livingston Parish is an upland parish east of Baton Rouge. Its expected population growth is from 44,056 in 1977 to 127,527 in 2030, an increase of 189.5 percent (2.1 percent per year).

In addition to population growth surrounding the major metropolitan areas, the region's medium-sized cities can expect continued growth[4]. In eastern sections, development is expected to continue to take place along the waterways. As the land bordering the principal highways and waterways becomes completely settled, expansion will probably proceed into the agricultural land of the natural levees. This pattern of development is taking place in Houma and Thibodaux, and along the Mississippi River[7]. The Houma area, including Bayou Cane, is rapidly assuming regional importance[7]. Terrebonne Parish, in which Houma is located, is expected to grow from a population of 84,564 in 1977 to 143,403 in 2030, a 69.6 percent increase (1.0 percent per year). Lafourche Parish, which contains Thibodaux and other rapidly growing communities along Bayou Lafourche, is expected to increase from 74,240 persons in 1977 to 107,075 in 2030, a 44.2 percent increase (0.7 percent per year). Growth is also expected in East Baton Rouge Parish (1.1 percent per year), St John the Baptist Parish (1.1 percent per year), and Plaquemines Parish (0.8 percent per year).

The annular sectors expected to experience the most rapid growth are those covering the areas described above. The ENE 40-50 annular sector, covering the Slidell area of St Tammany Parish, is expected to grow from a population of 31,012 in 1977 to 102,844 in 2030, an increase of 231.6 percent (2.3 percent per year). The annular sectors near New Orleans should also have rapid growth rates: E 10-20 is expected to grow by 1.8 percent per year, while ESE 20-30 should experience a 1.5 percent annual growth rate.

The most rapidly growing annulus is expected to be that between 10 and 20 miles from the plant. A large portion of this annulus includes parts of St Charles and Jefferson Parishes, two of the fastest growing areas within 50 miles of Waterford 3. This annulus is expected to grow from a population of 283,822 in 1977 to 735,167 in 2030, a 159 percent increase (1.8 percent per year). The 20-30 mile annulus, however, is expected to grow by only 28.6 percent (0.5 percent per year), primarily because its major component, the City of New Orleans, is expected to decline in population. The outer annuli (30-40 miles and 40-50 miles from the plant) are expected to more than double their populations. These annuli include St Tammany Parish and the area influenced by Baton Rouge.

2.1.2.3 Transient Population

The peak daily transient population resulting from recreational, industrial and transportation activity within 10 miles of the Waterford 3 site is estimated to be 119,422 persons. This amount represents daily and seasonal variations in the movement or temporary redistribution of persons within the 10 mile zone as ascertained from the available data base. The transient population is expected to increase to about 2 1/2 times its current size by the year 2030. The year 2030 estimate of transient population is 313,486 persons. Table 2.1-4 is a summary and percent breakdown of the transient population by activity category for the years 1977 and 2030. Table 2.1-5 and Figure 2.1-8 show peak seasonal and daily transient population projected from 1977 to 2030 by annular sector. A detailed discussion of each activity category is presented in the following sections. The methodology employed to derive the population estimates within various categories is discussed in Section 6.1.4.

2.1.2.3.1 Recreation

There are three categories of recreational population which were possible to allocate by annular sector. These three are high school football games, two annual festivals, and two local auto race tracks. People in the area also participate in many other recreational activities, but they could not be included in the annular sector projections because it was not possible to know specifically where these individuals engaged in recreational activity. Table 2.1-6 is a list of the various activities that the local population engages in at least once in the highest quarter of recreational activity, which is June, July and August. The total estimated population involved in these activities is about 16,416. Possible places where some of these people may go are shown on Figure 2.1-9[8, 9].

An estimated 35,500 persons are involved in the activities that were projected by annular sector. These include a reported 12,500 average attendance at football games at five high schools within the 10 mile zone[10], 20,000 in attendance at two annual 3-day festivals that are held the last weekend in October[11], and an estimate of potentially 3000 persons at a local stock car race track stadium[12]. The Laplace Drag Strip, on US Highway 61 west of Laplace, has crowds as large as 10,000 persons for races[13], and it is also the site of the Andouille Festival in October, which draws about 10,000 people[11]. There is also a festival at the Destrehan Plantation in October, drawing 10,000 persons[11]. Figure 2.1-9 also shows the locations of these facilities while Table 2.1-7 shows the existing and future estimates for these activities by annular sector. The area within 10 miles of the site contains no state parks. Not included in the estimates are the people involved in indoor activities such as movie attendance, bowling or religious activities.

2.1.2.3.2 Transportation

The area within 10 miles of Waterford 3 is serviced by auto, rail and waterborne transportation modes. There is one private airstrip within the area but no passenger activity occurs there. Figure 2.1-10 shows 1977 and 2030 traffic volumes for the entire transportation network within 10 miles of the plant. The estimated population is 78,598; 89.8% or 70,551, is derived from the highway network[14]; 9.6%, or 7514 persons, is derived from waterborne sources[15,16] and 0.7% is derived from rail activity[17]. For vehicles on the highway network and ferries carrying vehicles, 1.5 and 1.8 persons per auto occupancy factors were used[18]. These numbers therefore represent an estimated count of the people and not vehicles. Table 2.1-8 shows the projected transportation related transient population to the year 2030.

2.1.2.3.3 Industrial Employment

Peak daily transient population resulting from industrial employment within 10 miles of Waterford 3 is shown on Table 2.1-9. Figure 2.1-11 shows the location of industrial facilities within 10 miles of Waterford 3. Table 2.1-9 shows both existing and projected peak industrial employment by annular sectors. The peak daily industrial employment represents the largest number of employees at the plant at any given time. In most cases, this is during the day shift. The employment figures given below are peak daily employment, not total employment. In the subsequent sections (Section 2.1.3) manufacturing employment is presented in terms of total employment. The projection methodology is explained in Section 6.1.4.2.

In 1977, there was a daily peak of 5,324 industrial employees within 10 miles of Waterford 3. Of these, 3,230 worked within five miles of Waterford 3. Construction workers on capital improvement projects at industrial sites were not included in these totals or projections because it would be highly speculative to predict where and when such projects will take place. In such instances, the number of employees at a particular site, and therefore in a particular annular sector, could be larger than those shown on Table 2.1-9. Large construction projects generally last from two to five years.

The industries within 10 miles of Waterford 3 include chemical manufacturers, oil refineries, oil storage facilities, grain elevators, a sugar producer, and a paper company. The largest manufacturer within the study area, in terms of employment, is Union Carbide, with 1225 workers on the day shift [19]. Union Carbide is a diversified chemicals manufacturer producing such products as aromatics, ethylene oxide, epoxy plasticizers, and acrylic acid [20]. Union Carbide's property is approximately 1.2 miles east-southeast of the Waterford 3 site.

The closest manufacturer to the site is Beker Industries, a producer of fertilizer chemicals with a daily peak of 144 employees at its plant. Beker's property line is 0.6 miles east-southeast of the Waterford 3 site. East of Beker is the Hooker Chemical Company, a manufacturer of chlorine-based chemicals, 0.8 miles east-southeast of the Waterford 3 site. Hooker and various subcontractors and subsidiaries employ a total of 528 people on the peak shift. Two other small chemical companies, Argus and Witco, are located adjacent to Union Carbide, Argus is 1.1 miles southeast of the site and has a peak daily employment of 40 people. Witco, located 1.2 miles southeast of the site, has a peak daily employment of 41 people. Shell Chemical Company, employing 300 people at peak, is located across the
Mississippi River in Norco, approximately 2.5 miles to the east of the Water- 1
ford 3 site. Other major chemical companies within 10 miles of Waterford 3 include Dupont (peak of 350 employees) 5.3 miles northwest of Waterford 3, Monsanto (peak of 500 employees) 8.5 miles east-southeast, Sewell Plastics Company (peak of 40 employees) 8 miles to the northwest, and USAMEX (peak of 15 employees) 8.8 miles east-southeast of Waterford 3.

There are three refineries located in Norco and Good Hope: the Shell Oil Company located 3.5 miles to the east of Waterford 3, with a daily peak of 700 employees, the Chevron Oil Company located 4.2 miles to the east of the
site with a daily peak of 17 employees, and the Good Hope Refinery located 1
4.3 miles to the east of Waterford 3, with a daily peak of 120 employees. Also in this area is the General American Transportation Company (GATX), a tank storage firm storing oil, chemicals, and food oils. GATX employs a peak of 115 people and is located 4.2 miles to the east of Waterford 3. Other refineries and oil storage facilities within 10 miles of Waterford 3 include Texaco (peak of 79 employees) 7.9 miles south-southeast of Waterford 3, Marathon Oil Company (peak of 200 employees) 9 miles west-northwest, and International Tank Terminal (peak of 60 employees) 9 miles east-southeast.

Other industries within 10 miles of Waterford 3 include the Bunge Grain Elevator Company (peak of 210 employees) 8.3 miles east-southeast of Waterford 3, the Godchaux-Henderson Sugar Company (peak of 112 employees) 7.3 miles northwest, and the St Joe Paper Company (peak of 51 employees) 8.6 miles northwest, ADM Milling (peak of 46 employees) 7.4 miles east-southeast, Bayside Grain Elevator (peak of 65 employees) 7.9 miles west-northwest, Cargill (peak of 6 employees) 8.0 miles west-northwest, Coastal Canning Company (peak of 30 employees) 8 miles northwest, and St Charles Grain Elevator Company (peak of 60 employees) 7.5 miles to the east-southeast of the site. 1

Manufacturing is expected to continue its growth in St John the Baptist and St Charles Parishes. In the past, the area has been attractive for development of refineries and petrochemicals because of the easy availability of oil resources in the Louisiana coastal areas. Depletion of petroleum resources in Louisiana could have negative effects on these industries, but the construction of the Louisiana Offshore Oil Port (LOOP) should offset declining state resources as a source of raw materials. Additionally, the fresh water and navigational access provided by the Mississippi River are likely to continue to make the area attractive for industrial development [7]. Projections by the U.S. Department of Commerce [21] and projections prepared for the LOOP environmental impact assessment [22] were analyzed to determine future industrial employment trends. This analysis indicates that coastal Louisiana employment in petrochemical industries is expected to grow rapidly, by 4% to 5% per year, while employment in refineries is expected to grow by about 1% per year until 1990, after which it should level off. Food products industries, which include grain elevators and sugar producers, are not expected to grow rapidly.

Estimated future industrial employment by annular sectors is shown on Table 2.1-9. These numbers reflect an assumed employment growth at suitable industrial sites along the Mississippi River. In general, the most rapid industrial development is projected to take place southeast and northeast of Waterford 3. There are some large industrial sites within three miles of Waterford 3 and these can be expected to be developed for industrial use during the life of the plant. These properties consist of a 3100-acre parcel owned by Koch Industies immediately to the west of Killona, and the as yet undeveloped portions of the Hooker Chemical and Union Carbide properties.

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2.1.3 USES OF ADJACENT LANDS AND WATERS

2.1.3.1 Existing Land Uses on the Applicant's Property

The Louisiana Power & Light Company property, which includes the Waterford 3 site, encompasses 3,561.3 acres. A map showing existing land uses on and near this property appears in Figure 2.1-12. A statistical summary of land use acreage on the property is given in Table 2.1-10, and a statistical summary of land use acreage within the exclusion area only is shown on Table 2.1-11. Land uses have been classified according to USGS Professional Paper 964, as discussed in Section 6.1.4.2.

Approximately 52.5 percent of the LP&L property is forested wetlands, totaling 1,868.6 acres. The wetland areas are all south of Louisiana Highway 3127. Agriculture is the next largest land use category, covering 785 acres on the north end of the LP&L land, or 22 percent of the property. Up to the present time, the agriculture has consisted mostly of sugar cane farming, with a few areas planted in soybeans. Farming on LP&L property 3
is restricted and the cultivation of leafy vegetables is prohibited. Pasturing of animals is also prohibited. Transportation routes crossings the property include Louisiana Highways 18 and 3127 and the Missouri Pacific Railroad. Transportation facilities utilized by LP&L personnel to travel to and from Waterford 3 are shown on Figure 2.1-3.

Pipelines traversing the property are shown on Figure 2.1-13. The major ones include four Texaco pipelines running along the eastern edge of the property, including one 26-inch and one 20-inch natural gas pipelines, and two 6-inch propane pipelines. Sugarbowl Natural Gas Company has a 12-inch natural gas pipeline running east-west across the center of the property, and LP&L maintains a 10-inch natural gas pipeline to serve Waterford 1 and 2. There is also a 4-inch liquid anhydrous ammonia pipeline owned by Gulf Central Pipeline Company running south of the site.

Utility facilities on the property include the Waterford 1 and 2 and Waterford 3 generating station facilities, and associated fuel tanks, storage areas, offices, parking areas, switchyards, and transmission lines. These are shown on Figure 2.1-4. Transmission lines crossing the property are shown on Figure 2.1-14. The total acreage of utility uses on the property is 402 acres, or 11.3 percent of the property. This acreage does not include some of the transmission lines which are counted as agricultural land when the lines pass over agricultural areas.

Other land uses on the property include the leaves (shown as "Other Urban or Built-Up Land"), non-forested wetland, forest land on the batture, barren lands on the batture, a canal in the southern portion of the property, and a small area devoted to aboveground facilities for the Texaco pipeline, which is labeled industrial on Figure 2.1-11 and Table 2.1-10. These areas total 404.9 acres, or 11.4 percent of the property.

There is no residential or recreational land on the property. Killona, a residential area with an estimated 1977 population of 1,203 persons, is adjacent to the LP&L property on the west. Also adjacent to the property on the west is the Killona Elementary School, which includes Kindergarten and grades 1-6. School membership in March 1977 was 152 pupils[1]. Adjacent to the property on the east are the manufacturing facilities of Beker Industries, a producer of fertilizer. The MIssissippi River abuts the property on the north, and the southern half of the property is surrounded by forested wetlands.

2.1.3.2 The Exclusion Area

The exclusion area, with a radius of 914 meters, encompasses 625.6 acres. Within the exclusion area, the predominant land use is utility facilities, as shown in Table 2.1-11. The exclusion area also includes a portion of the Mississippi River. Agriculture represents 22 percent of the total. Other land uses within the exclusion area include forest land, the levee, barren land on the batture, and a small portion of the Missouri Pacific Railroad right-of-way. Louisiana Highway 18 also traverses the exclusion area.

2.1.3.3 Proposed Land Uses on the LP&L Property

There are no proposed land use on the LP&L property or within the exclusion area other than the structures and facilities associated with Waterford 3, and these are contained within the category "Utilities" shown on Figure 2.1-12. All proposed offsite access corridors, cooling water conveyances, and transmission facilities will be contained within this area. Future expansion of facilities for purposes other than the generation and transmission of electricity beyond those shown on Figure 2.1-4 is not anticipated. Agricultural activity, within the restrictions imposed by LP&L is likely to continue for the foreseeable future in the areas currently utilized for this purpose. These restrictions are that "leafy 3
vegetables intended for, or likely to be used for human consumption or as fodder or silage for dairy animals" shall not be grown or stored in this area.

There is no visitor center or recreation area planned within the LP&L property.

The only oather expected change in land use configuration on the property is the addition of two lanes to Louisiana Highway 3127, which is planned to take place during the 1980's[2].

2.1.3.4 Nearest Residences and Agricultural Activities

In April 1976, a field survey was conducted to locate, in each sector with- 1
in a five-mile radius of Waterford 3, the nearest: 1) beef and milk cows, 2) milk goat, 3) vegetable garden (of 500 square feet or larger), and, 4) residence. In June 1979, an update of this survey was performed for the purpose of concirming that the parameters identified in the original survey had not significantly changed. The 1979 survey was conducted as follows:

a) The study area was divided into 16 equal sectors centered on the sixteen cardinal compass directions with associated distance annuli. 1
b) Aerial reconnaissance was conducted to determine initial locations for each parameter.
c) Ground surveys were then performed by driving all passable roads within a five mile radius of Waterford 3.

d) All parameters located nearest to the plant were recorded and mapped by annular sector.

e) Where possible, local people were interviewed to aid in determining the location of beef cattle, milk cows and milk goats. In addition, local vetenarians and feed store operators were contacted to obtain information on livestock in the area. 1

Table 2.1-12 summarizes the results for each parameter by sector. Figure 2.1-15 illustrates these results within the five mile radius study area.

Tables 2.1-13 through 2.1-17 contain detailed data on milk cows, beef cattle, milk goats, vegetable gardens, and residences, respectively. Each table indicates annular sector, distance, direction, and survey identification number. These data indicate that the nearest location to Waterford 3 for each parameter is as follows:

a) <u>Milk Cows</u> - 0.9 miles, in the NW sector;

b) <u>Beef Cattle</u> - 0.8 miles, in the NW and NNW sectors; 1

c) <u>Milk Goats</u> - 3.1 miles, in the E sector;

d) <u>Vegetable Gardens</u> - (500 square feet or larger) 0.8 miles, in the NNE sector;

e) <u>Residence</u> - 0.8 miles, in the N and NE sectors; and

f) <u>Nearest Site Boundary</u> - 0.17 mile in the NNE sector. The nearest site boundary is considered to be the LP&L property boundary at the edge of the Mississippi River.

2.1.3.5 <u>Land Uses Within Five Miles of Waterford 3</u>

2.1.3.5.1 Overview

Land uses in the area within five miles of Waterford 3 were inventoried in February and March of 1977. The inventory was carried out principally through interpretation of aerial photographs, with field checks. Land uses were classified according to USGS Professional Paper 964[3]. The quantitative results of the survey appear on Table 2.1-18. Land uses on this table are broken down into three levels of classification, with Level I being the least detailed and Level III the most detailed. Figure 2.1-16 shows land use distribution for Level I and II classifications within five miles of Waterford 3. Detailed discussions of the survey and land use classification methodologies are in Section 6.1.4.2.

Much of the area within five miles of Waterford 3 is wetlands, both forested and nonforested. Wetlands account for 19,306 acres, or 38.4 percent of the total area within five miles. Urban or built-up land and agricultural land are generally concentrated within one to two miles of the Mississippi River. Urban or built-up land covers 7,256.5 acres, or 14.4 percent of the total within 5 miles. Nearly 30 percent of this category is industrial, composed of large refineries and petrochemical complexes along the banks of the river. Residential acreage is next largest in the urban or built-up category, composed primarily of communities flanking the river.

Agricultural land comprises 10,306.5 acres, or 20.5 percent of the total area within five miles. The richest agricultural land lies between the Mississippi River and the wetlands. Up to the present time, most of this land has been planted in sugar cane and, to a lesser extent, soybeans.

Other categories of land use include forest land, water (mostly the Mississippi River) and barren lands (transitional areas, open batture, and sand pits). These account for 26.6 percent of the area within 5 miles of the plant.

Future land use is expected to reflect a continuation of past trends: the urbanization and industrialization of the area primarily at the expense of agricultural land. Additions to the regional highway network, improving access to New Orleans, suggest rapid urban growth in the vicinity of Waterford during coming years. Population within five miles of the plant is expected to grow from its present 17,268 to 38,701 by 2030 (see also Section 2.1.2.1). Projections also indicate that areas along the Mississippi River between New Orleans and Baton Rouge should continue to be attractive for industrial development.

2.1.3.5.2 Urban or Built-up Land

Urban or built-up land comprises 7,256.5 acres within five miles of Waterford 3. The subcategories are discussed below.

a) Residential

The residential land use classification includes facilities for both resident and transient population. The total category covers 1894.6 acres within five miles of Waterford 3. Most of this acreage consists of single family units. The remaining acreage includes several mobile home parks, a few apartment buildings, a motel, and campground. Principal population centers in the vicinity include Killona, Norco, Hahnville and Laplace. There are also smaller settlements at Lucy, Montz and New Sarpy.

Recent residental growth patterns within five miles of the plant have varied widely. The most extensive growth has taken place in the Laplace area. Residential growth has also occurred in the vicinity of Hahnville. However, the Norco area has grown more slowly, because it is nearing its capacity for development, is now bounded by industrial facilities and the Bonnet Carre Floodway, and has little vacant land remaining in its vicinity. The area northwest of the plant, including Lucy and Edgard, has also grown slowly, because it is considerably less accessible to New Orleans than areas to the east or north of the plant.

There is relatively little large-scale tract housing development taking place within five miles of the plant. Most of the residential development in the study area has consisted of the construction of individual homes or very small subdivisions. The only large residential subdivision currently under construction in the area is "River Forest", a 263-acre, 327-lot development off US Highway 61 (Airline Highway) near Laplace. This development should be completed by 1980[4]. Most of the large-scale tract housing development has taken place and is expected to take place in the next 10 years to the east and north of the Waterford area. The area north of Laplace and the eastern portion of St Charles Parish abutting Jefferson Parish are expected to continue to attract housing development during this period[4, 5]. One of the largest subdivisions currently under construction is "Ormond Plantation Estates", immediately outside the five-mile radius to the east, near Destrehan. This subdivision includes 1200 acres, and plans call for the development of 282 lots by 1980 and 1400 lots after 1980.

The most significant foreseeable trend which is expected to affect residential development within five miles of the plant is highway construction. I-410 is scheduled for completion in 1981 connecting I-10 to US Highway 90 near Luling via a bridge across the Mississippi River[5]. In addition, Louisiana Highway 3127 is expected to be completed from Killona to Edgard by 1980[6]. The completion of these roads will probably make currently vacant land around Hahnville, Lucy and Edgard attractive for development of large subdivisions. Rapid residential growth can therefore be projected in the vicinity of Edgard, Lucy, and Hahnville after 1981. Also, the present rapid growth rate in the Laplace-Montz area is expected to continue during the plant life. However, residential growth is not expected to take place in any significant amounts in the area between Lucy and Hahnville because of present or projected industrial development there. Population growth trends within five miles of the plant are also discussed in Sections 2.1.2.1 and 6.1.4.2.

b) Commercial and Services

The USGS commercial and services land use classification system includes retail and services as well as schools and other public-institutional land uses. Within five miles of Waterford 3 there are 279.9 acres within this category.

There are 143.3 acres of commercial land uses within five miles of the plant, mostly serving local residential settlements. The remaining are highway-oriented uses on U.S. Highway 61 near Laplace and Norco. There are no large shopping centers within five miles of the plant, although there are some just outside of the five-mile radius in Laplace. Most of the shopping center or larger-scale commercial development during the next ten years is expected to take place outside the five-mile radius, along U.S. Highway 90 near Luling, Boutte and Mimosa Park, on the east bank of St Charles Parish between Destrehan and Jefferson Parish, and north of Laplace on the U.S. Highway 61. Within the five-mile radius, substantial commercial development prior to 1986 will probably be limited to US Highway 61[4, 5].

Beyond the next ten years, it can be assumed that commercial development should grow with residential development. This assumption would indicate expansion of commercial facilities in Hahnville and the Laplace-Montz area. The Lucy-Edgard area, which presently has few commercial or service uses, is anticipated to experience rapid growth of these land uses if the projected population expansion in that area materializes.

There are twelve schools located within five miles of Waterford 3, comprising a total of 101.3 acres. The school locations are shown on Figure 2.1-17, and membership statistics for 1973 through 1977 are shown on Table 2.1-19. The closest school to Waterford 3 is Killona Elementary School (grades K-6), approximately 5100 feet from the plant. This school had 152 students in March 1977, a decline from 215 in 1973[7]. It is possible that this school will be phased out of operation if this decline in membership continues[8]. All other schools are farther than three miles from Waterford 3.

Membership has been static or declined in all schools within 5 miles except those in Laplace, where population growth has been the greatest in the area. The trend towards slight declines in membership has occurred in all of St Charles and St John the Baptist Parishes as well since 1973[7, 8], in spite of general population increases. These declines in membership probably reflect the reduction in birth rates since the mid-1960's. There are no plans at the present time for construction of new school facilities within five miles of Waterford 3[8, 9]. However, reduced school enrollments cannot be expected to persist for the life of the plant in the face of population growth. Therefore, it is reasonable to expect the construction of new school facilities in the Lucy-Edgard area and possibly in the Laplace-Montz and Hahnville Area prior to 2030.

Other institutional facilities within five miles of Waterford 3 include the St Charles Parish Courthouse in Hahnville, and several churches and cemeteries in the residential communities. These uses cover 35.3 acres.

c) Manufacturing

Industrial land uses cover 2,148.6 acres within five miles of Waterford 3. The industries include chemical manufacturers, oil refineries, and an oil storage facility. Table 2.1-20 lists the major manufacturers within five miles of Waterford 3, and Figure 2.1-18 shows their locations. In terms of employment, the largest manufacturer within five miles of Waterford 3 is Union Carbide, with a total of 1528 workers on all shifts[10]. Union Carbide is a diversified chemicals manufacturer producing aromatics, ethylene oxide, epoxy plasticizers, acrylic acid and other products[11], and is located approximately 1.2 miles east-southeast of the Waterford 3 site. Union Carbide is currently undertaking a large expansion at its Taft plant, and 2200 construction workers are employed for this work. However, the expanded facilities are not expected to increase operational employment at the plant. The expansion should be completed in 1978.

The closest manufacturer to the site is Beker Industries, which employs a total of 210 people. Beker, a producer of fertilizer chemicals, is located 0.6 miles east-southeast of the Waterford 3 site. East of Beker is the Hooker Chemical Company, a manufacturer of chlorine-based chemicals, which employs a total of 666 people among its various subcontractors and subsidiaries. Hooker is 0.8 miles from the Waterford 3 site. Two other small chemical companies, Argus and Witco, are located adjacent to Union Carbide. The Shell Chemical Company, employing 461 people, is located across the Mississippi River in Norco.

There are three refineries located in Norco and Good Hope, including the Shell Oil Company, with a total of 945 employees; the Chevron Oil Company, with a total of 17 employees; and the Good Hope Refinery, with a total of 160 employees. The closest of these to the Waterford 3 site is Shell, 3.5 miles away. Also in this area is the property of General American Transportation Company (GATX), on which oil, chemicals, and food oils are stored. GATX employs a total of 163 people.

Immediately beyond the five miles radius are two chemical companies: Monsanto, in Luling, and Du Pont, west of Laplace.

Manufacturing is expected to continue its growth in the region including Assumption, St James, St John the Baptist, and St Charles Parishes. This area has been attractive for development of refineries and petrochemicals because of the availability of oil resources in the nearby Louisiana coastal areas. Depletion of petroleum resources in Louisiana could have negative effects on these industries, but the construction of the Louisiana Offshore Oil Port (LOOP) should offset declining state resources as a source of raw materials. Additionally, the fresh water and navigational access provided by the Mississippi River are likely to continue to make the area attractive for industrial development[12]. Projections by the US Department of Commerce[13] and projections prepared for the LOOP environmental impact assessment[14] were analyzed to determine future industrial employment trends. This analysis indicates that coastal Louisiana employment in petrochemical industries is expected to grow rapidly, by 4% to 5% per year, while employment in refineries is expected to grow by about 1% per year until 1990, after which it should level off. Therefore, continued industrial development can be expected in the vicinity of Waterford 3.

There are a number of large tracts of land within five miles of Waterford 3 which are listed on promotional maps as available for industrial use[15]. One of these, a 3100 acre tract owned by Koch Industries, is presently zoned for industrial use and is located immediately west of Killona. The company is presently looking for an industrial buyer or user for the property[16]. With frontage on the Mississippi River and access to good rail and highway transportation, this property is likely to be developed for industrial use during the life of the Waterford 3 plant. Another parcel to the east of Waterford 3, owned by the Midland Ross Corporation, is also zoned industrial, but for light manufacturing. This parcel, including 340 acres, is adjacent to Union Carbide, and has rail, highway, and river access. However, there are presently no plans to develop this tract[17]. Other potential parcels for industrial development are near Hahnville, in the Lucy area, and between Laplace and Montz. However, these sites are considered more attractive for residential development over the life of Waterford 3 for the following reasons:

1) Residential development is expected to occur rapidly in these areas, and is already occurring near several of the industrial sites; and

2) Many better industrial sites are available outside the study area along the Mississippi River in areas less likely to experience population increases.

Petroleum and gas production is an important industrial activity in coastal Louisiana, and takes place at several locations within five miles of Waterford 3. Figure 2.1-18 shows the location of oil and gas fields in the study area. Four of these, the Lucy, Bonnet Carre, Norco and Good Hope fields, are currently producing oil and gas. The largest producer is the Good Hope field, over four miles from the site. The closest producing wells are in the Lucy field, about 3 miles west of the site. The Hahnville and Taft fields near the site are not currently producing. Future oil and gas production in the Louisiana coastal zone is not expected to grow rapidly, although trends will probably be affected by deregulation of gas and oil prices, price increases, or development of alternative energy sources[12].

d) Transportation, Communication, and Utilities

A total of 1895.6 acres within five miles of Waterford 3 is occupied by transportation, communication, and utility uses. Of this, 1119.5 acres are devoted to utility facilities, mostly the LP&L facilities at Waterford 1, 2, 3 and Little Gypsy. Also included in the category of utilities are transmission lines, of which there are several within 5 miles of the plant, as shown on Figure 2.1-14. Other utility facilities in the area are sewage treatment and water treatment plants in Norco and Laplace.

Transportation and communications facilities within five miles of Waterford 3 account for 776.1 acres. Most of this is in major transportation facilities rights of way, including U S Highway 61, the Louisiana and Arkansas Railroad and the Illinois Central Gulf Railroad on the east bank of the Mississippi, and the Missouri Pacific Railroad and Louisiana Highway 3127 on the west bank. Within the study area the only future transportation facility forseeable at this time is the extension and widening of Louisiana Highway 3127 west from Killona, toward Donaldsonville. A section of this road, including a branch to Edgard, will be completed by 1980[2]. Other transportation and communication facilities include radio towers near Laplace and Hahnville, and a small private grass airstrip between Taft and Hahnville. The Mississippi River is, of course, also a major transportation facility, but is not included in this land use classification. Waterborne commerce and passenger service on the river are discussed in Section 2.1.3.5.5.

There are approximately 43 major pipelines operated by eleven different companies within five miles of Waterford 3[18]. Products carried in these pipelines include natural gas, sodium chloride brine, crude oil, gasoline and fuel oils, ethane, propane, ethylene, propylene, industrial gases and liquid anhydrous ammonia. The closest pipelines to Waterford 3 are Louisiana Power & Light's 10-inch natural gas pipeline 0.61 miles to the west-northwest of the site; Gulf Central Pipeline Company's four-inch liquid anhydrous ammonia pipeline 0.6 miles to the south of Waterford 3; and Texaco's natural gas pipelines approximately 0.5 miles to the east of Waterford 3. These and all other major pipelines within a five mile radius of Waterford 3 are shown in Figure 2.1-13.

Smaller gas pipelines serve the populated areas within five miles of the plant, and the closest of these is a 2-inch pipeline in Killona. There are no plans at present to expand residential natural gas service[19].

e) Mixed Urban or Built-up Land

This category consists of areas where commercial and residential land uses are mixed. This occurs in Hahnville along Louisiana Highway 18. A total of 25.9 acres is included in the category within 5 miles of Waterford 3.

f) Other Urban or Built-up Land

This category includes recreational facilities and the Mississippi River levee. The entire category consists of 1,018.8 acres, 853.7 of which is covered by the levee system. Recreational land uses, shown on Figure 2.1-17, occupy 165.1 acres, with 79.0 acres in the public recreational facilities category. Public recreational facilities within five miles of Waterford 3 consist of small, local-oriented facilities, mostly playgrounds. Private recreational facilities, totaling 86.1 acres, consist of a nine-hole golf course in Hahnville, a swim club in Norco, a dirt stock car race track east of Laplace (currently not in operation) and a hunting club near Montz.

Private recreation in the form of fishing and hunting takes place throughout the five mile area. Fishing is known to take place near the Waterford 1 and 2 discharge structure. A small amount of hunting probably takes place in the wetlands[20].

2.1.3.5.3 Agricultural Land

There are 10,306.5 acres of agricultural land within five miles of Waterford 3, accounting for 20.5 percent of the land within the five mile radius. Statistics on agriculture for St Charles and St John the Baptist Parishes are shown in Table 2.1-21, which indicates a decline of all sectors of agriculture in St Charles Parish except cattle-raising. However, agricultural growth has continued in St John the Baptist Parish.

It is probable that much of the agricultural land within five miles of Waterford 3 is not in active use for agricultural purposes. Of the 44,505 acres of farmland in St Charles Parish in 1974, only 13.1 percent (5,824 acres) were used for harvested cropland or pasture. In St John the Baptist Parish, the rate of active usage of agricultural land was somewhat higher: 45.5 percent of its 26,933 total acres of farmland[21].

Acreage in cropland in St Charles Parish was nearly halved between 1969 and 1974, while that in St John the Baptist Parish increased slightly. The only agricultural sector which experienced growth in St Charles Parish between 1969 and 1974 was cattle-raising. Sugar cane production, long the Parish's predominant agricultural product, declined markedly. In St John the Baptist Parish, cattle-raising, soybean production, and hay production increased in importance, while sugar cane has retained its position as the Parish's most important crop[21].

Total land in sugar cane in St Charles Parish declined from 2,814 acres in 1970 to 1,208 acres in 1975[12]. It has since remained at about that level[22]. In St John the Baptist Parish, land in sugar cane increased to 10,138 acres in 1975 from 8,301 acres in 1970, reversing a 20-year decline in sugar cane acreage. Most of the sugar cane within five miles of Waterford 3 is grown on the west bank of the Mississippi River in the rich agricultural belt there[22, 23]. Sugar cane farming is not expected to expand significantly within the coastal zone region unless higher yields per acre or long-term higher prices can be obtained[24]. This expected down-trend, plus the expected population and manufacturing growth within five miles of Waterford 3, will probably act to reduce the importance of this crop in the study area. There has been sugar cane farming within the LP&L property, and within the exclusion area for Waterford 3. No changes in this land usage are foreseen at present (see also Section 2.1.3.1).

Soybeans have become an increasingly important crop in the coastal zone due to high bean prices and amenable growing conditions[24]. Soybean acreage has increased rapidly in St John the Baptist Parish from 205 acres in 1969 to 2,704 in 1974. A State Planning Office report contains data which are in disagreement with these Census of Agriculture figures, and this report gives the Parish 3,600 acres in 1974[12]. In St Charles Parish, however, the trend has been the reverse: preliminary Census of Agriculture statistics indicate no soybean acreage in 1974, compared with 110 acres in 1969[21]. (the State Planning Office report indicates 400 acres of soybeans in St Charles Parish in 1974, down from 1,000 in 1970[12]). Within the study area for Waterford 3, soybeans are grown primarily on the west bank of the Mississippi River[22, 23]. Soybean farming is expected to continue to become increasingly popular in the coastal zone[24], but it is doubtful that it will consume large acreage within the five-mile study area because of the residential and manufacturing development expected there.

The nearest vegetable gardens to Waterford 3 are small ones in Killona and Montz (see also Section 2.1.3.4). In general, vegetable gardens are more prevalent in the Montz area than elsewhere within the study area[22, 23]. The Montz area is located between 1 and 2 miles from Waterford 3.

Cattle - raising is becoming an increasingly important activity in both St Charles and St John the Baptist Parishes. It was the only agricultural sector within St Charles Parish to experience growth in the 1969 - 1974 period. During that period the number of cattle in the Parish increased by 16.4 percent to 3,033 (not including cattle sold during the year). Pastureland also increased by 11.8 percent to 3,755 acres in 1974. St John the Baptist Parish had fewer cattle in 1974 (529), but their numbers had increased by nearly five times since 1969[21]. About 99.8 percent of the cattle in both parishes were beef cattle in 1974[21]. There were only eight dairy cows in the two Parishes in 1974[21], and no milk has been produced in either Parish for commercial consumption since 1959[24].

Within five miles of Waterford 3, the principal cattle-raising areas are between Lucy and Edgard, within the Bonnet Carre Floodway, and near Hahnville. The first two areas are the most important. The Gold Mine Plantation between Lucy and Edgard has a large herd of beef cattle. The plantation is located about 4.5 miles from Waterford 3. Cattle can also be observed grazing on the pasture and the levee as far east as Killona[25]. The Bonnet Carre Floodway contains leased grazing land on its eastern half, south of the U S Highway 61. At present there are 1,500 to 2,000 head of cattle in the Bonnet Carre Floodway, and expansions of this number to 3,000 are foreseen[26].

Cattle production in the coastal zone is expected to experience increases, depending upon higher prices and expanded markets[24]. A continued increase of this activity within five miles of Waterford 3 can be expected. The increases in number of cattle should take place primarily in the Lucy - Edgard area and in the Bonnet Carre Floodway. However, residential development in the Lucy - Edgard area can be expected to pre-empt some cattle raising land there during the latter years of the plant life (see Section 2.1.3.4).

2.1.3.5.4 Forest Land

The land use category of forest land covers 6,491.5 acres within five miles of Waterford 3. However, forests, including forested wetlands, actually cover over one-third of the five-mile radius Waterford 3 study area (20,628.6 acres total). Forest land is a potentially important resource, but neither St Charles nor St John the Baptist Parishes are very productive forestry areas. Growth of forestry in the coastal zone is not expected to be strong[24]. Therefore, timber production within five miles of Waterford 3 is not expected to be a significant land use factor, although forest land (both upland and wetland) should continue to be a predominant land use in terms of area, since much of it is undevelopable for other uses.

2.1.3.5.5 Water

Water constitutes 4,332.3 acres within five miles of Waterford 3. Most of this acreage consists of the Mississippi River; and the remainder, canals and ponds. Commercial fishing is not an important activity in either St Charles or St John the Baptist Parishes. Of the many varieties of aquacultural activity pursued in Louisiana, only one, catfish farming, is carried out in St Charles and St John the Baptist Parishes. St Charles Parish had 270 acres of catfish ponds in 1973, and St John the Baptist Parish had 105 acres [24]. There are no catfish ponds within five miles of Waterford 3[22]. Recreational fishing probably takes place at all water areas, but user data are not available on recreational fishing areas within the study area.

The Mississippi River serves as a major transportation artery. In 1975, 201,600,768 tons of freight were shipped on the river between Baton Rouge and New Orleans. Table 2.1-22 shows the tonnage shipped on the Mississippi in this area, broken down by the most important commodities. Agricultural products and commodities related to the refinery and petrochemical industries were the largest tonnages shipped[27]. Tonnage shipped on the river is increasing by about 3 percent per year[28]. The Mississippi River is also an important artery for passenger transportation. In 1975, a total of 10,462 passengers were carried on the river in 3,004 passenger and dry cargo vessels[27].

2.1.3.5.6 Wetlands

Wetlands consist of 19,306 acres within five miles of Waterford 3. Most of this area, or 14,137.1 acres, is forested wetlands. The remaining 5,168.9 acres are open (nonforested) wetlands. The principal human activities in the wetlands include oil and gas production and forestry. There are also several small hunting clubs in the wetlands southwest of the LP&L property, but hunting is not extensive because game has been depleted in this area[20]. Wetlands will undoubtedly continue to be a predominant land use in the study area throughout the life of Waterford 3 because much of this land is undevelopable.

2.1.3.5.7 Barren Land

Barren land covers 2,565.8 acres within five miles of the plant. Just over half of this consists of sand extraction areas, which take place mostly in the Bonnet Carre Floodway, and on the batture to the east of Hahnville. Approximately 1,033.3 acres consist of transitional areas, or those areas where the land use is in the process of change. Most of this category lies within the Bonnet Carre Floodway where sand extraction has ceased and the land is being re-vegetated. The remaining acreage consists of barren, unvegetated land on the batture.

2.1.3.6 <u>Local Zoning and Land Use Plans</u>

A zoning map of the area within five miles of Waterford 3 is shown on Figure 2.1-19. Zoning restrictions are in force only in St Charles Parish; St John the Baptist Parish has no zoning ordinance. The land on which the Waterford site is located, as well as LP&L's property, is zoned

M-3, "Heavy Manufacturing District." According to the St Charles Parish Zoning Ordinance[29] "Any manufacturing establishment" is permitted within this zone, including electric generating stations. The majority of the area surrounding LP&L's property is also zoned M-3, with the exception of the Killona area, which is zoned R-1 (Single Family Residential) and C-3 (Highway Commercial). The M-3 zoning in the area of the plant does not prohibit development of residences or commercial uses within the Heavy Manufacturing District, but it is considered unlikely that residential development will take place in these areas. The only other zoning district within the Low Population Zone (2 mile radius from the plant) is A-1, "Rural District", in which single family and two-family dwellings are permitted, as well as uses such as churches, schools, golf courses, recreation facilities, and farming. The A-1 district areas are located in a narrow strip southwest of Killona, in Montz, and in the Bonnet Carre Floodway.

A land use plan was prepared for St Charles Parish in 1974[30] but has never been formally adopted. This plan is considered to have represented essentially a continuation of present land use and zoning patterns, with a slight expansion of future industrial land use shown beyond the M-3 zoning district, west of Killona. The Waterford 3 site was incorporated in the land use plan.

2.1.3.7 Surface Water Use

2.1.3.7.1 Industrial and Municipal Water Use

Surface water in the Mississippi River is used for many purposes including industrial cooling, residential and commercial use, and agriculture. The points of surface water usage, including all municipal water usage, between Waterford 3 and the Gulf of Mexico, appear in Figure 2.1-20 and are described in Table 2.1-23. Surface water usage in this portion of Louisiana is far more substantial than groundwater usage, and the heaviest water users along the Mississippi River are the chemical and petrochemical complexes and large population centers.

The portion of the Mississippi River between Waterford 3 and the Gulf falls within the Southeast Water Resources Planning Area (WRPA) as designated by the State of Louisiana[31]. At present, this region has the largest surface water requirement of all areas in Louisiana, and projections indicate that this relatively high usage will continue. Industrial and thermal electric categories claim the largest percentage of the present and projected requirements.

Between Waterford 3 and the Gulf of Mexico, the largest users of water from the Mississippi are LP&L/Ninemile Point Steam Electric Station (899.0 mgd) at River Mile 103.9, above Head of Passes, La. (AHP); Union Carbide (720.0 mgd) at RM 128; and Kaiser Chalmette Works (410.8 mgd) at RM 89.3. The next largest user and the largest of the municipal intakes on this section of the Mississippi, is the Carrollton Plant (RM 104.7) which serves New Orleans, and draws 122.65 mgd. The average withdrawal of all other municipal users is 7.9 mgd. The major concentration of population downstream of the plant is New Orleans, where a total of 593,000 persons are served by both the Carrollton and Algiers (6.27 mgd) (RM 95.8) plants[32].

Other sources of surface water within a 50-mile radius of Waterford 3, such as Bayou La Fourche, Bayou Black, etc., are not expected to be affected by its operation because they do not interconnect with the Mississippi River downstream from the plant.

Since other surface water supplies in the region are adversely affected by tides, salt water, and undependable flow, the Mississippi River is expected to be relied upon for most future surface water needs. Projections show that the Mississippi will be able to meet all future needs for the region[31].

Nearly all water used by Waterford 3 will be returned to the Mississippi River. Therefore, because consumptive water use is negligible, operation of Waterford 3 will not affect the availability of supplies to downstream users. Water use by Waterford 3 is described in Section 3.3.

2.1.3.7.2 Recreational Water Use

The Mississippi River is not extensively used for recreational purposes in the Waterford 3 area. However, several land-oriented recreational areas are located along the banks of the river. Recreational areas which are located between Waterford 3 and the Gulf of Mexico, and from levee to levee, are identified in Table 2.1-24 and are shown on Figure 2.1-21.

Lake Pontchartrain is a major recreational area and receives flood water directly from the Mississippi River via the Bonnet Carre Floodway. The Floodway is located just downstream of the Waterford 3 site, on the opposite side of the Mississippi. However, the Floodway has only been used on five occasions since its construction in 1931, as described in Section 2.4. Nevertheless, recreational uses on the southern half of the lake as well as on the Floodway are shown on Table 2.1-24 and Figure 2.1-21.

2.1.3.7.3 Water-based Transportation

The Mississippi is a major transportation artery for both commodities and passengers. Section 2.1.3.5.5 describes in more detail the transportation use of the Mississippi River.

2.1.3.8 <u>Groundwater Use</u>

Groundwater is a much less significant water source than surface water in the region of Waterford 3. Section 2.4 describes the groundwater resources in the region and the Waterford 3 site area, and a detailed discussion of groundwater use is contained in Section 2.4 of the Final Safety Analysis Report. Because Waterford 3 relies exclusively on surface water and is considered to be hydrologically isolated from aquifers utilized for water supply, a detailed inventory of groundwater utilization is not repeated here.

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31. Louisiana Department of Public Works. Surface Water Resources and Requirements for Louisiana, 1970 to 2020. Series II, Volume III. January, 1974.

32. State of Louisiana. Lower Mississippi River Basin Water Quality Management Plan. June, 1973.

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
1977

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	* TOTAL * 0-10 *	10-20	20-30	30-40	40-50	* TOTAL * 10-50 *	TOTAL 0-50
N	0	171	311	870	2120	3149	* 6621 *	0	1432	38688	12255	* 52375 *	58996
NNE	0	154	0	331	174	404	* 1063 *	0	120	11299	11822	* 23241 *	24304
NE	63	150	0	0	0	0	* 213 *	0	0	8343	10463	* 18805 *	19018
ENE	33	0	0	2206	105	0	* 2344 *	7504	0	575	31012	* 39092 *	41436
E	0	0	99	3380	610	1430	* 5519 *	215564	555731	57377	0	* 828672 *	834191
ESE	0	0	0	1339	1151	7350	* 9840 *	35619	170248	11462	3109	* 220437 *	230278
SE	0	0	0	0	429	5130	* 5559 *	320	2290	3371	2899	* 8881 *	14440
SSE	0	0	0	0	0	1294	* 1294 *	1197	2911	9152	4268	* 17528 *	18822
S	0	0	0	0	0	179	* 179 *	4013	10805	9058	0	* 23875	24055
SSW	0	0	0	0	0	0	* 0 *	1582	10771	58624	2593	* 73570 *	73570
SW	0	0	0	0	0	0	* 0 *	562	22939	5983	155	* 29639 *	29639
WSW	0	0	0	0	0	0	* 0 *	2249	18124	5583	30423	* 56379 *	56379
W	26	307	0	21	0	524	* 878 *	5808	2862	11087	5735	* 25492 *	26369
WNW	232	435	0	0	0	4515	* 5182 *	9332	6771	26045	12649	* 54797 *	59979
NW	99	104	108	0	363	7289	* 7963 *	71	3391	11661	86743	* 101866 *	109829
NNW	0	0	11	497	1369	2438	* 4315 *	0	3622	8286	6117	* 18025 *	22340
TOTAL	453	1321	529	8644	6321	33702	*50970 *	283822	812018	276593	220242	*1592676 *	1643646

Data derived by methodologies explained in Section 6.1.4.2.

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
1980

SECTOR	8-1	1-2	2-3	3-4	4-5	5-10	* TOTAL 0-10 *	10-20	20-30	30-40	40-50	* TOTAL 10-50 *	TOTAL 0-50
N	0	182	334	896	1275	3266	* 6853 *	0	1515	40718	12825	* 55058 *	61912
NNE	0	171	51	366	325	419	* 1332 *	0	127	12145	12756	* 25029 *	26361
NE	63	166	5	15	3	0	* 252 *	0	0	9021	11314	* 20335 *	20587
ENE	33	0	0	2206	105	0	* 2344 *	8295	0	622	33535	* 42452 *	44796
E	0	0	102	3386	626	1519	* 5633 *	236347	548275	60803	0	* 845425 *	851059
ESE	0	0	21	1421	1166	7809	*10417 *	39314	182279	12192	3396	* 237181 *	247598
SE	0	0	20	65	548	5449	* 6082 *	340	2531	3615	2972	* 9458 *	15540
SSE	0	0	0	0	0	1375	* 1375 *	1271	3020	9496	4213	* 18001 *	19375
S	0	0	0	0	0	190	* 190 *	4256	11073	9450	0	* 24779 *	24969
SSW	0	0	0	0	0	0	* 0 *	1642	11188	61340	2715	* 76885 *	76885
SW	0	0	0	0	0	0	* 0 *	583	23847	6159	162	* 30751 *	30751
WSW	0	0	0	0	0	0	* 8 *	2276	18677	5704	32191	* 58848 *	58856
W	26	318	0	21	0	543	* 908 *	5862	2830	11231	5821	* 25744 *	26652
WNW	232	435	3	17	27	4683	* 5397 *	9443	7034	27615	12825	* 56917 *	62314
NW	99	104	132	27	384	7562	* 8308 *	74	3616	12427	91330	* 107447 *	115755
NNW	0	0	19	518	1375	2530	* 4442 *	0	3905	8934	6556	* 19395 *	23836
TOTAL	453	1384	687	8938	6734	35345	*53451 *	309704	819917	291474	232611	*1653706 *	1707247

Data derived by methodologies explained in Section 6.1.4.2

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
1981

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	TOTAL 0-10	10-20	20-30	30-40	40-50	TOTAL 10-50	TOTAL 0-50
N	0	186	343	906	2196	3310	6941	0	1526	40915	12892	55333	62274
NNE	0	178	70	379	383	424	1434	0	128	12382	13056	25566	27000
NE	63	172	6	22	4	0	267	0	0	9254	11605	20859	21126
ENE	33	0	0	2206	105	0	2344	8540	0	638	34402	43581	45925
E	0	0	103	3388	633	1552	5676	243986	547486	61915	0	853305	858982
ESE	0	0	29	1451	1171	7979	10630	40465	186443	12434	3483	242825	253455
SE	0	0	27	89	592	5569	6277	348	2606	3697	3005	9655	15932
SSE	0	0	0	0	0	1405	1405	1299	3056	9609	4236	18200	19605
S	0	0	0	0	0	195	195	4346	11184	9591	0	25120	25315
SSW	0	0	0	0	0	0	0	1662	11328	62379	2761	78129	78129
SW	0	0	0	0	0	0	0	590	23180	6255	165	31190	31190
WSW	0	10	0	0	0	0	10	2283	18880	5749	32781	59694	59704
W	26	322	0	21	0	550	919	5880	2833	11310	5849	25873	26792
WNW	232	435	4	25	37	4746	5479	9476	7164	28271	12880	57791	63271
NW	99	104	142	37	392	7663	8437	75	3703	12729	92970	109477	117914
NNW	0	0	22	526	1377	2563	4488	0	3993	9136	6693	19822	24310
TOTAL	453	1407	746	9050	6890	35957	54503	318869	824510	296263	236779	1676421	1730924

Data derived by methodologies explained in Section 6.1.4.2

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
1990

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	TOTAL 0-10	10-20	20-30	30-40	40-50	TOTAL 10-50	TOTAL 0-50
N	0	203	383	970	2325	3732	7613	0	1663	43870	13819	59352	66966
NNE	0	206	200	549	586	479	2020	0	137	14792	16008	30937	32956
NE	63	195	53	53	10	0	374	0	0	11515	14441	25956	26330
ENE	33	0	0	2206	105	0	2344	10733	0	794	42804	54331	56675
E	0	0	103	3429	672	1855	6059	311694	534702	71695	0	918091	924149
ESE	0	0	34	1718	1294	9536	12582	50763	224061	14493	4258	293575	306156
SE	0	0	27	204	967	6655	7853	415	3276	4397	3253	11341	19194
SSE	0	0	0	0	0	1679	1679	1553	3370	10598	4439	19960	21639
S	0	0	0	0	0	233	233	5162	12153	10868	0	28183	28416
SSW	0	0	0	0	0	0	0	1833	12563	71882	3184	89462	89462
SW	0	0	0	0	0	0	0	651	27176	7125	190	35142	35142
WSW	0	10	0	0	0	0	10	2364	20675	6165	35194	64399	64409
W	26	322	0	21	0	620	989	6089	2879	12069	6155	27193	28182
WNW	232	435	30	179	559	5351	6786	9848	8410	34527	13043	65820	72615
NW	99	104	251	245	559	8640	9898	84	4529	15575	106973	127162	137060
NNW	0	0	63	643	1388	2890	4984	0	4827	11042	7953	23822	28807
TOTAL	453	1475	1144	10217	8465	41670	63424	401189	860423	341407	271715	1874734	1938148

Data derived by methodologies explained in Section 6.1.4.2

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
2000

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	* TOTAL * 0-10 *	10-20	20-30	30-40	40-50	* TOTAL * 10-50 *	TOTAL 0-50
N	0	221	425	1037	2460	4134	* 8277 *	0	1852	48055	15116.	* 65022 *	73299
NNE	0	235	335	725	798	530	* 2623 *	0	150	17850	19712	* 37712 *	40335
NE	63	219	102	85	16	0	* 485 *	0	0	14335	17978	* 32313 *	32798
ENE	33	0	0	2206	105	0	* 2344 *	12483	0	989	53292	* 66764 *	69108
E	0	0	103	3472	712	2179	* 6466 *	365840	530962	80110	0	* 976912 *	983378
ESE	0	0	39	1996	1422	11202	* 14659 *	59060	254707	16310	4908	* 334984 *	349643
SE	0	0	27	324	1358	7818	* 9527 *	488	3810	4987	3516	* 12800 *	22327
SSE	0	0	0	0	0	1972	* 1972 *	1824	3587	11280	4579	* 21270 *	23242
S	0	0	0	0	0	273	* 273 *	6023	12822	11711	0	* 30556 *	30829
SSW	0	0	0	0	0	0	* 0 *	1950	13406	78017	3457	* 96830 *	96830
SW	0	0	0	0	0	0	* 0 *	693	29169	7688	207	* 37756 *	37756
WSW	0	10	0	0	0	0	* 10 *	2411	21918	6485	38159	* 68973 *	68983
W	26	322	0	21	0	687	* 1056 *	6235	2905	12731	6342	* 28213 *	29270
WNW	232	435	57	339	1103	5928	* 8094 *	10111	9675	40915	12985	* 73687 *	81781
NW	99	104	365	462	733	9571	* 11334 *	93	5418	18621	120272	* 144405 *	155739
NNW	0	0	106	765	1399	3201	* 5471 *	0	5859	13405	9515	* 28779 *	34250
TOTAL	453	1546	1559	11432	10106	47495	* 72591 *	467211	896241	383487	310038	*2056977 *	2129568

Data derived by methodologies explained in Section 6.1.4.2.

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
2010

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	* TOTAL 0-10 *	10-20	20-30	30-40	40-50	* TOTAL 10-50 *	TOTAL 0-50
N	0	242	473	1115	2616	4580	9026	0	2066	52698	16565	71329	80355
NNE	0	269	491	929	1044	587	3320	0	165	21602	24302	46069	49389
NE	63	247	160	122	23	0	615	0	0	17848	22383	40231	40846
ENE	33	4	0	2206	105	0	2348	14512	0	1231	66349	82092	84440
E	0	0	103	3521	758	2559	6941	428617	527673	89823	0	1046113	1053055
ESE	0	0	45	2318	1570	13157	17090	68685	290310	18370	5655	383020	400110
SE	0	0	27	463	1812	9182	11484	573	4429	5660	3799	14462	25945
SSE	0	0	0	0	0	2316	2316	2143	3818	12004	4728	22692	25008
S	0	0	0	0	0	321	321	7031	13530	12618	0	33179	33500
SSW	0	0	0	0	0	0	0	2076	14304	84677	3754	104810	104810
SW	0	0	0	0	0	0	0	737	31308	8298	225	40568	40568
WSW	0	10	0	0	0	0	10	2459	23236	6821	41128	73644	73654
W	26	322	0	21	0	761	1130	6393	2933	13462	6543	29332	30462
WNW	232	435	88	526	1733	6567	9581	10393	11179	48537	12951	83059	92640
NW	99	104	496	714	934	10603	12950	103	6482	22265	135479	164329	177280
NNW	0	0	156	906	1412	3547	6021	0	7113	16275	11404	34792	40812
TOTAL	453	1633	2039	12841	12007	54180	83153	938545	432188	355265	2269721	2269721	2352874

Data derived by methodologies explained in Section 6.1.4.2.

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
2020

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	* TOTAL * 0-10	* 10-20	20-30	30-40	40-50	* TOTAL * 10-50 *	TOTAL 0-50
N	0	266	529	1205	2798	5074	* 9872	* 0	2308	57859	18189	* 78356 *	88228
NNE	0	308	672	1168	1329	650	* 4127	* 0	180	26210	29993	* 56384 *	60512
NE	63	279	227	165	31	0	* 765	* 0	0	22221	27868	* 50089 *	50854
ENE	33	6	0	2206	105	0	* 2350	* 16864	0	1532	82605	* 101002 *	103352
E	0	0	103	3578	812	3007	* 7500	* 501407	524886	101026	0	*1127319 *	1134819
ESE	0	0	52	2692	1742	15456	*19942	* 79849	331655	20705	6513	* 438723 *	458665
SE	0	0	27	625	2339	10786	*13777	* 673	5147	6432	4106	* 16357 *	30134
SSE	0	0	0	0	0	2721	* 2721	* 2517	4061	12771	4885	* 24234 *	26956
S	0	0	0	0	0	377	* 377	* 8213	14282	13595	0	* 36090 *	36467
SSW	0	0	0	0	0	0	* 0	* 2208	15258	91898	4075	* 113440 *	113440
SW	0	0	0	0	0	0	* 0	* 784	33606	8959	244	* 43594 *	43594
WSW	0	10	0	0	0	0	* 10	* 2509	24633	7173	44353	* 78668 *	78678
W	26	322	0	21	0	844	* 1213	* 6561	2963	14274	6758	* 30556 *	31768
WNW	232	435	124	742	2467	7275	*11275	* 10694	12966	57620	12966	* 94246 *	105521
NW	99	104	649	1006	1168	11746	*14772	* 115	7756	26622	152910	* 187402 *	202174
NNW	0	0	214	1070	1428	3929	* 6641	* 0	8636	19757	13691	* 42084 *	48725
TOTAL	453	1730	2597	14478	14219	61865	*95342	* 632395	988338	488655	409157	*2518544 *	2613886

Data derived by methodologies explained in Section 6.1.4.2.

TABLE 2.1-1

RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3
2030

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	*	TOTAL 0-10	*	10-20	20-30	30-40	40-50	*	TOTAL 10-50	*	TOTAL 0-50
N	0	299	606	1329	3046	5620	*	10900	*	0	2585	63602	20012	*	86199	*	97100
NNE	0	362	920	1493	1719	720	*	5214	*	0	197	31881	37052	*	69131	*	74345
NE	63	323	319	224	42	0	*	971	*	0	0	27666	34695	*	62361	*	63332
ENE	33	9	0	2206	105	0	*	2353	*	19592	0	1908	102844	*	124344	*	126697
E	0	0	103	3656	886	3532	*	8177	*	585801	522666	113943	0	*	1222410	*	1230587
ESE	0	0	62	3204	1977	18155	*	23398	*	92800	379657	23356	7502	*	503314	*	526713
SE	0	0	27	846	3062	12670	*	16605	*	791	5979	7314	4437	*	18522	*	35127
SSE	0	0	0	0	0	3196	*	3196	*	2956	4320	13584	5052	*	25912	*	29109
S	0	0	0	0	0	443	*	443	*	9598	15080	14647	0	*	39325	*	39768
SSW	0	0	0	0	0	0	*	0	*	2348	16275	99737	4424	*	122785	*	122785
SW	0	0	0	0	0	0	*	0	*	834	36074	9677	265	*	46851	*	46851
WSW	0	10	0	0	0	0	*	10	*	2560	26113	7542	47859	*	84074	*	84084
W	26	322	0	21	0	934	*	1303	*	6741	2994	15176	6988	*	31900	*	33204
WNW	232	435	174	921	2650	8060	*	12472	*	11018	15089	68449	13032	*	107588	*	120059
NW	99	104	858	1405	1487	13012	*	16965	*	127	9279	31837	172941	*	214184	*	231148
NNW	0	0	293	1294	1449	4352	*	7388	*	0	10485	23986	16462	*	50932	*	58321
TOTAL	453	1864	3362	16599	16423	70695	*	109396	*	735167	1046794	554306	473566	*	2809833	*	2919229

Data derived by methodologies explained in Section 6.1.4.2

TABLE 2.1-2

TOWNS WITH OVER 1,000 PERSONS WITHIN 10 MILES OF WATERFORD 3

Parish	1960 Population	1970 Population	Estimated 1977 Population*
St Charles			
Hahnville	1,297	2,483	2,655
Killona	NA	NA	1,203
Luling	2,122	3,255	3,760
Mimosa Park	NA	1,624	1,877
Norco	4,682	4,773	5,236
St Rose	1,099	2,106	2,432
St John the Baptist			
Garyville	2,389	2,474	2,710
Laplace	3,541	5,953	6,521
Reserve	5,297	6,381	6,990

*1977 population estimates assume that the boundaries have remained the same as in 1970.

Sources: 1960 and 1970 data from: 1970 U S Census of Population, Number of Inhabitants, Louisiana, Table 10.

1977 data derived by methodologies described in Section 6.1.4.2.

TABLE 2.1-3

CITIES, TOWNS, AND COMMUNITIES WITH OVER 10,000 PERSONS WITHIN 50 MILES OF WATERFORD 3

City or Town	Parish	1960 Population	1970 Population	Estimated 1977 Population*
Baton Rouge	East Baton Rouge	NC	165,963	187,194
Bayou Cane	Terrebonne	3,173	9,077	10,134
Gretna	Jefferson	21,967	24,875	32,093
Hammond	Tangipahoa	NC	12,487	13,928
Harahan	Jefferson	9,275	13,037	16,821
Houma	Terrebonne	NC	30,922	34,522
Jefferson Heights	Jefferson	19,353	16,489	14,484
Kenner	Jefferson	NC	29,858	38,524
Little Farms	Jefferson	NA	15,713	20,273
Marrero	Jefferson	NA	29,015	37,436
Metairie	Jefferson	NA	106,523	137,438
Morgan City	St Mary	NC	16,586	18,527
New Orleans	Orleans	627,525	593,471	562,560
Scotlandville	East Baton Rouge	NA	22,557	25,443
Slidell	St Tammany	NC	16,101	19,586
Terrytown	Jefferson	NA	13,832	17,486
Thibodaux	Lafourche	NC	14,922	16,342
Westwego	Jefferson	NC	11,402	14,711

NA = Not available
NC = Not comparable because of boundary changes

*1977 population estimates assume that the boundaries have remained the same as in 1970.

Sources: 1960 and 1970 data from: 1970 U S Census of Population, Number of Inhabitants, Louisiana, Table 10.

1977 data derived by methodologies described in Section 6.1.4.2.

TABLE 2.1-4

TOTAL ESTIMATED PEAK DAILY AND SEASONAL TRANSIENT POPULATION
1977 AND 2030

Activity	1977	%	2030	%
Transportation	78,598	65.8	214,749	68.5
Recreation	35,500	29.7	66,608	21.2
Industrial	5,324	4.5	32,129	10.3
Total	119,422	100.0	313,486	100.0

Data derived by methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

1977

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

ANNULUS 1977	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1		56				375	269	29						46			775
2						613	326										939
3				180	60	245	123										608
4				95	130												225
5	3,000			420	287	2,500											6,207
10				23	58	13,206	250	79						2,895	5,583	10,000	32,094
Total	3,000	56		718	535	16,939	968	108						2,941	5,583	10,000	40,848

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

1980

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

ANNULUS

1980	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1		56				395	287	37						46			821
2						616	329										945
3				192	64	248	125										629
4				103	137												240
5	3,000			504	327	2,500											6,331
10				24	68	13,647	340	84					12	2,949	5,735	10,396	33,255
Total	3,000	56		823	596	17,406	1,081	121					12	2,995	5,735	10,396	42,221

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

1981

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

ANNULUS

1981	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1		56				395	287	38						46			822
2						616	330										946
3				192	64	250	126										632
4				103	137												240
5	3,000			504	327	2,500											6,331
10				24	72	13,818	399	87					20	2,964	5,759	10,557	33,700
Total	3,000	56		823	600	17,579	1,142	125					20	3,010	5,759	10,557	42,671

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

1990

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

ANNULUS 1990	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1		56				395	287	51						46			835
2						616	347	28	10				28	53	53		1,135
3				192	66	269	139					43	53	53	38		853
4				103	137												240
5	3,000			504	327	2,500											6,331
10				24	118	15,389	1,118	129					116	3,144	6,055	11,924	38,017
Total	3,000	56		823	648	19,169	1,891	208	10			43	197	3,296	6,146	11,924	47,411

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

2000

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

	2000	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1		56				395	287	67	10					46			861
	2						616	368	57	21				57	109	109		1,337
	3				192	69	293	155	10				89	109	109	78		1,104
INULUS	4				103	137												240
	5	3,000			504	327	2,500	16										6,347
	10				24	177	16,847	2,037	183					239	3,374	6,433	13,122	42,436
	Total	3,000	56		823	710	20,651	2,863	317	31			89	405	3,638	6,620	13,122	52,325

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

2010

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

ANNULUS

2010	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1		56				395	287	93	19					46			896
2						616	403	105	39				105	201	201		1,670
3				192	73	332	181	19				163	201	201	144		1,506
4				103	137												240
5	3,000			504	327	2,500	29										6,360
10				24	273	18,772	3,540	271					441	3,751	7,051	14,623	48,746
Total	3,000	56		823	810	22,615	4,440	488	58			163	747	4,199	7,396	14,623	59,418

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

2020

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

		SECTOR																
	2020	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1		56				395	287	133	32					46			949
	2						616	456	178	66				178	341	341		2,176
	3				192	80	392	221	32				276	341	341	244		2,119
ANNULUS	4				103	137												240
	5	3,000			504	327	2,500	49										6,380
	10				24	420	21,294	5,830	405					748	4,325	7,992	16,497	57,535
	Total	3,000	56		823	964	25,197	6,843	748	98			276	1,267	5,053	8,577	16,497	69,399

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-5

2030

PEAK DAILY AND SEASONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3*

SECTOR

	2030	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1		56				395	287	194	52					46			1,030
	2						616	537	290	107				290	555	555		2,950
	3				192	90	484	282	52				449	555	555	397		3,056
ANNULUS	4				103	137												240
	5	3,000			504	327	2,500	80										6,411
	10				24	644	24,461	9,318	608					1,216	5,200	9,426	18,677	69,574
	Total	3,000	56		823	1,198	28,456	10,504	1,144	159			449	2,061	6,356	10,378	18,677	83,261

* Does not include transient population related to transportation facilities.
**Blank space means zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-6

AVERAGE ESTIMATED SUNDAY PARTICIPATION IN RECREATIONAL ACTIVITY DURING JUNE, JULY, AND AUGUST WITHIN TEN MILES OF WATERFORD 3

Activity	Year 1977	1980	1981	1990	2000	2010	2020	2030
Boating	987	1047	1069	1295	1594	1062	2415	2973
Fishing	1653	1804	1863	2503	3463	4791	6629	9171
Swimming	1496	1617	1663	2168	2885	3839	5109	6799
Camping	423	457	470	613	815	1085	1445	1923
Walking	1911	2058	2117	2760	3569	4751	6323	8416
Horseback Riding	207	224	230	302	405	544	731	983
Golf	248	269	277	360	479	637	848	1128
Tennis	334	361	371	484	650	874	1174	1578
Motorcycling	410	443	456	594	798	1072	1140	1935
Bicycling	1259	1358	1398	1821	2447	3387	4553	6118
Picnicking	438	474	488	635	853	1146	1541	2071
Birdwatching	323	349	359	468	628	845	1135	1525
Driving	2251	2427	2500	3254	4373	5877	7898	10614
Play Baseball	523	564	580	757	1030	1385	1861	2501
Play Basketball	378	408	420	548	736	989	1330	1787
Play Volleyball	275	300	309	402	540	726	975	1310
Play Football	443	478	492	641	861	1157	1555	2090
Hunting	1034	1116	1149	1497	2011	2703	3633	4883
Watching Baseball	604	652	671	875	1175	1580	2123	2854
Watching Golf	57	62	63	83	111	149	200	269
Watching Auto Racing	86	93	95	125	168	225	302	406
Watching Tennis	150	134	135	145	157	170	180	199
Watching Horse Racing	151	163	168	219	294	395	531	714
Watching Outdoor Concert	72	78	80	105	141	189	254	342
Watching Football	703	797	813	986	1479	1821	2241	2758
TOTALS	16416	17733	18236	13640	31662	42299	56430	751247

Source: State of Louisiana, State Parks and Recreation Commission, Outdoor Recreation Plan. June, 1974.

TABLE 2.1-7

1977

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS 1977	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						12,500								2,500	5,000	10,000	30,000
Total	3,000					15,000								2,500	5,000	10,000	35,500

**Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

1980

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS

1980	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						12,895								2,500	5,000	10,396	30,791
Total	3,000					15,395								2,500	5,000	10,396	36,291

**Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

1981

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS 1981	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						13,041								2,500	5,000	10,542	31,083
Total	3,000					15,541								2,500	5,000	10,542	36,583

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

1990

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

NNULUS

1990	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						14,340								2,500	5,000	11,840	33,680
Total	3,000					16,840								2,500	5,500	11,840	39,180

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

2000

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

NNULUS

2000	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						15,450								2,500	5,000	12,950	35,900
Total	3,000					17,950								2,500	5,000	12,950	41,400

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

2010

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS

2010	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						16,805								2,500	5,000	14,306	38,611
Total	3,000					19,305								2,500	5,000	14,306	44,111

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

2020

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

NNULUS

2020	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						18,459								2,500	5,000	15,960	41,919
Total	3,000					20,959								2,500	5,000	15,960	47,419

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-7

2030

PEAK DAILY AND SEASONAL RECREATIONAL TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS

2030	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1																	
2																	
3																	
4																	
5	3,000					2,500											5,500
10						20,304								2,500	5,000	17,804	45,608
Total	3,000					22,804								2,500	5,000	17,804	51,108

** Blank spaces mean zero population.

Data derived from methodologies explained in Section 6.1.4.2.

TABLE 2.1-8

TRANSPORTATION TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

(Passengers Per Day)

Highways	1977	1980	1981	1990	2000	2010	2020	2030
I- 10	16,092	16,683	17,087	19,040	21,473	24,217	27,312	30,803
La 18	4,393	4,554	4,609	5,136	5,792	6,532	7,367	8,309
La 44	2,333	2,419	2,448	2,728	3,077	3,470	3,913	4,413
La 48	4,833	5,011	5,072	5,652	6,374	7,189	8,108	9,144
La 49	5,319	5,514	5,581	6,219	7,014	7,910	8,921	10,061
La 53	4,947	5,129	5,191	5,784	6,523	7,357	8,297	9,357
La 54	1,081	1,121	1,135	1,265	1,427	1,609	1,815	2,047
I- 55	NA	NA	NA	10,900	12,293	13,864	15,636	17,635
US 61	13,024	13,503	13,666	15,228	17,174	19,369	21,844	24,636
US 90	12,304	12,756	14,214	16,031	18,080	20,391	22,997	25,936
I- 410	*	*	NA	NA	12,400	13,985	15,772	17,788
La 626	2,114	2,192	2,219	2,473	2,789	3,145	3,547	4,000
La 628	3,099	3,213	3,252	3,624	3,681	4,151	4,682	5,280
La 3127	1,012	1,049	1,062	1,183	1,334	1,504	1,696	1,913
SUB TOTAL	70,551	73,144	75,536	95,263	119,431	134,693	151,907	171,322
Ships, Including Ferries	7,514	8,210	8,456	11,144	14,977	20,128	27,050	36,354
Rail	533	617	647	1,005	1,637	2,666	4,342	7,073
TOTAL	78,598	81,971	84,639	107,412	136,045	157,487	183,299	214,749

NA - Not Available
* - Highway Not Completed

TABLE 2.1-9

1977

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	1977	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				375	269	29						46			775
	2						613	326										939
ANNULUS	3				180	60	245	123										608
	4				95	130												225
	5				420	287												707
	10				23	58	706	250	79						395	583		2,094
	Total		56		718	535	1,939	968	108						451	583		5,348

**Blank spaces mean zero population.

TABLE 2.1-9

1980

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	1980	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	287	37						46			821
	2						616	329										945
ANNULUS	3				192	64	248	125										629
	4				103	137												240
	5				504	327												831
	10				24	68	752	340	84					12	449	735		2,464
	Total		56		823	596	2,011	1,081	121					12	495	735		5,930

**Blank spaces mean zero population.

TABLE 2.1-9

1981

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	1981	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	287	38						46			822
	2						616	330										946
ANNULUS	3				192	64	250	126										632
	4				103	137												240
	5				504	327												831
	10				24	72	777	399	87					20	464	759	15	2,617
	Total		56		823	600	2,038	1,142	125					20	510	759	15	6,088

**Blank spaces mean zero population.

TABLE 2.1-9

1990

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	1990	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	287	51						46			835
	2						616	347	28	10				28	53	53		1,135
ANNULUS	3				192	66	269	139					43	53	53	38		853
	4				103	137												240
	5				504	327												831
	10				24	118	1,049	1,118	129					116	644	1,055	84	4,337
	Total		56		823	648	2,329	1,891	208	10			43	197	796	1,146	84	8,231

**Blank spaces mean zero population.

TABLE 2.1-9

2000

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	2000	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	287	67	10					46			861
	2						616	368	57	21				57	109	109		1,137
ANNULUS	3				192	69	293	155	10				89	109	109	78		1,104
	4				103	137												240
	5				504	327		16										847
	10				24	177	1,397	2,037	183					239	874	1,433	172	6,536
	Total		56		823	710	2,701	2,863	317	31			89	405	1,138	1,620	172	10,925

**Blank spaces mean zero population.

TABLE 2.1-9

2010

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	2010	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	287	93	19					46			896
	2						616	403	105	39				105	201	201		1,670
ANNULUS	3				192	73	332	181	19				163	201	201	144		1,506
	4				103	137												240
	5				504	327		29										860
	10				24	273	1,967	3,540	271					441	1,251	2,051	317	10,135
	Total		56		823	810	3,310	4,440	488	58			163	747	1,699	2,396	317	15,307

**Blank spaces mean zero population.

TABLE 2.1-9

2020

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

ANNULUS

2020	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1	**	56				395	287	133	32					46			949
2						616	456	178	66				178	341			2,176
3				192	80	392	221	32				276	341	341	244		2,119
4				103	137												240
5				504	327		49										880
10				24	420	2,835	5,830	405					748	1,825	2,992	537	15,616
Total		56		823	964	4,238	6,843	748	98			276	1,267	2,553	3,577	537	21,980

**Blank spaces mean zero population.

TABLE 2.1-9

2030

PEAK DAILY INDUSTRIAL EMPLOYMENT WITHIN 10 MILES OF WATERFORD 3

SECTOR

	2030	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	1	**	56				395	387	194	52					46			1,030
	2						616	537	290	107				290	555	555		2,950
ANNULUS	3				192	90	484	282	52				449	555	397			3,056
	4				103	137												240
	5				504	327		80										911
	10				24	644	4,157	9,318	608					1,216	2,700	4,426	873	23,966
	Total		56		823	1,198	5,652	10,504	1,144	159			449	2,061	3,856	5,378	873	32,153

**Blank spaces mean zero population.

TABLE 2.1-10

LAND USES ON THE WATERFORD PROPERTY

Classification Number*	Land Use Classification	Acreage	Percent of Total
13	Industrial	9.2	0.3
141	Utilities	402.0	11.3
142	Transportation	100.8	2.8
173	Other Urban or Built-up Land (Levee)	45.8	1.3
21	Agricultural - Cropland	785.0	22.0
4	Forest Land	64.1	1.8
5	Water (Canal)	55.0	1.5
61	Nonforested Wetland	201.5	5.7
62	Forested Wetland	1,868.6	52.5
73	Barren Land - Sandy Areas other than Beaches	29.3	0.8
	TOTAL	3.561.3	100.0

* See Table 2.1-18 for a complete listing of land use classifications.

TABLE 2.1-11

LAND USES WITHIN THE WATERFORD 3 EXCLUSION AREA

Classification Number*	Land Use Classification	Acreage	Percent of Total
141	Utilities	240.9	38.5
142	Transportation	18.3	2.9
173	Other Urban or Built-up Land (Levee)	32.1	5.1
21	Agricultural - Cropland	137.4	22.0
4	Forest Land	18.3	2.9
5	Water (Mississippi River)	164.9	26.4
73	Barren Land - Sandy Areas other than Beaches	13.7	2.2
	TOTAL	625.6	100.0

*See Table 2.1-18 for a complete listing of land use classifications.

TABLE 2.1-12

LOCATION BY ANNULAR SECTOR* OF PARAMETERS NEAREST TO WATERFORD 3

Category	Direction (Sector)															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Milk Cows	-	—	2	2	-	-	5	—	—	—	—	—	—	—	1	5
Beef Cattle	4	4	2	2	3	3	4	—	—	—	—	—	1	—	1	1
Milk Goats	4	—	—	—	4	—	—	—	—	—	—	—		—	—	5
Vegetable Gardens	2	1	1	1	3	3	4	—	—	—	—	—	1	1	1	3
Residences	1	1	1	1	3	4	5	4	—	3	3	5**	1	1	1	3

1

*Annular Sector refers to the area between origin and/or mile radius lines (annuli) as shown on Figure 2.1-15. The numbers in this table refer to the mile radius (annulus) in which the parameters nearest to Waterford 3 are located. For example, N-2 indicates that the parameter nearest to Waterford 3 is located in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

**Hunter's camp.

TABLE 2.1-13

LOCATION OF MILK COWS IN WATERFORD 3 STUDY AREA, BY ANNULAR SECTOR(1)

Sector	Mile Radius (Annulus)	Distance from Waterford 3(2) (In Miles)	Survey(3) Number
N	-	-	-
NNE	-	-	-
NE	2	1.1	1
ENE	2	1.1	2
E	-	-	-
ESE	-	-	-
SE	5	4.6	3
SSE	-	-	-
S	-	-	-
SSW	-	-	-
SW	-	-	-
WSW	-	-	-
W	-	-	-
WNW	-	-	-
NW	1	0.9	4
NNW	5	4.8	5

(1) Annular Sector refers to the area between origin and/or mile radius (annuli) as shown on Figure 2.1-15. For example, N-2 indicates that area in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

(2) Distances have been rounded to the nearest one-tenth of a mile.

(3) Refers to numbers shown on Figure 2.1-15.

1

TABLE 2.1-14

LOCATION OF BEEF CATTLE IN WATERFORD 3 STUDY AREA, BY ANNULAR SECTOR [1]

Sector	Mile Radius (Annulus)[1]	Distance from Waterford 3[2] (In Miles)	Survey Number[3]
N	4	3.6	6
NNE	4	3.7	7
NE	2	1.4	8
ENE	2	1.4	9
E	3	2.5	10
ESE	3	2.4	11
SE	4	3.9	12
SSE	–	–	–
S	–	–	–
SSW	–	–	–
SW	–	–	–
WSW	–	–	–
W	2	1.0	13
WNW	–	–	–
NW	1	0.8	14
NNW	1	0.8	15

1

(1) Annular sector refers to the area between origin and/or mile radius (annuli), as shown on Figure 2.1-15. For example, N-2 indicates that area in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

(2) Distances have been rounded to the nearest one-tenth of a mile.

(3) Refers to numbers shown on Figure 2.1-15.

TABLE 2.1-15

LOCATION OF MILK GOATS IN WATERFORD 3 STUDY AREA, BY ANNULAR SECTOR (1)

Sector	Mile Radius (Annulus)	Distance from Waterford 3 (2) (In Miles)	Survey Number (4)	
N	4	3.9	16	
NNE	-	-	-	
NE	-	-	-	
ENE	-	-	-	
E	4	3.1	17	
ESE	-	-	-	
SE	-	-	-	
SSE	-	-	-	
S	-	-	-	
SSW	-	-	-	
SW	-	-	-	1
WSW	-	-	-	
W	-	-	-	
WNW	-	-	-	
NW	-	-	-	
NNW	5	4.6	18	

(1) Annular sector refers to the area between origin and/or mile radius (annuli), as shown on Figure 2.1-15. For example, N-2 indicates that area in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

(2) Distances have been rounded to the nearest one-tenth of a mile.

(3) Refers to numbers shown on Figure 2.1-15.

TABLE 2.1-16

LOCATION OF VEGETABLE GARDENS IN WATERFORD 3 STUDY AREA, BY ANNULAR SECTOR(1)

Sector	Mile Radius (Annulus)	Distance from Waterford 3(2) (In Miles)	Survey Number(3)
N	2	1.1	19
NNE	1	0.8	20
NE	1	0.9	21
ENE	1	1.0	22
E	3	2.3	23
ESE	3	2.3	24
SE	5	4.0	25
SSE	-	-	-
S	-	-	-
SSW	-	-	-
SW	-	-	-
WSW	-	-	-
W	2	1.0	26
WNW	1	0.9	27
NW	1	0.9	28
NNW	3	3.0	29

(1) Annular sector refers to the area between origin and/or mile radius (annuli), as shown on Figure 2.1-15. For example, N-2 indicates that area in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

(2) Distances have been rounded to the nearest one-tenth of a mile.

(3) Refers to numbers shown on Figure 2.1-15.

1

TABLE 2.1-17

LOCATION OF RESIDENCES IN WATERFORD 3 STUDY AREA, BY ANNULAR SECTOR(1)

Sector	Mile Radius (Annulus)	Distances from Waterford 3(2) (In Miles)	Survey Number(3)
N	1	0.8	30
NNE	1	0.8	31
NE	1	0.9	32
ENE	1	1.0	33
E	3	2.2	34
ESE	4	3.3	35
SE	5	4.0	36
SSE	4	3.1	37
S	-	-	-
SSW	-	-	-
SW	-	-	-
WSW	5*	4.1	38
W	2	1.1	39
WNW	1	1.0	40
NW	1	0.9	41
NNW	4	3.1	42

(1) Annular sector refers to the area between origin and/or mile radius (annuli), as shown on Figure 2.1-15. For example, N-2 indicates that area in the north sector between mile radius (annulus) 1 and mile radius (annulus) 2.

(2) Distances have been rounded to the nearest one-tenth of a mile.

(3) Refers to numbers shown on Figure 2.1-15.

* Hunter's camp.

1

TABLE 2.1-18

LAND USES WITHIN FIVE MILES OF WATERFORD 3

Land Use Classification*	Level III Acreage	Level III % of Total	Level II Acreage	Level II % of Total	Level I Acreage	Level I % of Total
1. Urban or Built-up Land	-	-	-	-	7,256.6	14.4
11. Residential	-	-	1,894.6	3.8	-	-
111. Single-Family Units	1,818.8	3.6	-	-	-	-
112. Multi-Family Units	9.2	**	-	-	-	-
115. Mobile Home Parks	56.6	0.1	-	-	-	-
116. Transient Lodgings	10.0	**	-	-	-	-
12. Commercial and Services	-	-	279.9	0.6	-	-
121. Commercial and Services, excluding Institutional	143.3	0.3	-	-	-	-
122. Schools	101.3	0.2	-	-	-	-
123. Other Institutional	35.3	0.1	-	-	-	-
13. Industrial	-	-	2,148.6	4.3	-	-
14. Transportation, Communications and Utilities	-	-	1,895.6	3.8	-	-
141. Utilities	1,119.5	2.2	-	-	-	-
142. Transportation and Communications	776.1	1.5	-	-	-	-
16. Mixed Urban or Built-up Land	-	-	25.9	0.1	-	-
17. Other Urban or Built-up Land	-	-	1,018.8	2.0	-	-
171. Public Recreation Facilities	79.0	0.2	-	-	-	-
172. Private Recreation Facilities	86.1	0.2	-	-	-	-
173. Other (levee)	853.7	1.7	-	-	-	-
2. Agricultural Land	-	-	-		10,306.5	20.5
21. Cropland and Pasture	-	-	10,199.3	20.3	-	-
24. Other Agricultural Land	-	-	107.2	0.2	-	-
4. Forest Land	-	-	-	-	6,491.5	12.9
5. Water	-	-	-	-	4,332.3	8.6
6. Wetland	-	-	-	-	19,306.0	38.4
61. Nonforested Wetland	-	-	5,168.9	10.3	-	-
62. Forested Wetland	-	-	14,137.1	28.1	-	-

TABLE 2.1-18

LAND USES WITHIN FIVE MILES OF WATERFORD 3

Land Use Classification*	Level III Acreage	Level III % of Total	Level II Acreage	Level II % of Total	Level I Acreage	Level I % of Total
7. Barren Land	-	-	-	-	2,565.8	5.1
73. Sandy Areas other than Beaches	-	-	125.2	0.3	-	-
75. Strip Mines, Quarries, and Gravel Pits	-	-	1,407.3	2.8	-	-
76. Transitional Areas	-	-	1,033.3	2.1	-	-
TOTAL	-	-	-	-	50,265.5	100.0

* Classification Level I uses are preceded by 1-digit numbers; Level II uses by 2-digit numbers; and Level III uses by 3-digit numbers. The Land Use Classifications within Levels I and II are not all divided into the next level of detail. Therefore, acreages in Levels II and III do not total 100%.

**Percentage less than 0.1

Source: Aerial photographs 1"=800' flown February, 1977; supplemented by field checks made March, 1977.

TABLE 2.1-19

SCHOOLS WITHIN FIVE MILES OF WATERFORD 3

School Name	Grades	1973	1974	1975	1976	1977
St Charles Parish[1]						
Good Hope Elementary	K-2	165[2]	162[2]	144	139	131
Norco Elementary	K-2	163[2]	230	229	209	224
Norco Elementary	3-6	398	392	352	388	345
New Sarpy Middle	7-8	745[3]	674[3]	619[3]	541	544
Hahnville Elementary	K-6	443[2]	431[2]	477	471	458
Carver Jr High School	7-8	603	608	627	618	614
Killona Elementary	K-6	215	220	185	181	152
Sacred Heart (Parochial)	K-8	421[2]	423	404	369	339
St John the Baptist Parish[4]						
Lucy Elementary	K-7	202	185	226	174	176
Milesville School	K	NA	NA	NA	100	75
Woodland Elementary	4-6	353[5]	442[5]	479[5]	356	334
John L Ory	1-6	332	423	520	475	520

Sources: St Charles Parish

Personal Communication, Secretary to Assistant Superintendent and Supervisor of Child Welfare, St Charles Parish Schools, Luling, Louisiana. March 21, 1977.

St John the Baptist Parish

Personal Communication, Supervisor, St John the Baptist Parish Schools, Reserve, Louisiana. March 21, 1977.

NA - Not Available

(1) Membership data given for a date in late February or early March.

(2) Did not include Kindergarten.

(3) Included Grades 6-8.

(4) Annual membership data given for 1973-76; March, 1977 membership for 1977.

(5) Included Grades K-7.

TABLE 2.1-20

MAJOR INDUSTRIES WITHIN 5 MILES OF WATERFORD 3

Company Name	Products	Employment
Argus Chemical Co.	Plasticizers & Stabilizers	69
Beker Industries	Fertilizer Chemicals	210
Chevron Oil Co.	Oil Storage	17
General American Transportation Co.	Storage of Petroleum Products, Food Oils	163
Good Hope Refinery	Oil Refinery	160
Hooker Chemical Co.(1)	Chlorine-based Chemicals	666
Kaiser Coke Calciner	Petroleum Coke	11
Louisiana Power & Light Co.	Power Generation (5 units)	137
Shell Chemical Co.	Diversified Chemicals	461
Shell Oil Co.	Oil Refinery	945
Union Carbide	Diversified Chemicals	1,528
Witco Chemical Co.	White Mineral Oil, Petrolatums	61

Sources: Telephone contacts with above companies, April-May 1977, and Louisiana Chemical Industry Directory, Louisiana Chemical Association, Baton Rouge, Louisiana, May 1976.

(1) Includes Occidental Chemical Co.

TABLE 2.1-21

AGRICULTURAL STATISTICS FOR
ST CHARLES AND ST JOHN THE BAPTIST PARISHES

	St Charles Parish		St John the Baptist Parish	
	1974	1969	1974	1969
Number of Farms	63	71	51	47
Acreage in Farms	44,505	33,653	26,933	22,556
Average Size of Farm (acres)	706	474	528	480
Land in Farms, according to use (acres):				
Cropland, total	6,914	12,165	15,848	13,677
Cropland, harvested	2,069	5,513	11,614	8,535
Cropland, used only for pasture	3,755	3,360	629	259
All Other Cropland	1,090	3,292	3,605	4,883
Woodland	423	9,874	9,098	4,817
All Other Land	37,168	11,614	1,987	4,062
Irrigated Land	2	0	6	0
Cattle & Calves, Inventory (excluding those sold)	3,033	2,615	529	119
Beef Cows	3,027	2,600	527	115
Milk Cows	6	15	2	4
Acreage in Crops				
Corn	40	67	106	136
Wheat	0	52	0	0
Soybeans	0	110	2,704	205
Hay	1,024	1,775	461	47
Vegetables	40	45	52	285
Sugar Cane*	845	3,319	7,867	7,326

* Data for farms with sales of $2,500 and over only.

Sources: U S Dept of Commerce, Bureau of the Census, 1974 Census of Agriculture, Preliminary Report, St Charles Parish (issued Sept 1976) and St John the Baptist Parish (issued Oct 1976).

TABLE 2.1-22

MAJOR WATERBORNE COMMERCE ON THE MISSISSIPPI RIVER*

Commodity	1975 Freight Traffic (Short Tons) Oceangoing	Internal
Corn	13,660,141	19,453,052
Wheat	1,905,585	4,561,177
Soybeans	5,794,572	8,457,143
Marine Shells	NA	1,176,439
Aluminum Ores	5,042,070	444,787
Coal and Lignite	10,365	8,170,268
Crude Petroleum	26,568,344	11,825,706
Phosphate Rock	4,983,142	1,386,635
Liquid Sulphur	NA	1,569,186
Sodium Hydroxide	103,834	1,380,797
Alcohols	175,458	1,467,203
Benzene and Toluene	219,953	1,062,858
Nitrogenous Chemical Fertilizers	386,180	1,304,970
Gasoline	3,249,810	7,551,554
Distillate Fuel Oil	3,927,143	3,893,380
Lubricating Oils and Greases	458,858	1,101,368
Residual Fuel Oil	2,764,245	8,285,292
Asphalt, Tar, and Pitches	121,713	1,900,462
Waterway Improvement Mat	NA	1,169,159

Source: Waterborne Commerce of the United States, 1975 Part 2, Waterways and Harbors, Gulf Coast, Mississippi River System and Antilles, Dept of the Army, Corps of Engineers, New Orleans, La. 1976.

NA = Not Available

* Includes the area of the Mississippi River from Baton Rouge to, but not including, New Orleans.

TABLE 2.1-23

MUNICIPAL AND INDUSTRIAL SURFACE WATER USERS DOWNSTREAM OF WATERFORD 3

Map Reference (Fig. 2.1-20)	Water Authority	Parish	Population Served	River Mile Location	Average Daily Production (mgd)
1	L P & L Co. Waterford 3	St Charles	-	129.6	1,404.485
2	LP & L Co. Little Gypsy	St Charles	-	129.4	933.12
3	Occidental Chemical Co.	St Charles	-	128.8	35.42
4	Union Carbide	St Charles	-	127.0	720.0
5	Shell Chemical Co.	St Charles	-	126.8	50.5
6	Shell Oil Co.	St Charles	-	125.9	10.66
7	General American Transportation Co.	St Charles	-	125.2	0.02
8	St Charles Parish Water Works District #1	St Charles	10,400	125.1	1.61
9	St Charles Parish Water Works District #2	St Charles	12,800	120.6	3.0
10	Monsanto Co.	St Charles	-	120.0	4.56
11	American Cyanamid	Jefferson	-	114.8	0.60
12	Jefferson Parish Water Works District #1	Jefferson	211,681	105.4	30.0
13	Alton Ochsner Medical Foundation	Jefferson	-	104.9	10.94
14	Carrollton Plant New Orleans, La.	Orleans	*	104.7	122.65

TABLE 2.1-23
MUNICIPAL AND INDUSTRIAL SURFACE WATER USERS

Map Reference (Fig. 2.1-20)	Water Authority	Parish	Population Served	River Mile Location	Average Daily Production (mgd)
15	L P & L Ninemile Point Plant	Jefferson	-	103.9	899.0
16	City of Westwego Water District	Jefferson	15,000	101.5	3.94(1)
17	Celotex Corp.	Jefferson	-	100.9	18.3
18	Jefferson Parish Water Works District #2	Jefferson	63,000	99.1	12.5
19	R J R Foods, Inc.	Jefferson	-	98.9	0.60
20	Witco Chemical Corp.	Jefferson	-	97.7	0.75
21	Hunt - Wesson Foods	Jefferson	-	97.6	3.31
22	Publicker Chemical Corp.	Jefferson	-	97.0	1.5
23	City of Gretna Water District	Jefferson	30,000	96.7	3.74
24	New Orleans Municipal Algiers Plant	Orleans	*	95.8	6.27
25	New Orleans Public Service	Orleans	-	96.5	152.64
26	Jackson Brewing Co.	Orleans	-	94.5	5.76
27	Amstar Corp.	St Bernard	-	90.7	30.5
28	Kaiser Chalmette Works	St Bernard	-	89.3	410.18
29	Tenneco Oil Co.	St Bernard	-	89.0	70.87
30	St Bernard Water Works District #1	St Bernard	46,300	87.9	6.1
31	Murphy Oil Co.	St Bernard	-	87.2	17.64

TABLE 2.1-23
MUNICIPAL AND INDUSTRIAL SURFACE WATER USERS

Map Reference (Fig. 2.1-20)	Water Authority	Parish	Population Served	River Mile Location	Average Daily Production (mgd)
32	Dalcour Water Works District	Plaquemines	1,435	80.9	0.22
33	Universal Foods Corp.	Plaquemines	-	75.8	2.90
34	Belle Chasse Water Works District	Plaquemines	6,600	75.8	5.0
35	Chevron Chemical Co.	Plaquemines	-	72.5	6.70
36	Gulf Oil Corp.	Plaquemines	-	62.5	27.05
37	Pointe-a-La-Hache Water District	Plaquemines	1,050	49.2	0.3
38	Freeport Sulfur	Plaquemines	-	39.4	1.43
39	Port Sulfur Water Works District	Plaquemines	5,000	39.2	0.6
40	Buras-Empire Water Works District	Plaquemines	12,200	29.9	1.5
41	Petrou Fisheries	Plaquemines	-	28.5(2)	0.50
42	Boothville-Venice Water Works District	Plaquemines	2,500	18.6	1.0
43	Texas Pipeline Co.	Plaquemines	-	2.4	0.5

*593,000 people are supplied between the Carrollton and Algiers plants.
(1) Sources conflict on pumpage. Figure of 3.94 mgd confirmed with Army Corps of Engineers.
(2) Sources conflict on river mile location. River mile 28.5 confirmed with Petrou Fisheries.
Sources:

State of Louisiana, "Lower Mississippi River Basin Water Quality Management Plan." Volume 1. June, 1973.

Louisiana Power & Light Co., "Industrial Opportunities and Resources on Louisiana's Lower Mississippi River." Undated.

U.S. Dept. of the Army, Corps of Engineers, "List of Mississippi River Terminals, Docks, Mooring Locations and Warehouses." New Orleans, La. Dec., 1976.

TABLE 2.1-24

RECREATION AREAS DOWNSTREAM OF WATERFORD 3*

PART I

RECREATION AREAS LOCATED ON THE MISSISSIPPI RIVER(BETWEEN THE LEVEES) FROM WATERFORD 3 TO THE GULF OF MEXICO

Map Reference (Fig. 2.1-21)	Recreation Area	Parish	Location (Approx. River Mile)	Description (Acreage and Facilities Where Available) Acreage	Playing Fields	Beach	Swim Pool	Picnic	Boating	Camping	Hunting	Other
1	Jackson Square	Orleans	93	2								Historic and scenic site
2	Audubon Park	Orleans	101	320	X		X	X	X			
3	Chalmette National Historic Park	St Bernard	90	130								Historic site
4	Braithwaite Park	Plaquemines	82	100								18-hole golf course
5	Port Sulphur Recreation Area	Plaquemines	38	30	X		X	X				
6	Port Sulphur Golf Course	Plaquemines	37	40								9-hole golf course
7	Bohemia Wildlife Management Area	Plaquemines	37	33,000							X	
8	Fort Jackson	Plaquemines	19	82								Historic and scenic site
9	Pompano Charter Boat	Plaquemines	11	1					X			
10	Ellzey Marina	Plaquemines	11	3					X			
11	Delta National Wildlife Refuge	Plaquemines	0	48,834							X	
12	Pass A Loutre Game and Fish Preserve	Plaquemines	**	66,000							X	

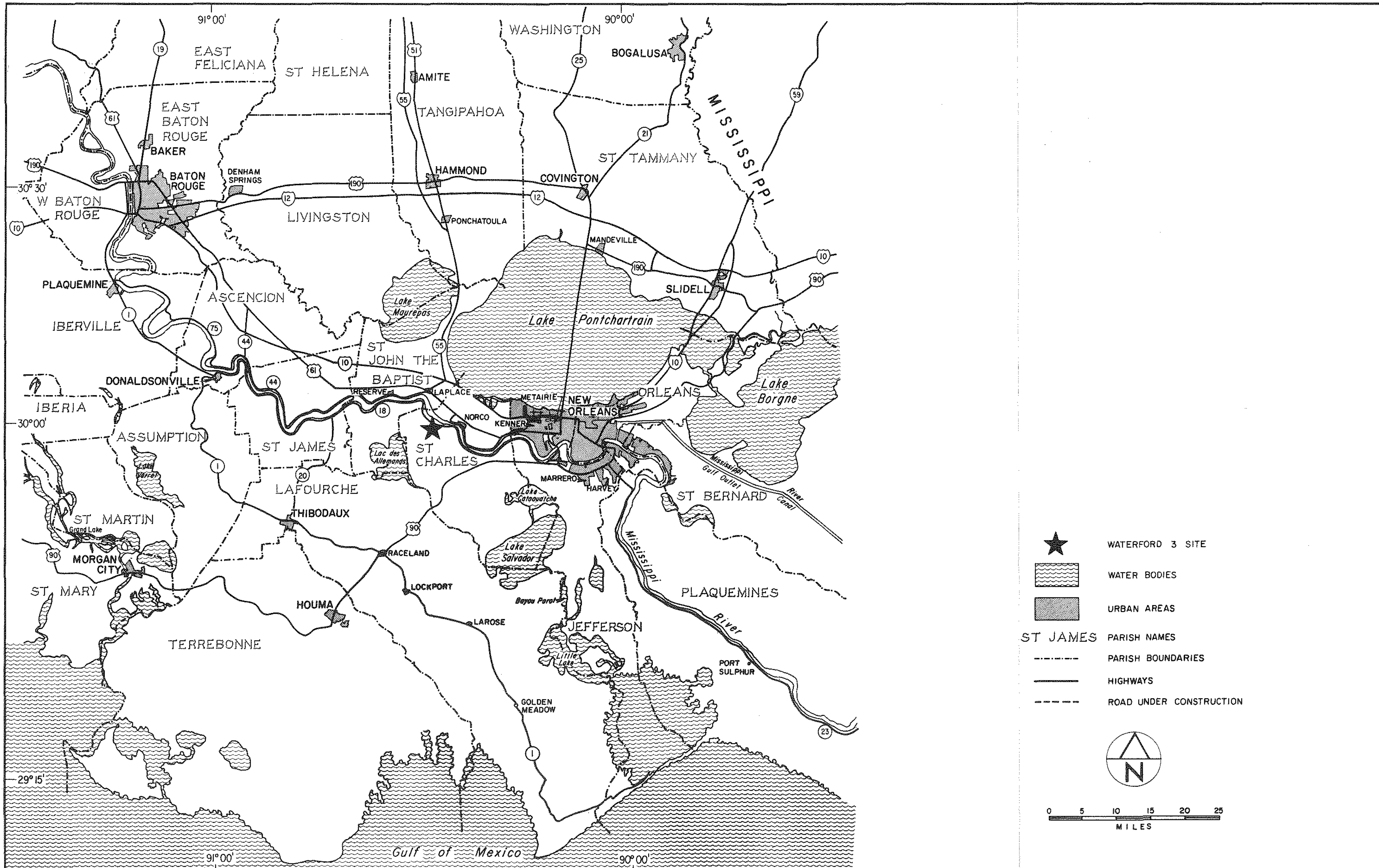
TABLE 2.1-24

RECREATION AREAS DOWNSTREAM OF WATERFORD 3*
PART II
RECREATION AREAS LOCATED ON THE BONNET CARRE FLOODWAY OR ON THE SOUTHERN SHORE OF LAKE PONTCHARTRAIN

Map Reference (Fig. 2.1-21)	Recreation Area	Parish	Location (Approx. River Mile)	Description (Acreage and Facilities Where Available)								
				Acreage	Playing Fields	Beach	Swim Pool	Picnic	Boating	Camping	Hunting	Other
13	Laplace Boat Ramp	St John the Baptist	LP+	1					X			
14	Manchac Wildlife Refuge	St John the Baptist	LP	5,261							X	
15	St Charles Parish Boating Club	St Charles	BCF++	25					X			
16	Norco Boating Club	St Charles	BCF	32				X	X	X		
17	March Duck Club, Inc.	St Charles	LP	30,000							X	Fishing pier
18	Bonnet Carre Wildlife	St Charles	BCF	3,800							X	
19	Kiddy Playground No. 1	Jefferson	LP	0.7								Playground facilities
20	Municipal Yacht Harbor	Orleans	LP	39					X			
21	Orleans Marina	Orleans	LP	35								Not Available
22	Orleans Lakefront Development	Orleans	LP	778	X	X	X	X				Water-skiing
23	Pontchartrain Beach	Orleans	LP	24		X						Amusement park rides, shows
24	Southern Yacht Club	Orleans	LP	3			X	X				
25	New Orleans Yacht Club	Orleans	LP	3								Not Available
26	Public Boat Launch (Inner Harbor Navig. Canal)	Orleans	LP						X			

*River Mile 129.6 **Below Head of Passes
+LP = Lake Pontchartrain ++BCF = Bonnet Carre Floodway

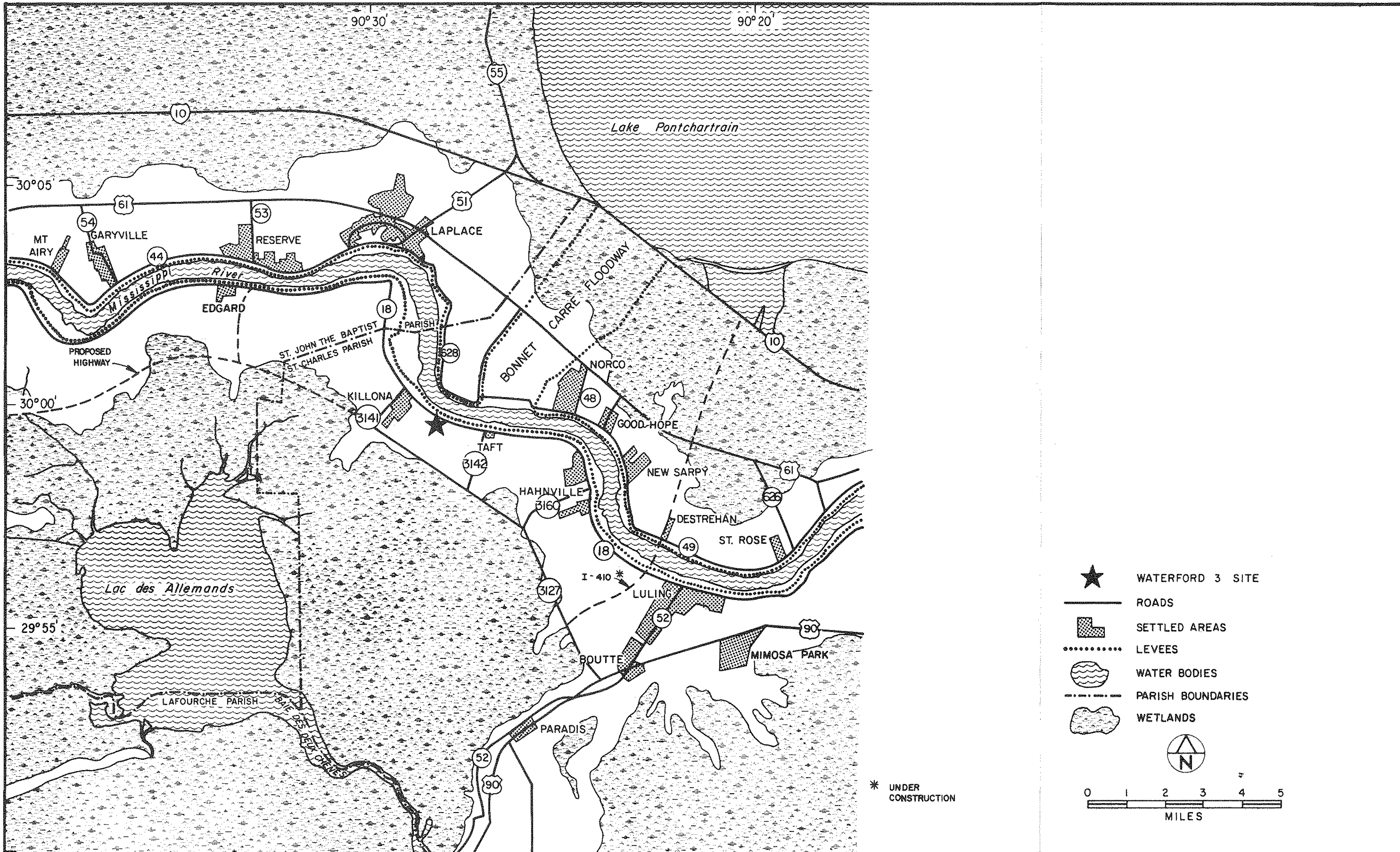
Sources: Louisiana State Parks and Recreation Commission, "Inventory of Recreation Sites by Parish." 1974.
Exxon Co. "Louisiana Gulf Coast and New Orleans." (Road Map) 1973.
Board of Levee Commissioners, Orleans Levee District. "Lake Recreation Restrictions." (Map) June, 1966.



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

THE REGION WITHIN 50 MILES OF WATERFORD 3

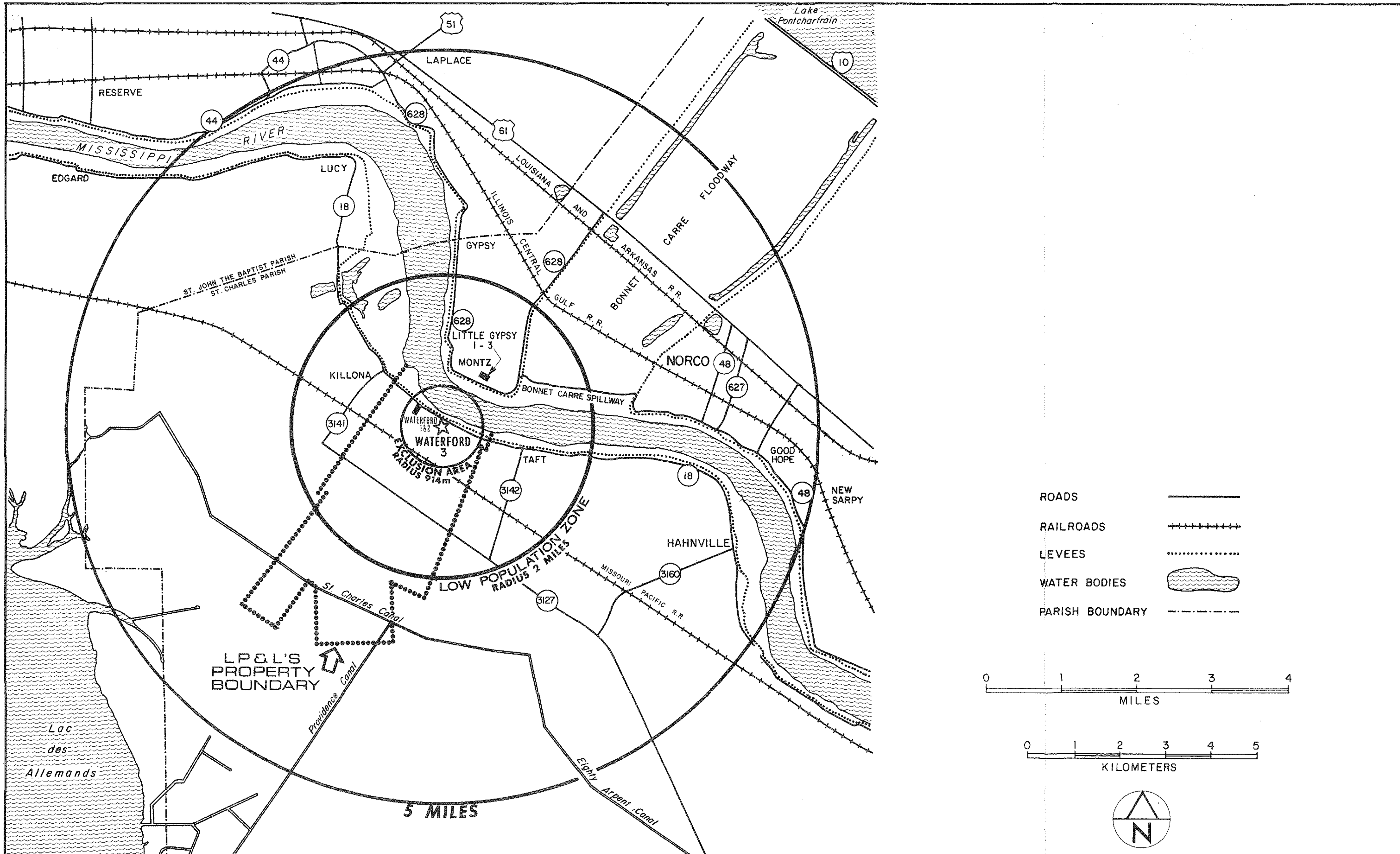
FIGURE 2.1-1



LOUISIANA
POWER & LIGHT Co.
Waterford Steam
Electric Station

THE REGION
WITHIN 10 MILES OF WATERFORD 3

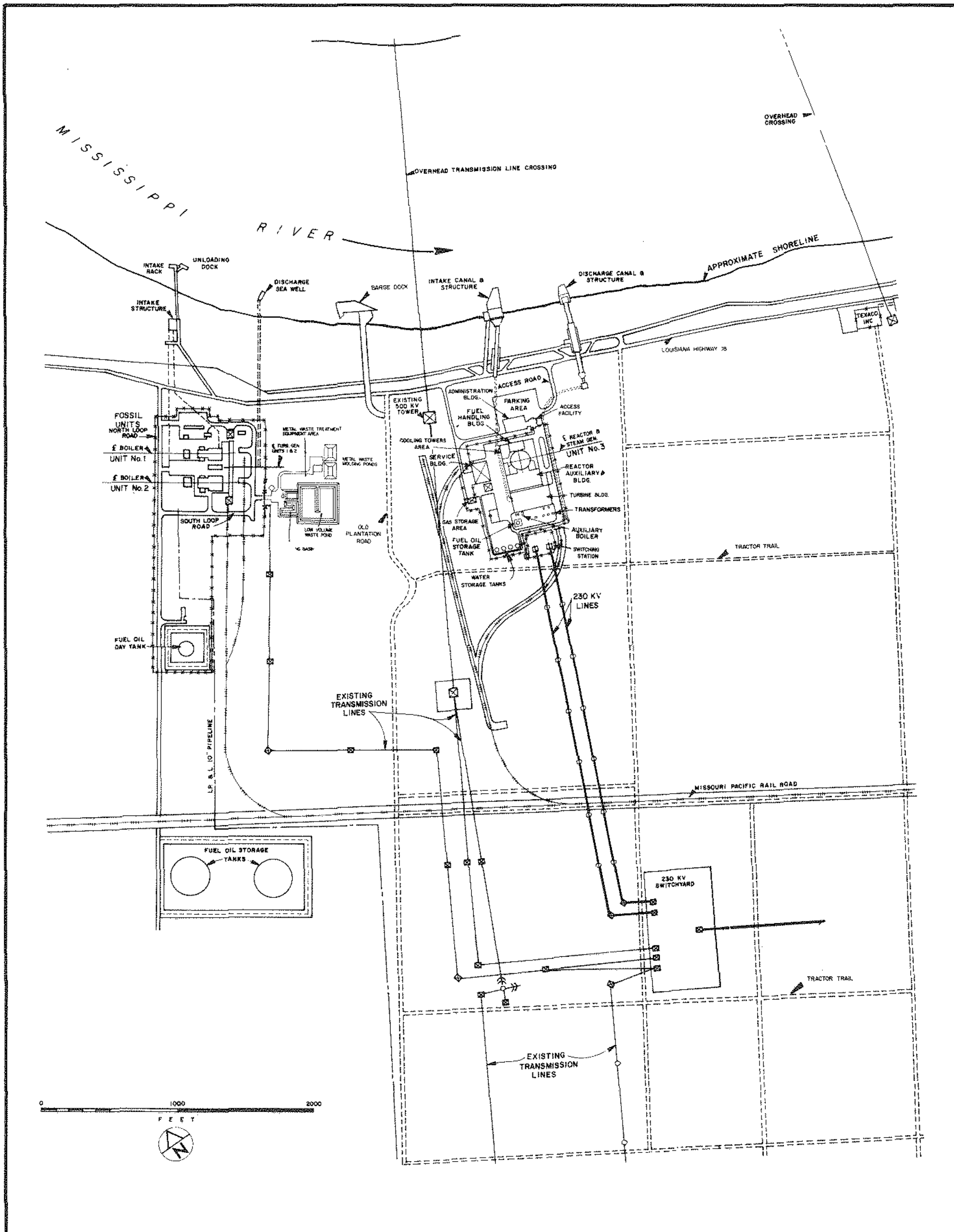
FIGURE
2.1 - 2



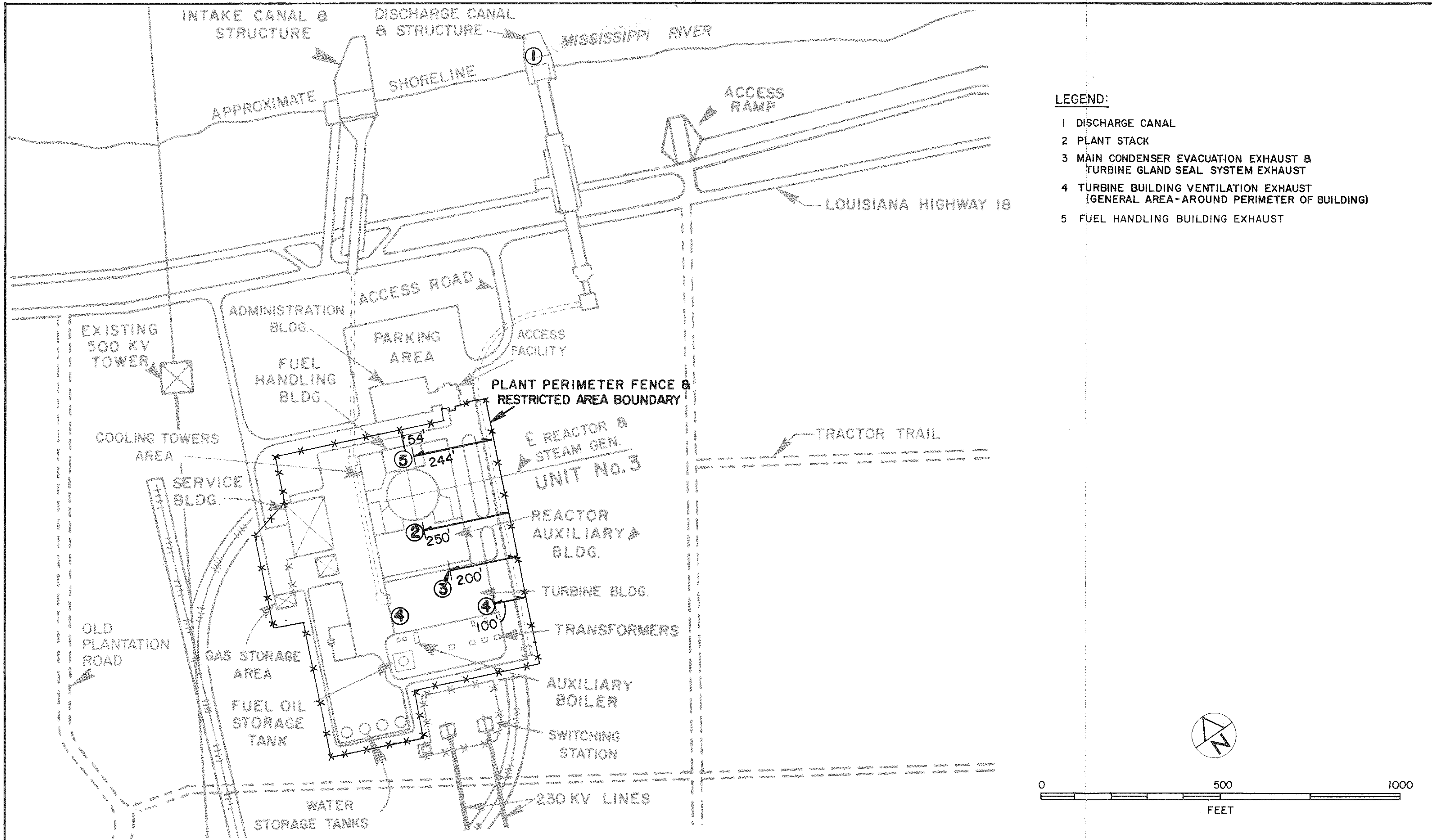
LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

THE AREA WITHIN 5 MILES OF WATERFORD 3

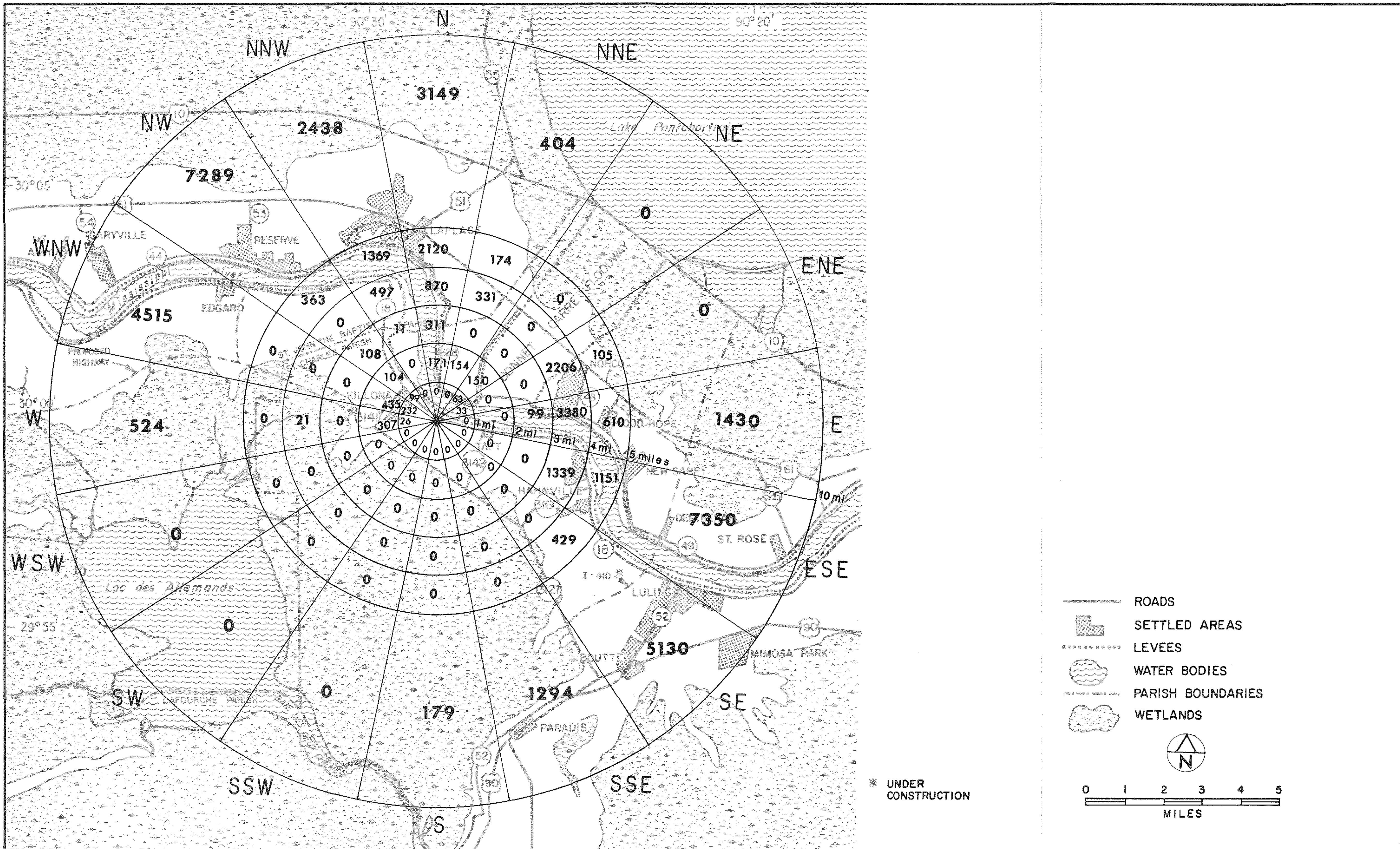
FIGURE 2.1-3



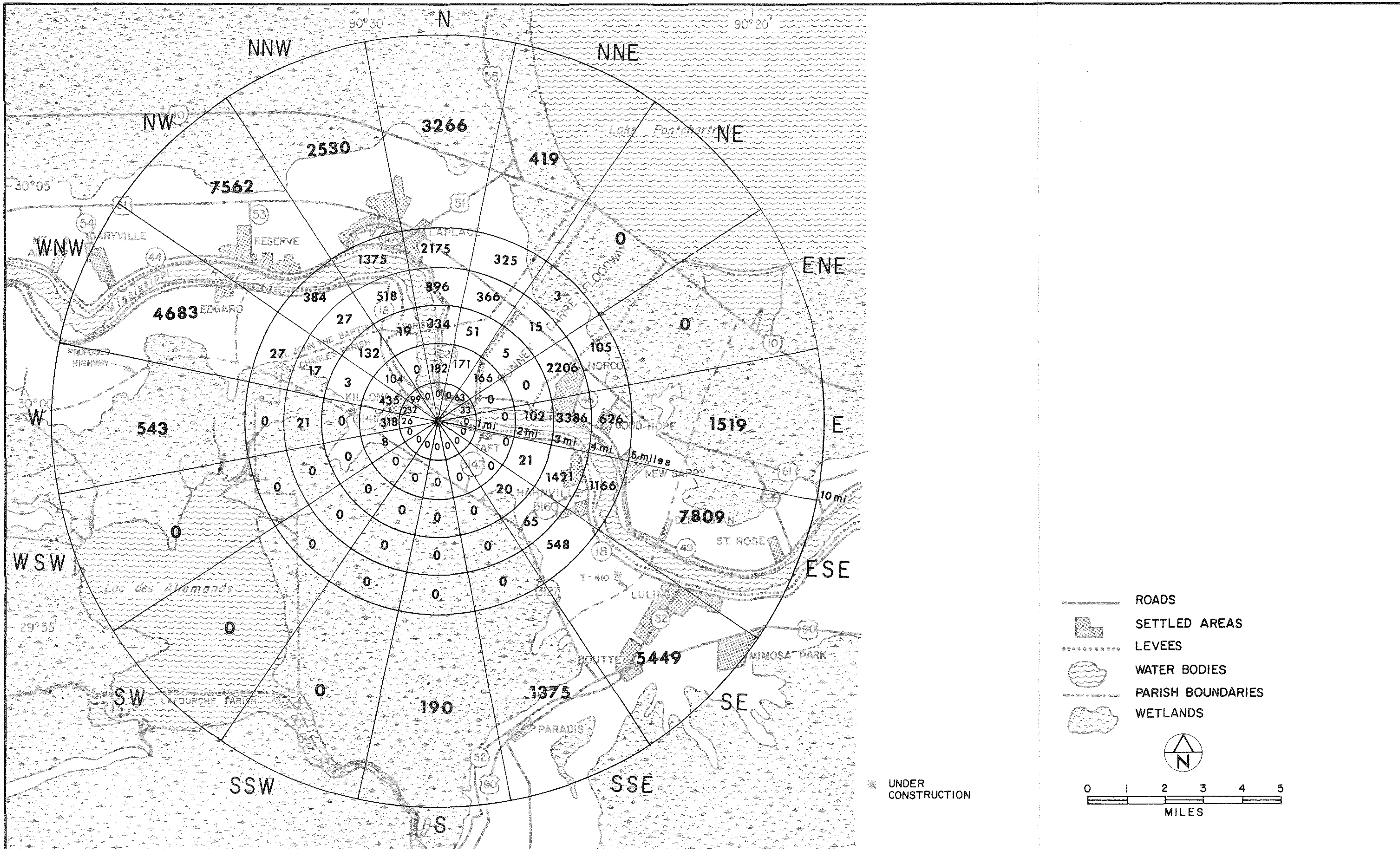
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	WATERFORD 3 SITE AND NEARBY STRUCTURES	Figure 2.1-4



LOUISIANA POWER & LIGHT Co. Waterford Steam Electric Station	EFFLUENT RELEASE POINTS AND RESTRICTED AREA BOUNDARY	FIGURE 2.1-5



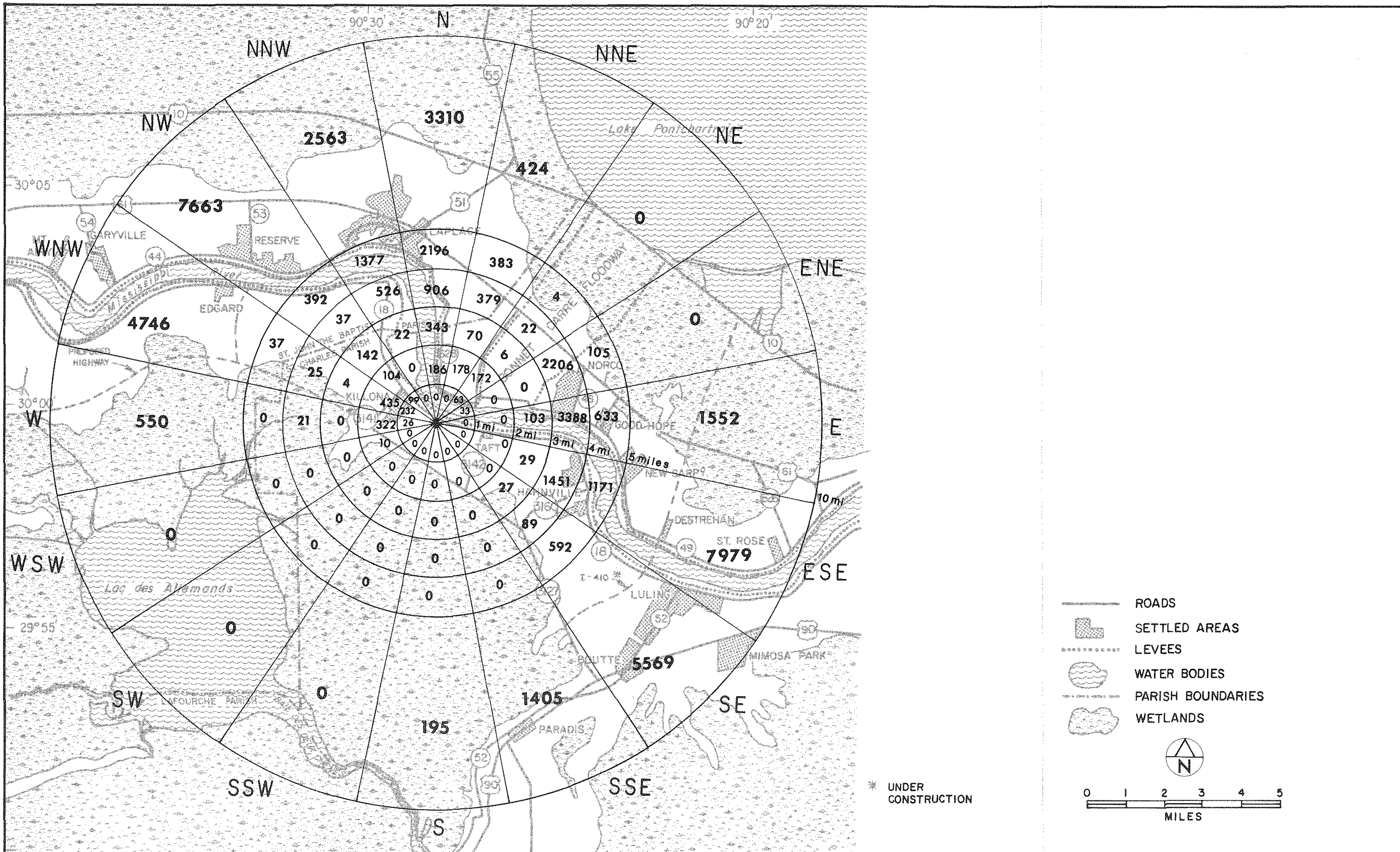
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	1977 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-6 SHEET 1 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1980 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

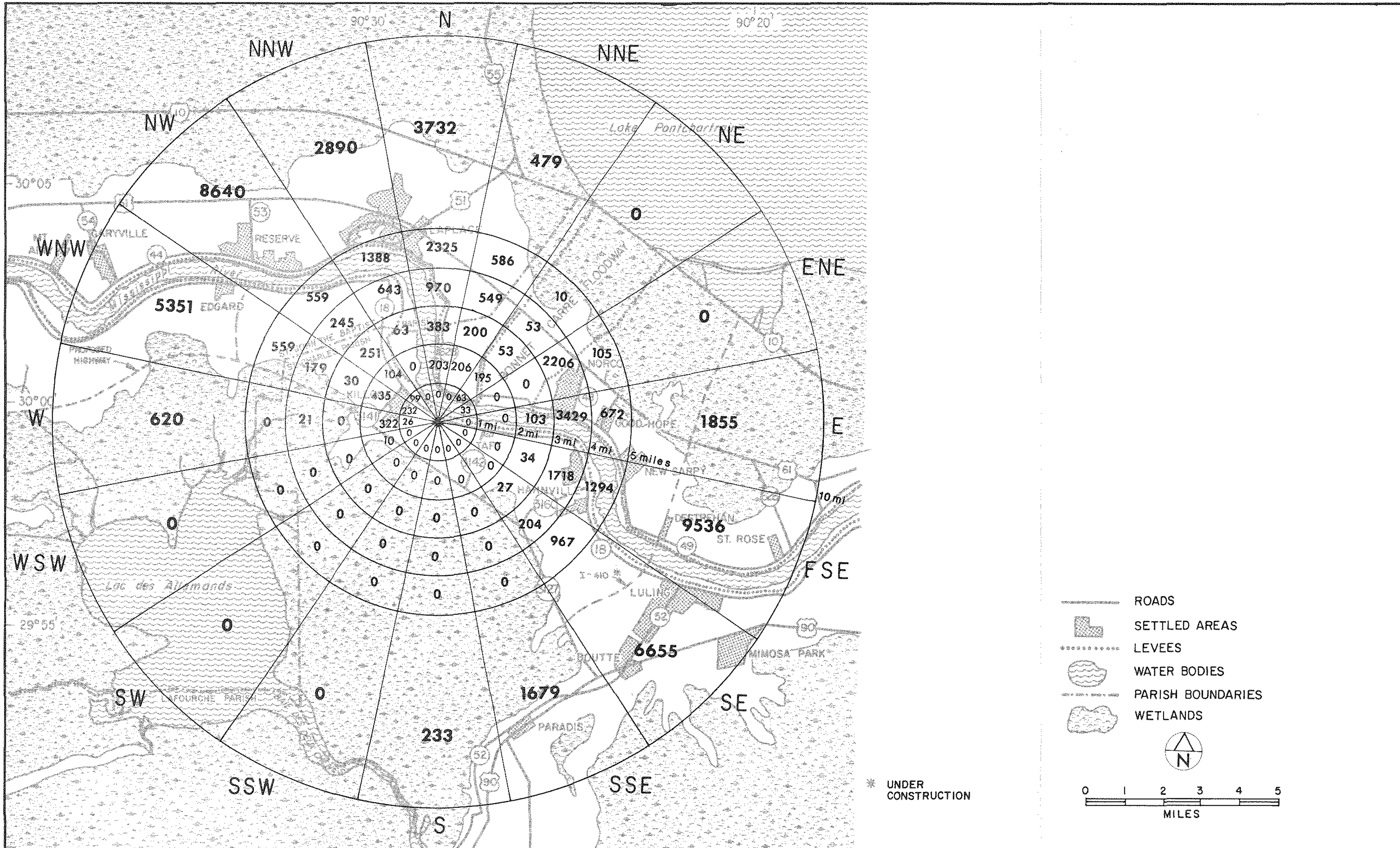
FIGURE 2.1-6
SHEET 2 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1981 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-6
SHEET 3 of 8

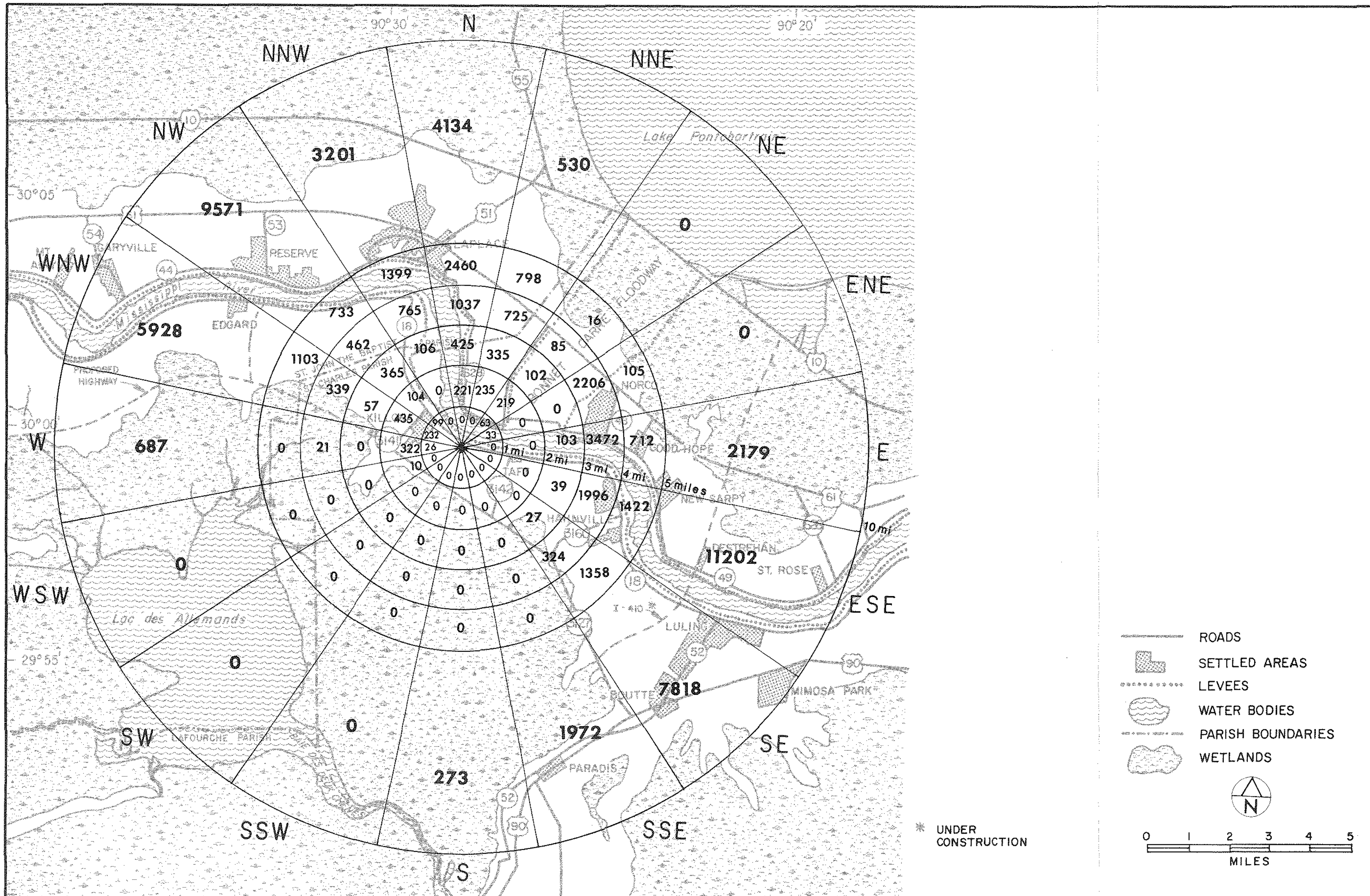


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1990 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1 - 6

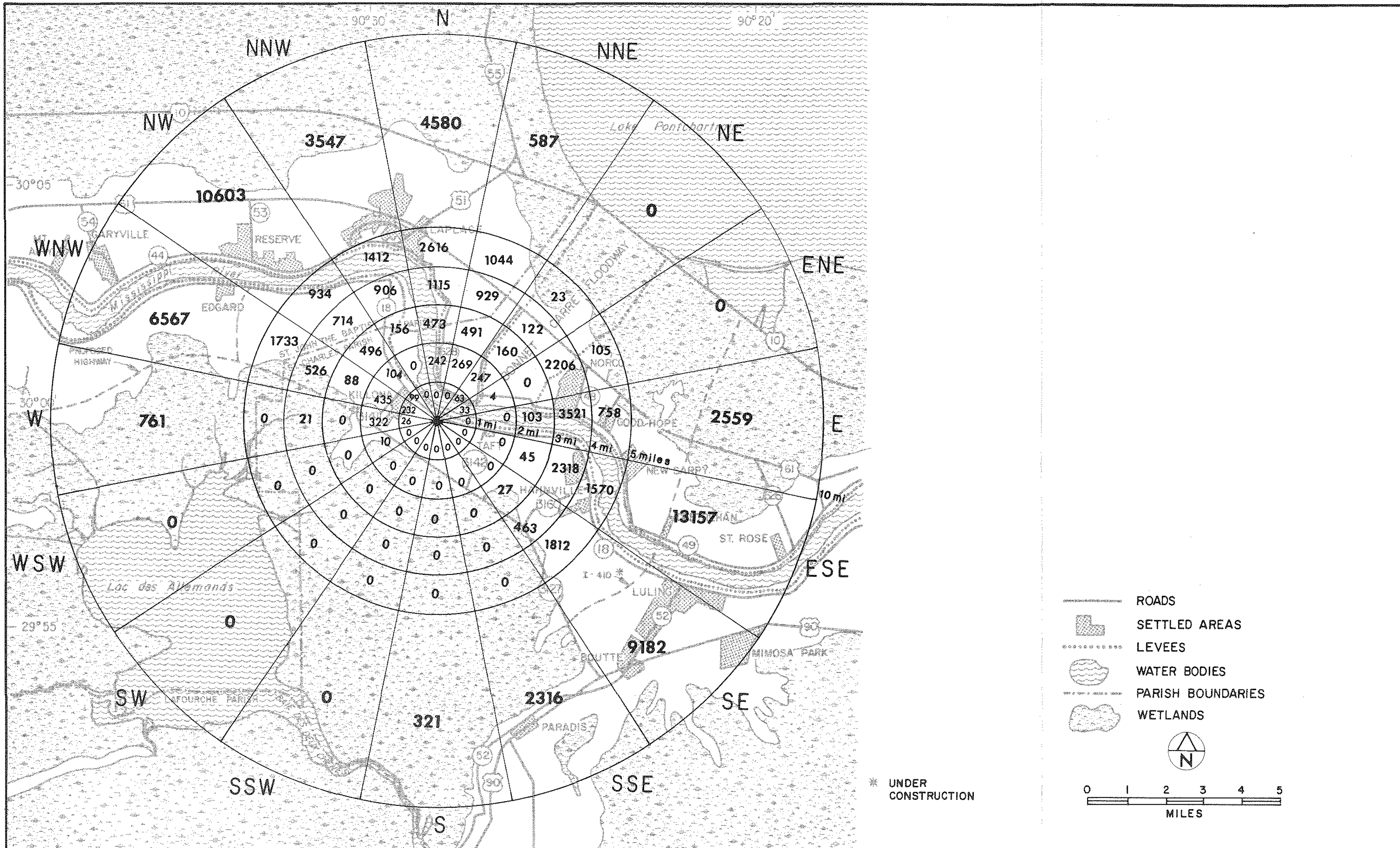
SHEET 4 of 8



LOUISIANA
POWER & LIGHT Co.
WATERFORD STEAM
ELECTRIC STATION

2000 RESIDENT POPULATION
WITHIN 10 MILES OF WATERFORD 3

FIGURE
2.1 - 6
SHEET 5 of 8

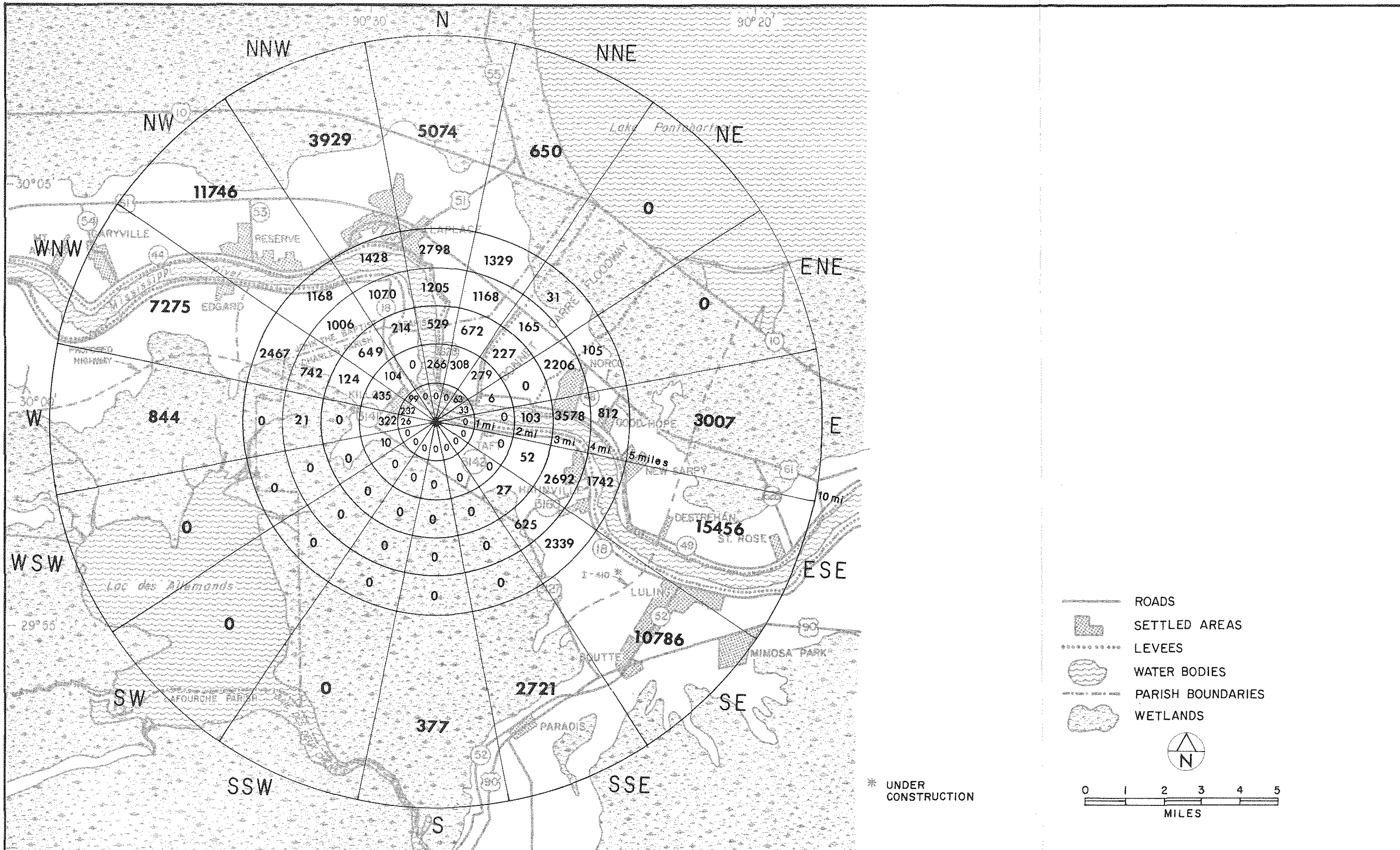


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2010 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-6

SHEET 6 of 8

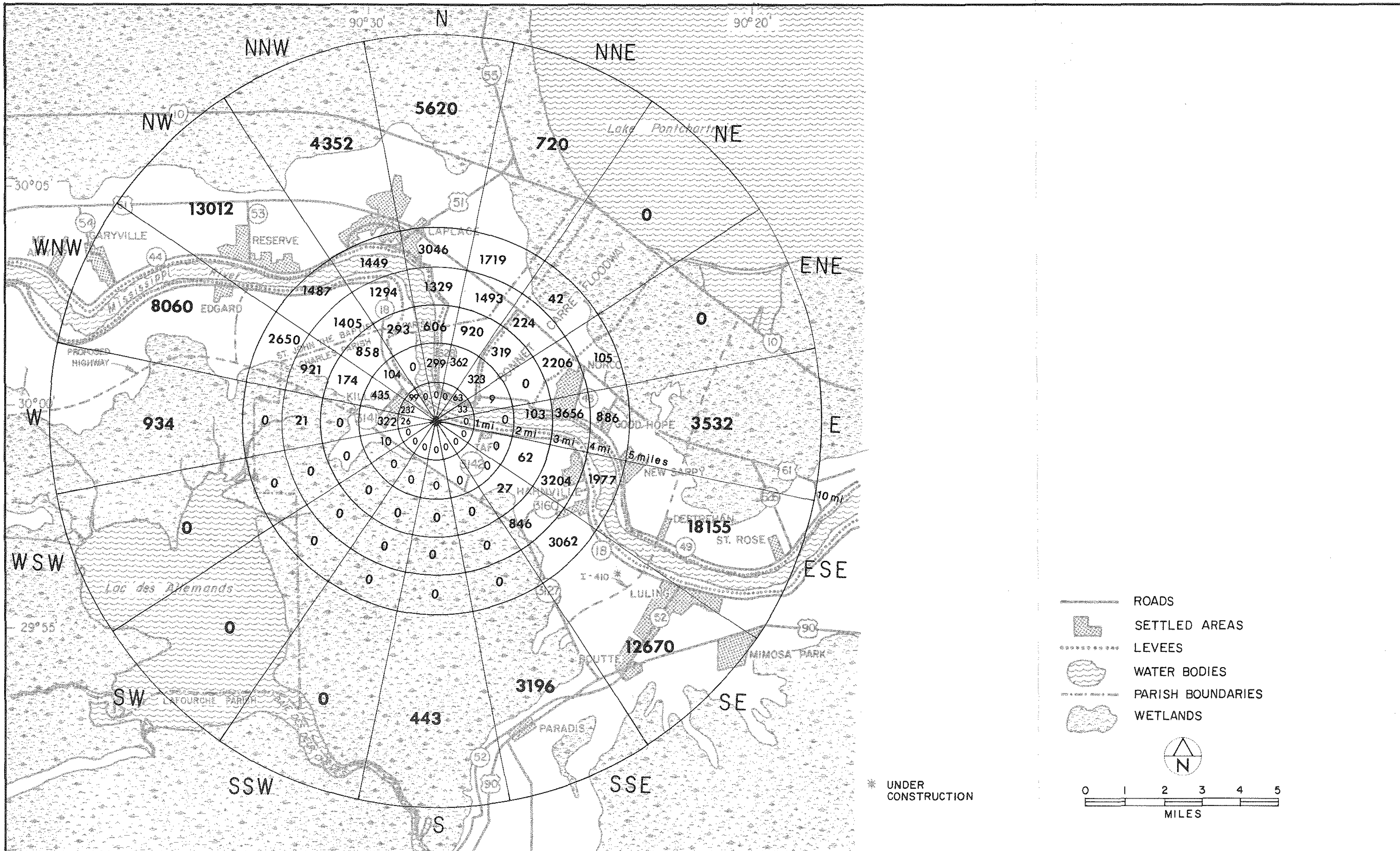


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2020 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-6

SHEET 7 of 8

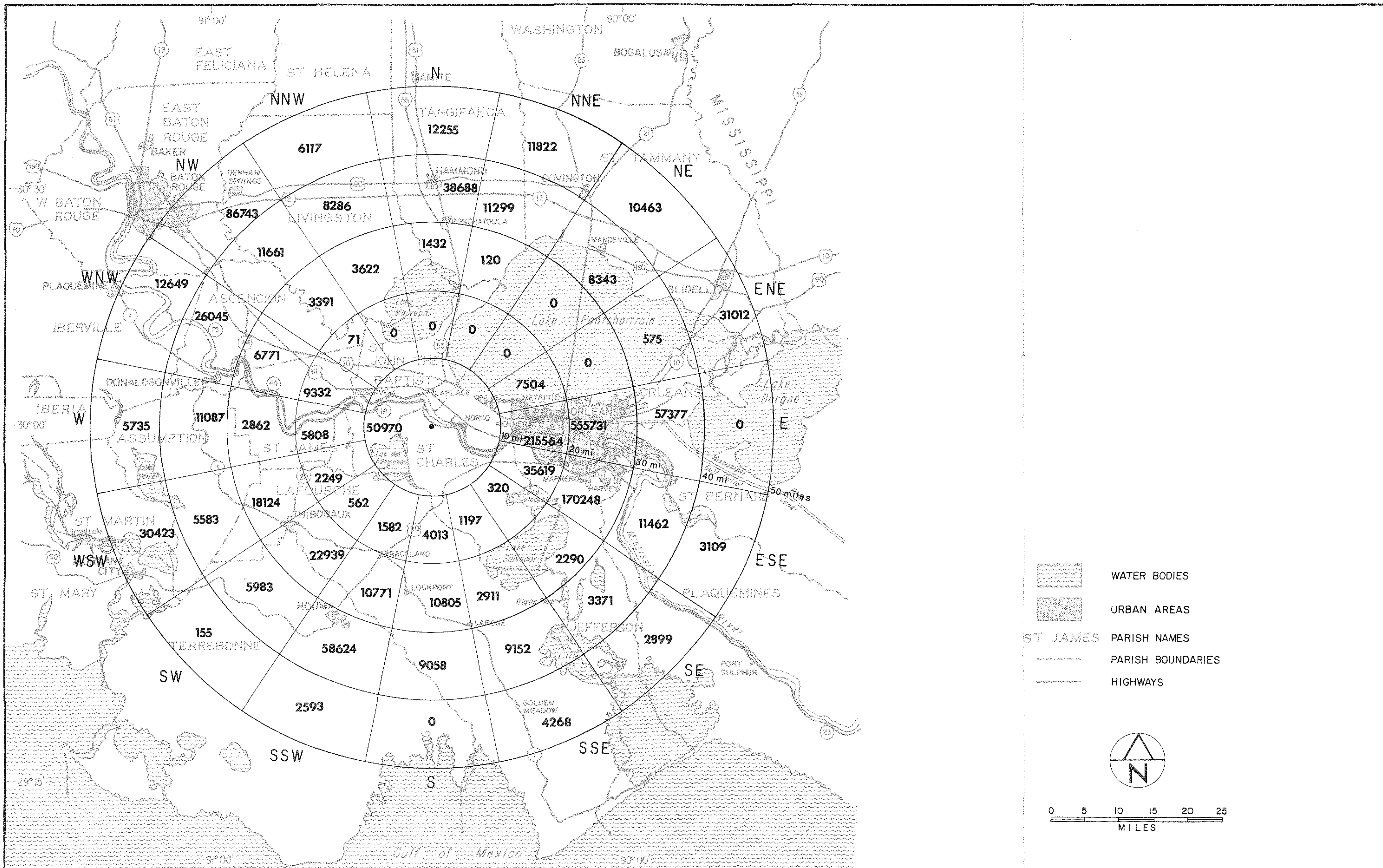


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2030 RESIDENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-6

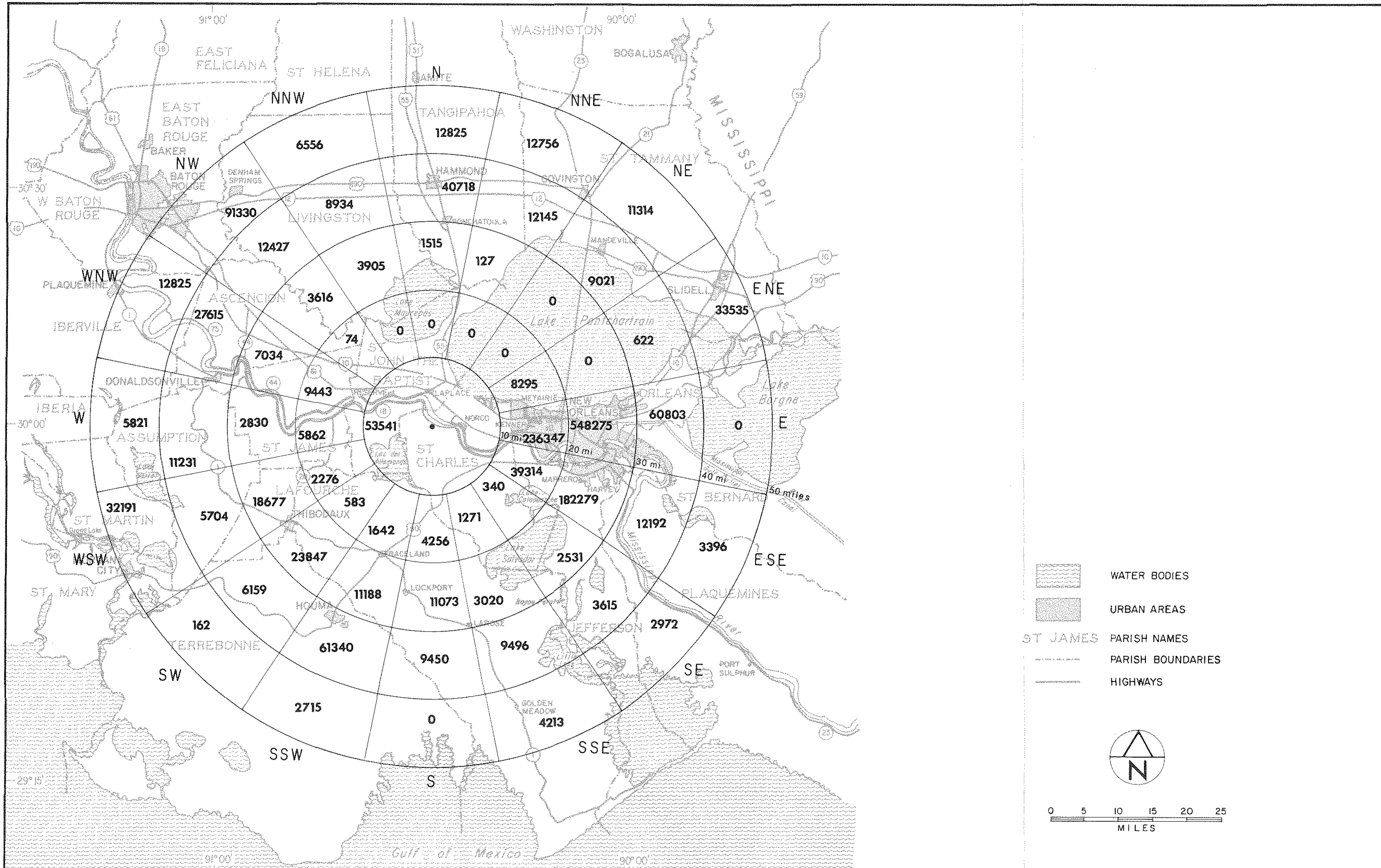
SHEET 8 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1977 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

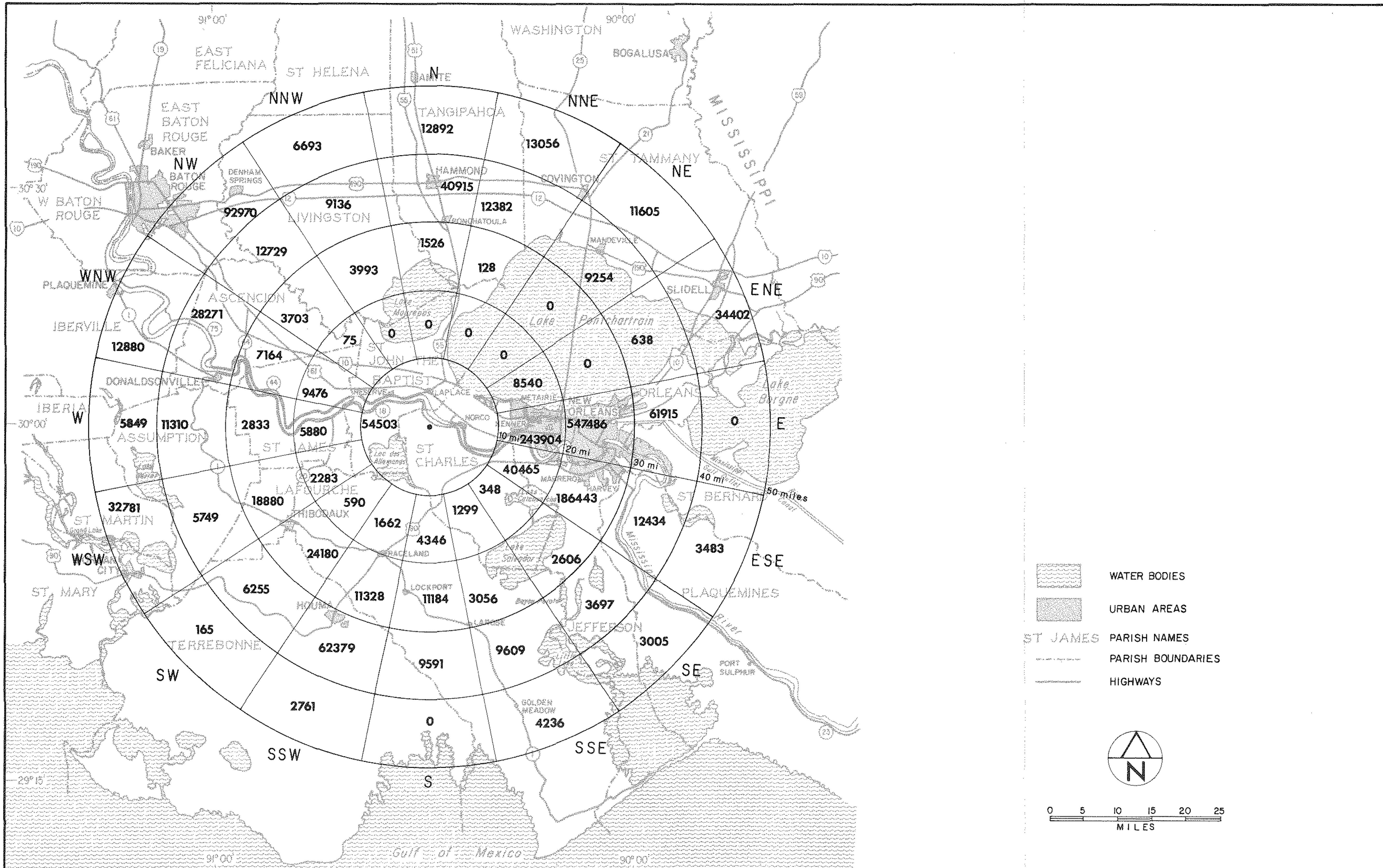
FIGURE 2.1-7
SHEET 1 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1980 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

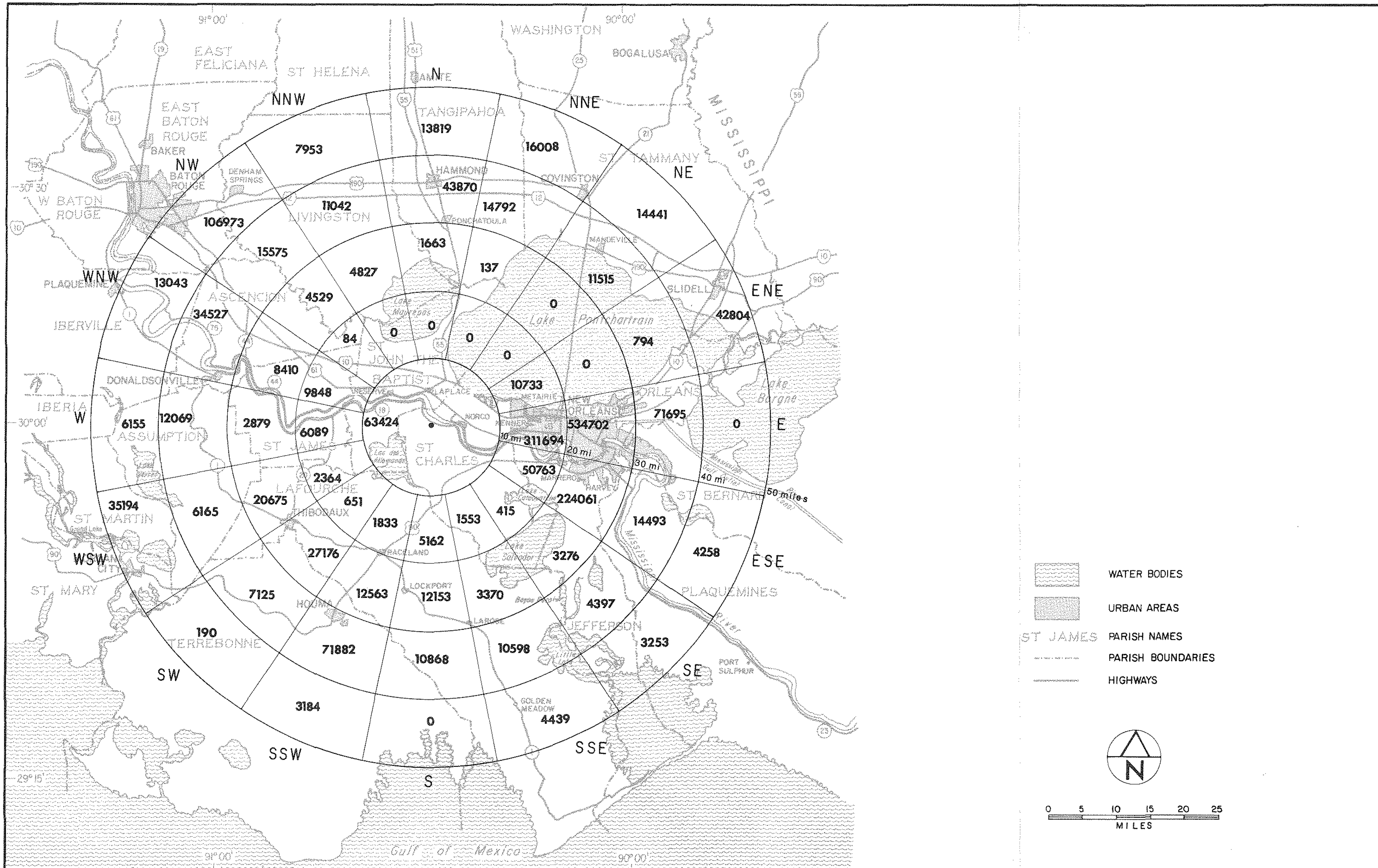
FIGURE 2.1-7
SHEET 2 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

1981 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

FIGURE 2.1-7
SHEET 3 of 8

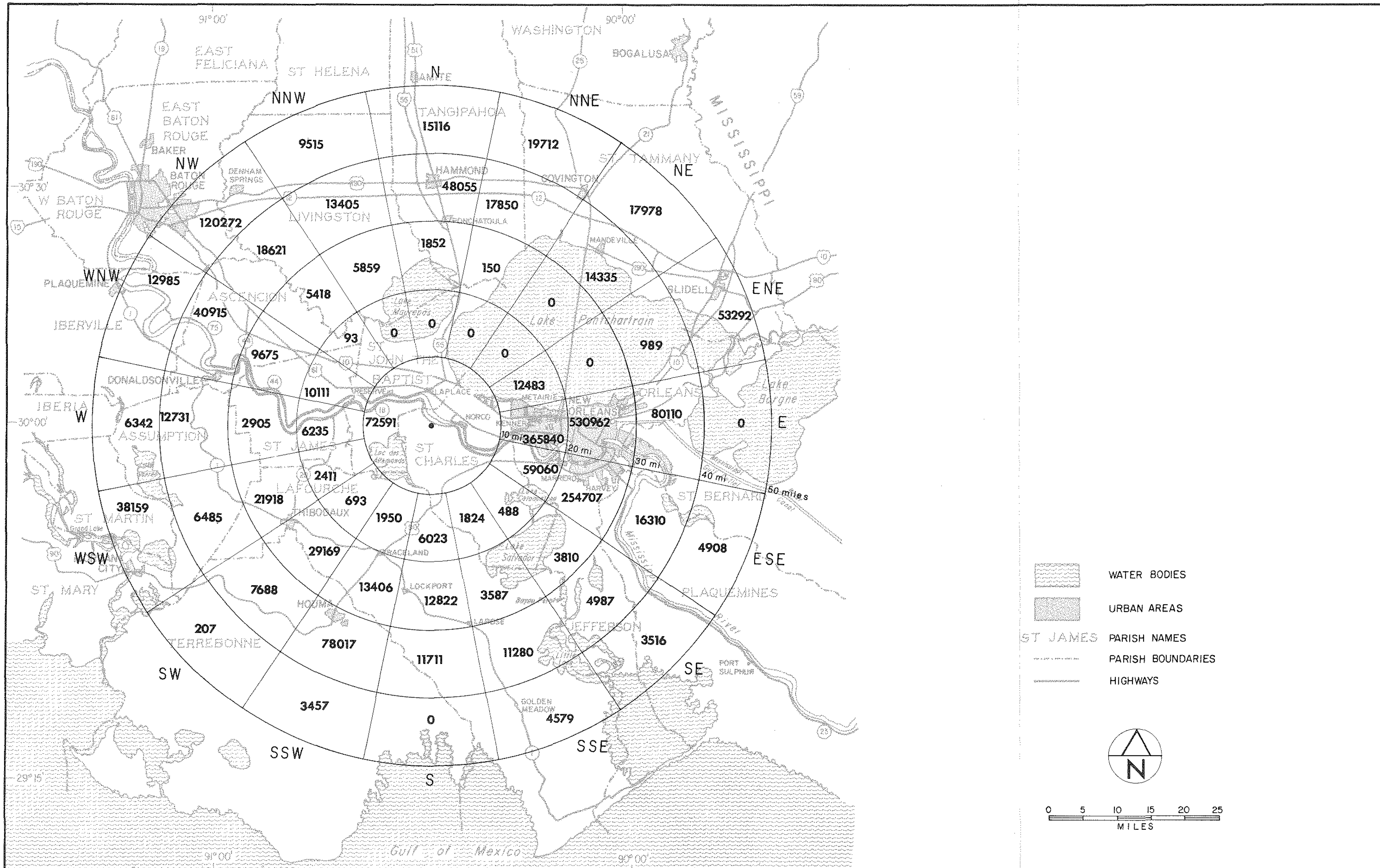


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

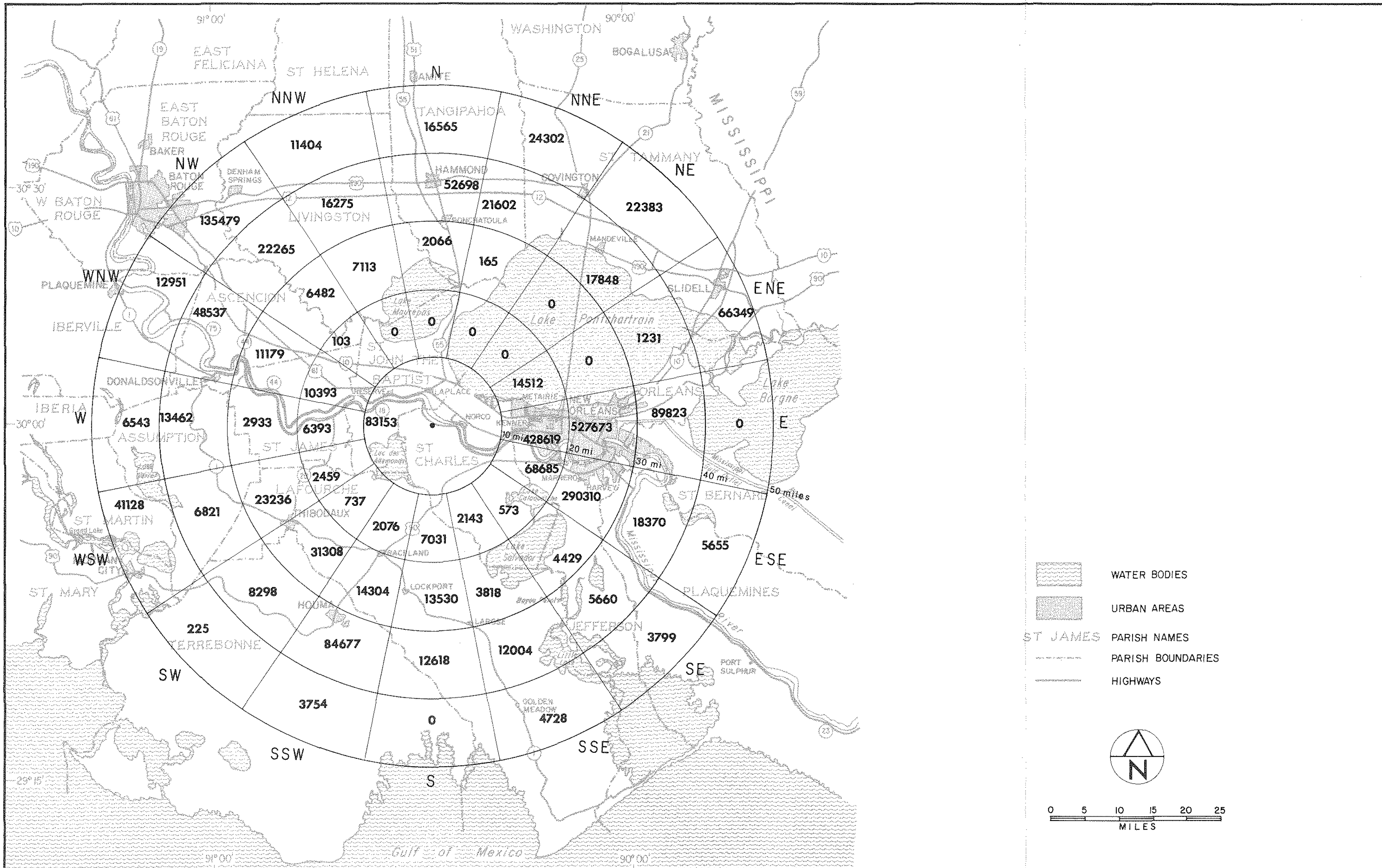
1990 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

FIGURE 2.1-7

SHEET 4 of 8



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	2000 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3	FIGURE 2.1-7 SHEET 5 of 8

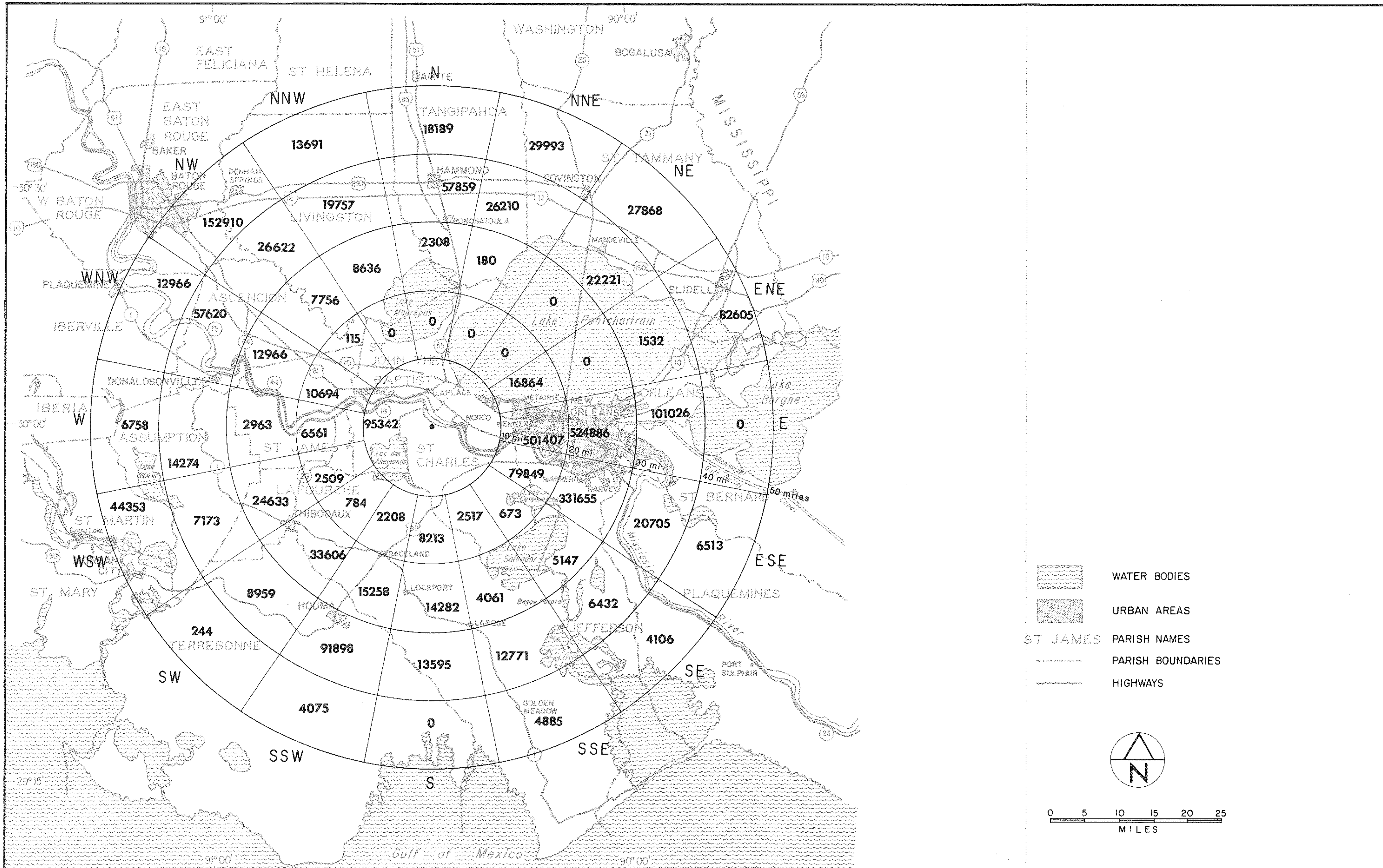


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

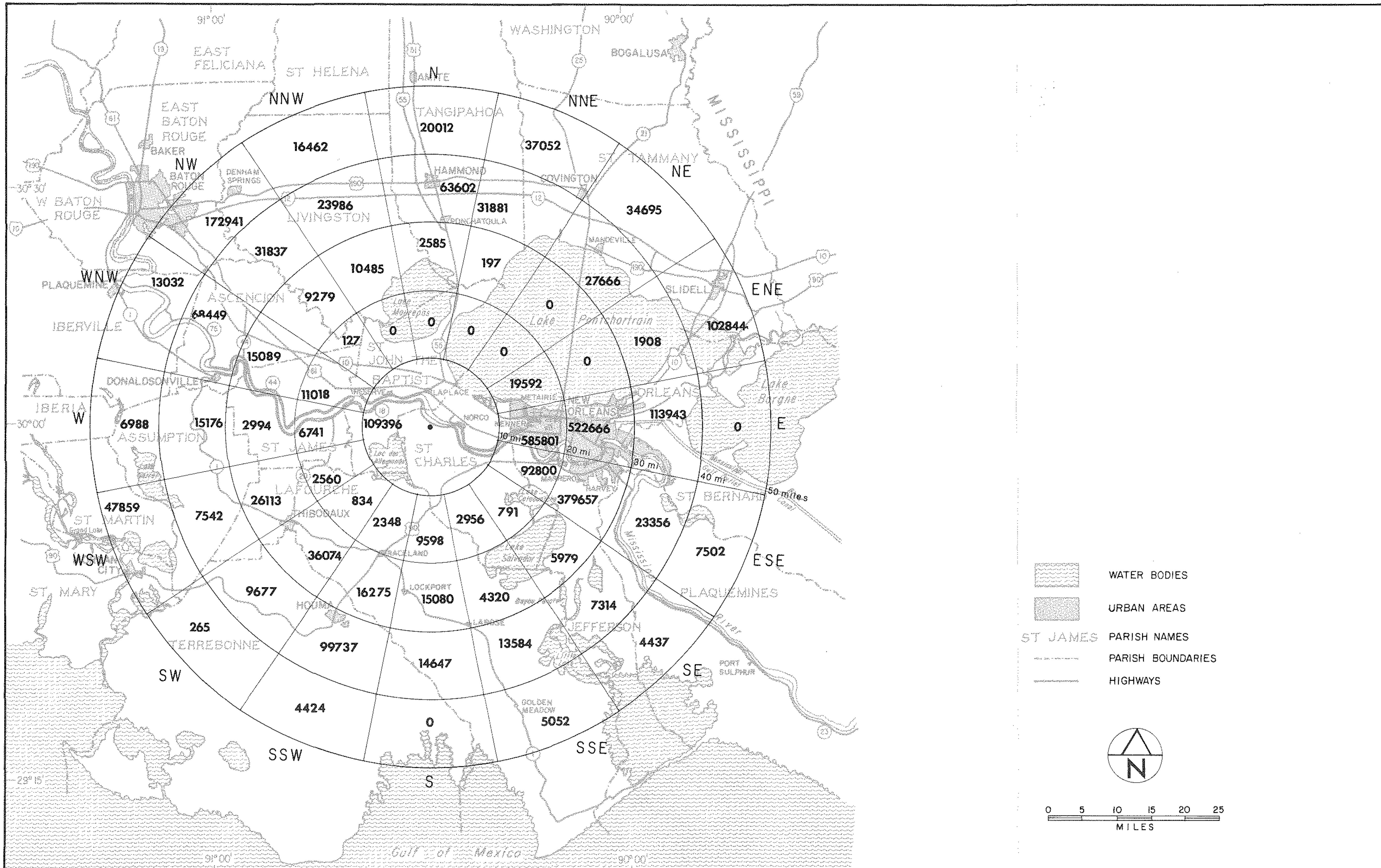
2010 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

FIGURE 2.1-7

SHEET 6 of 8



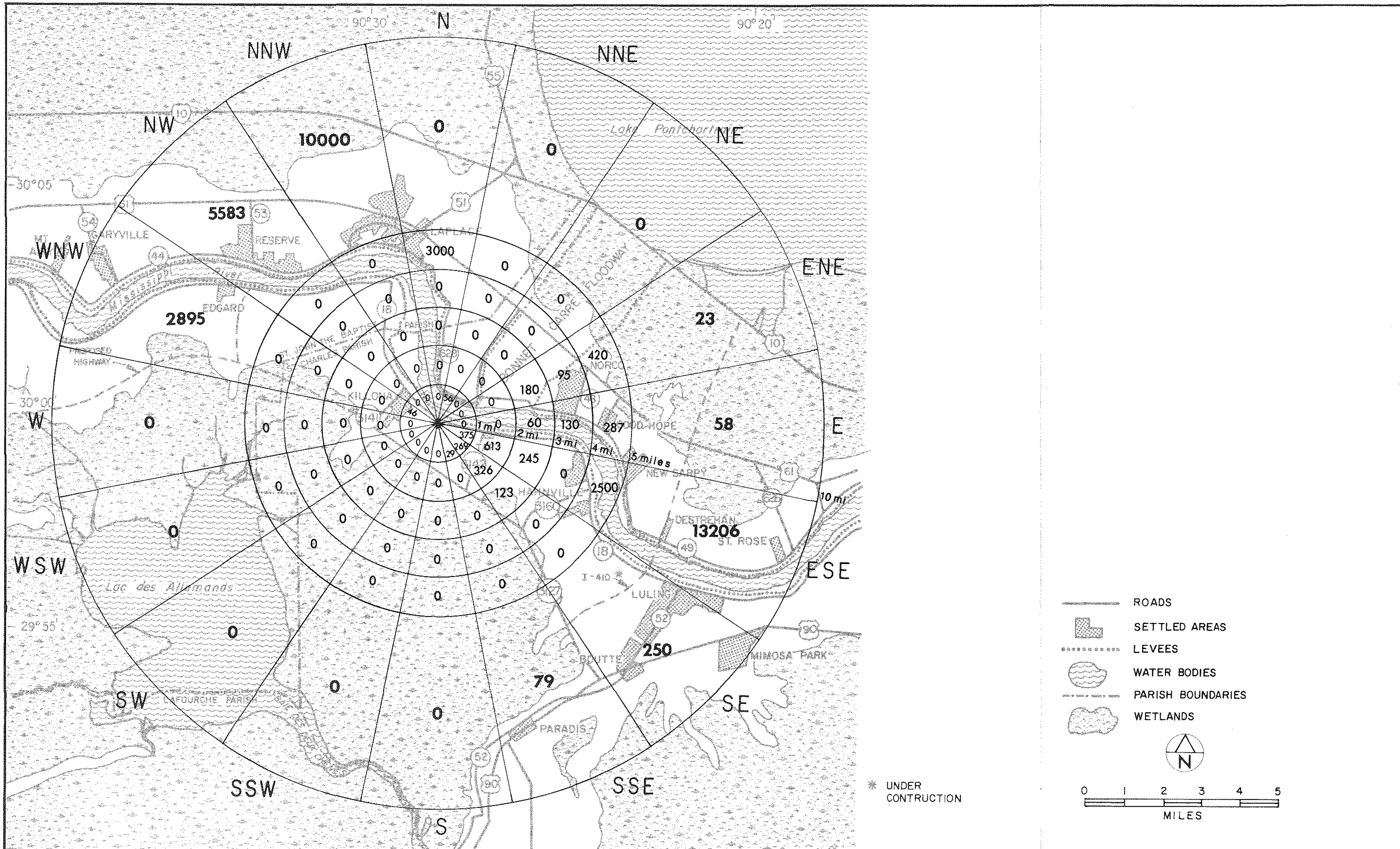
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	2020 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3	FIGURE 2.1-7 SHEET 7 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2030 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

FIGURE 2.1-7
SHEET 8 of 8

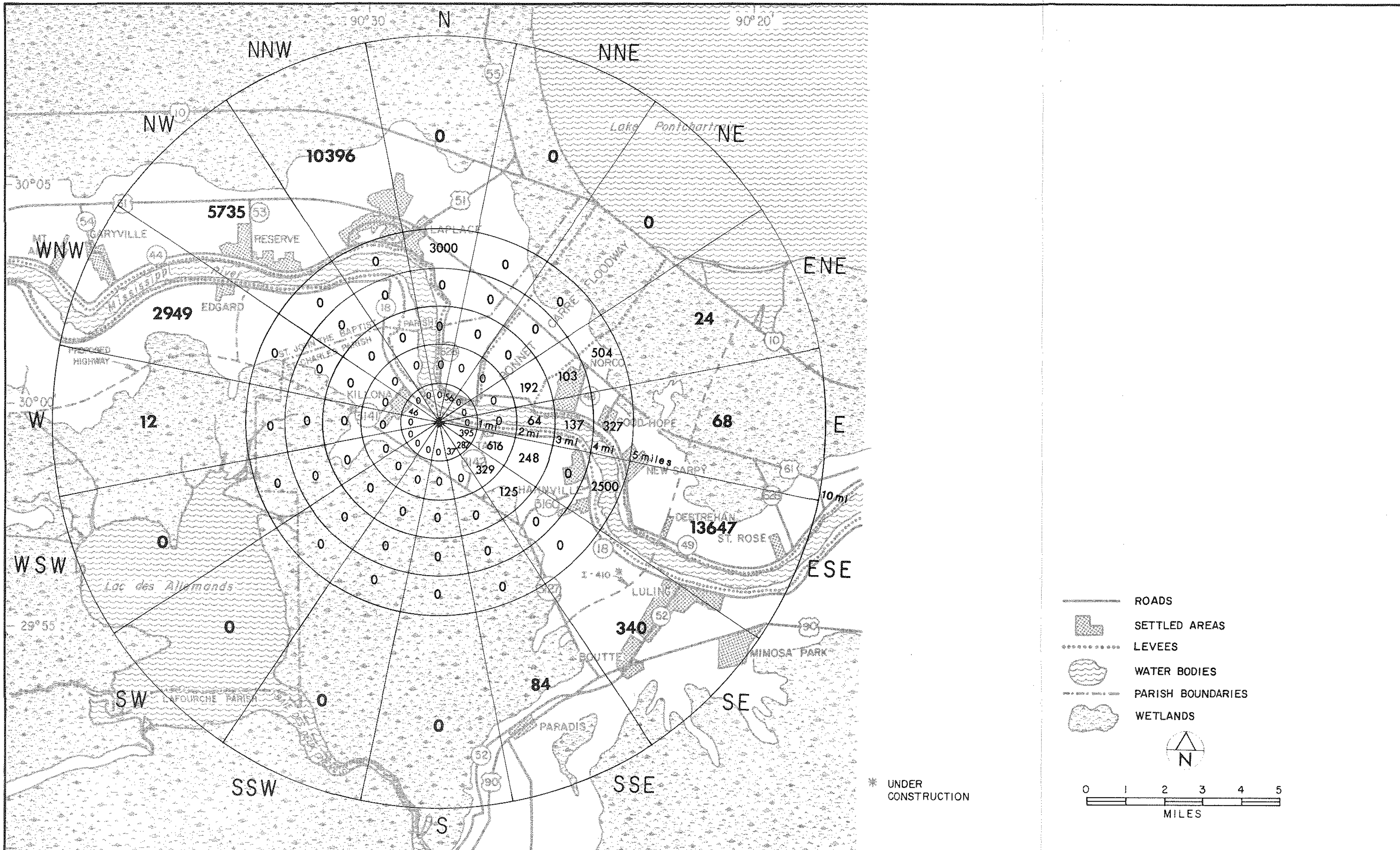


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

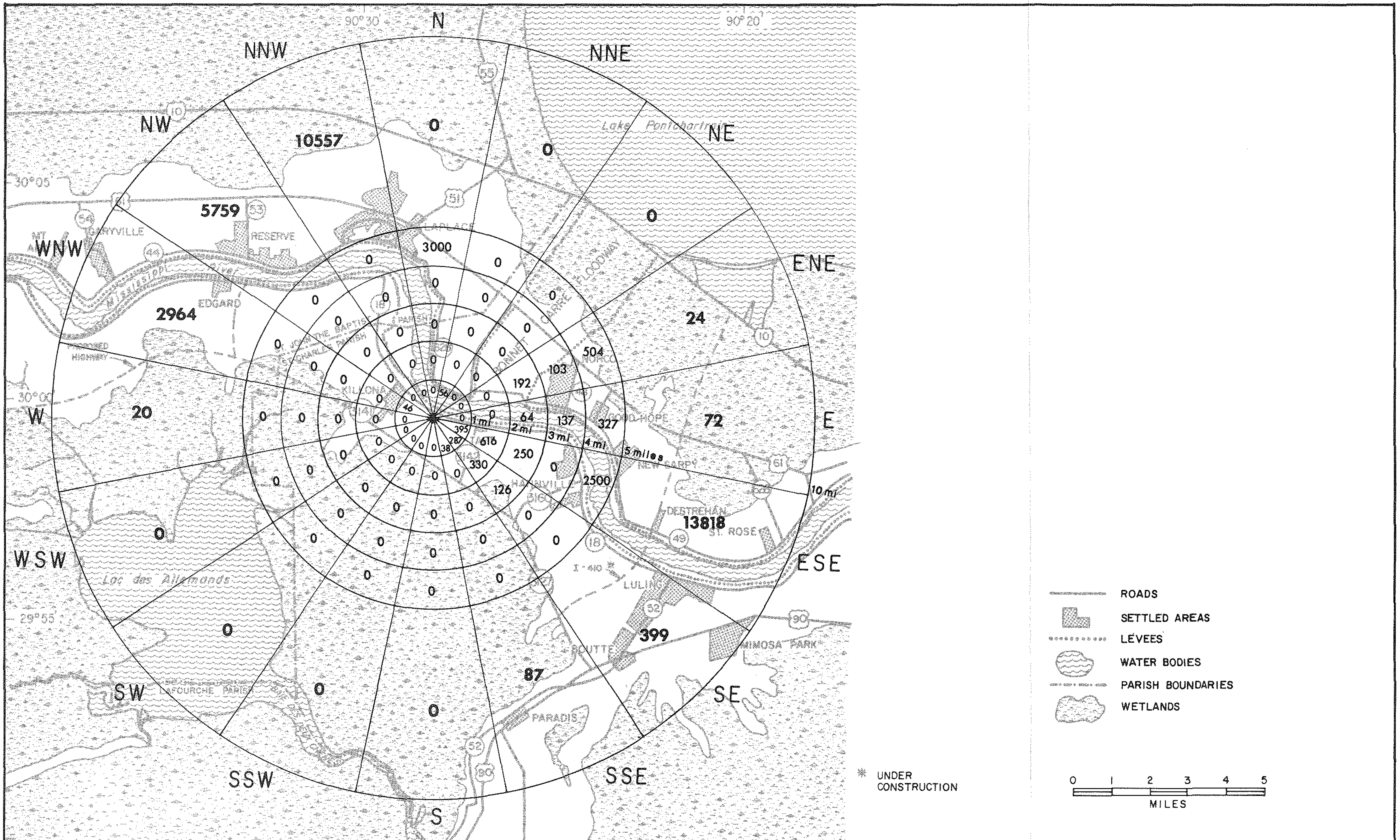
1977 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-8

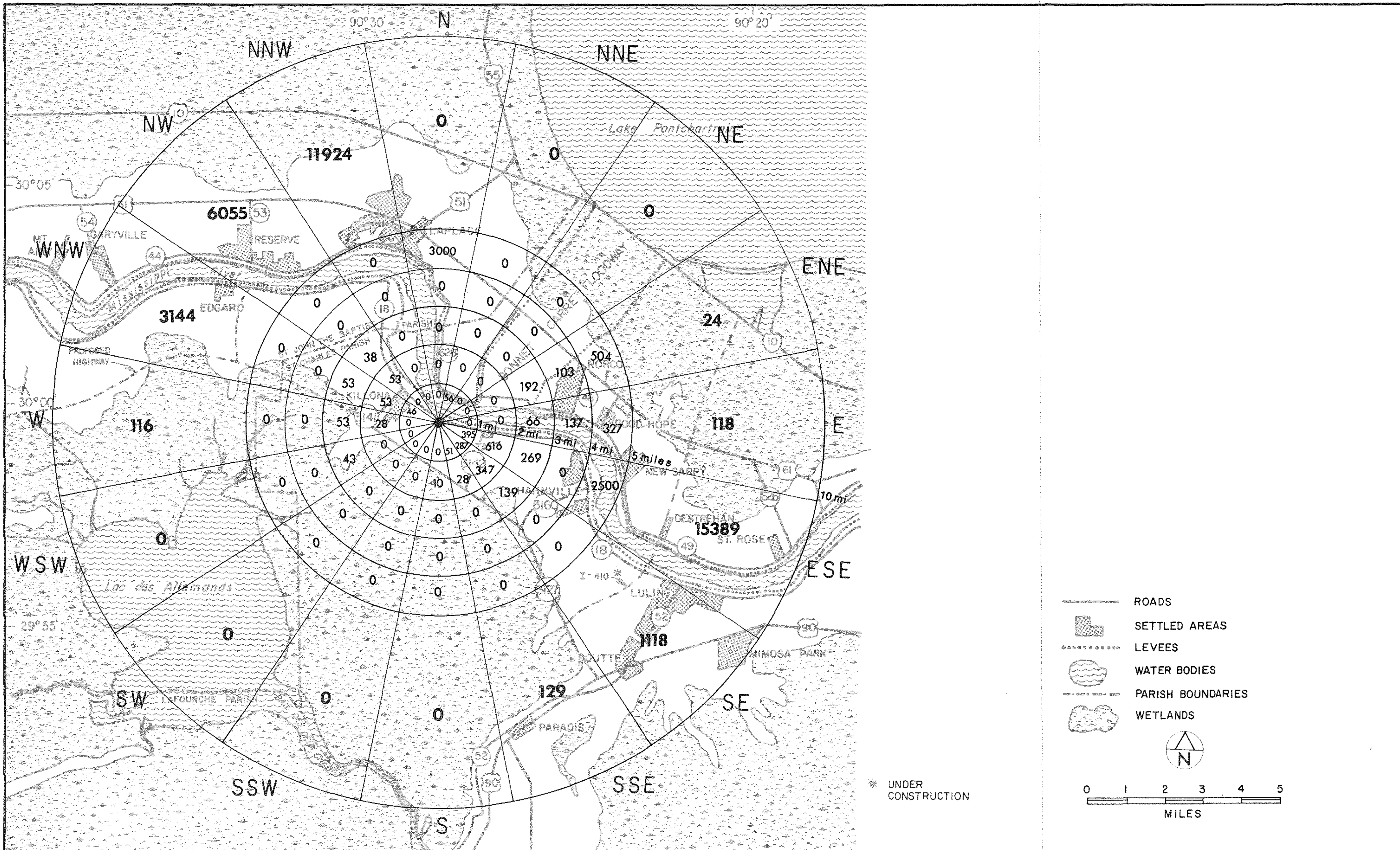
SHEET 1 of 8



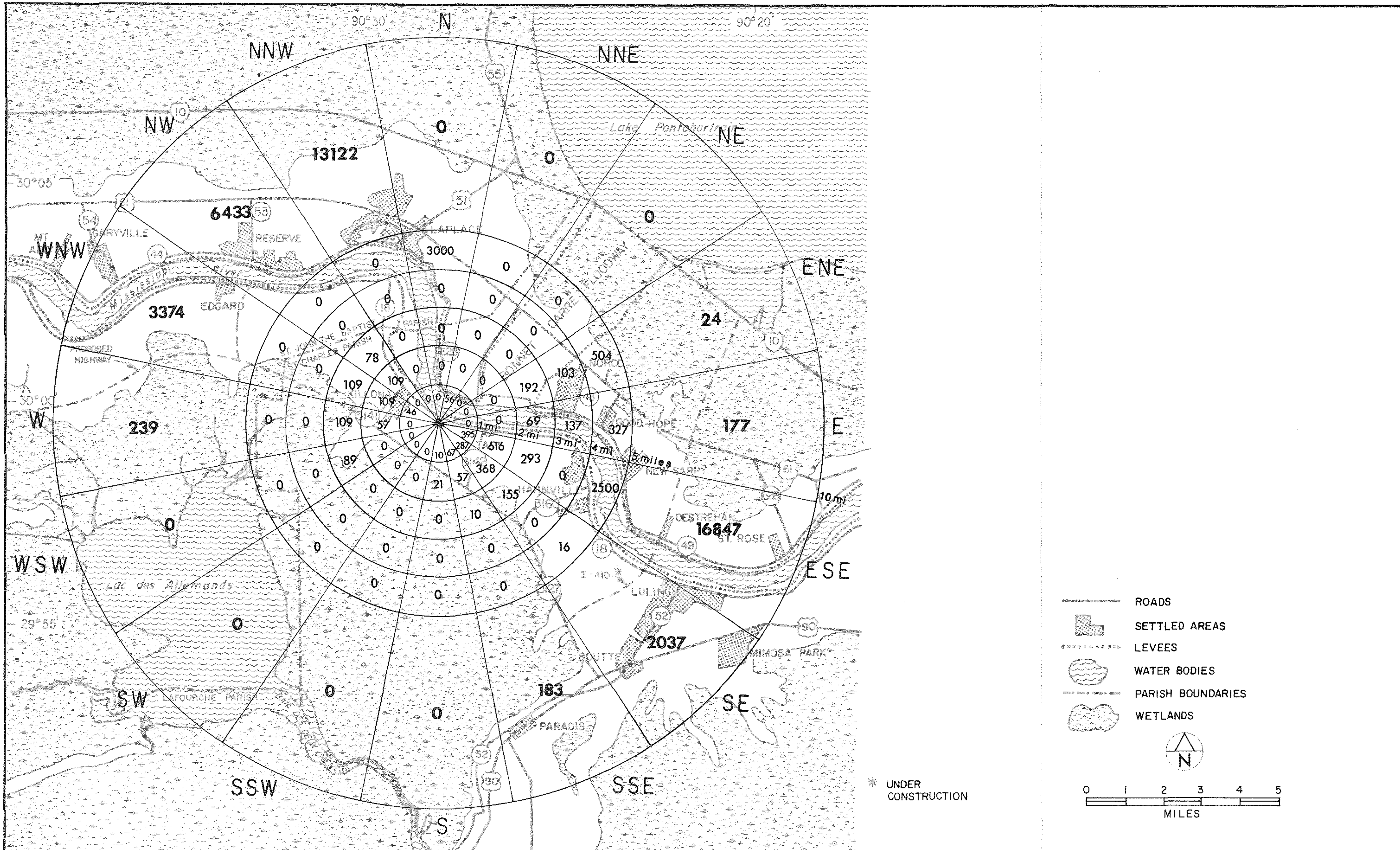
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	1980 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-8 SHEET 2 of 8



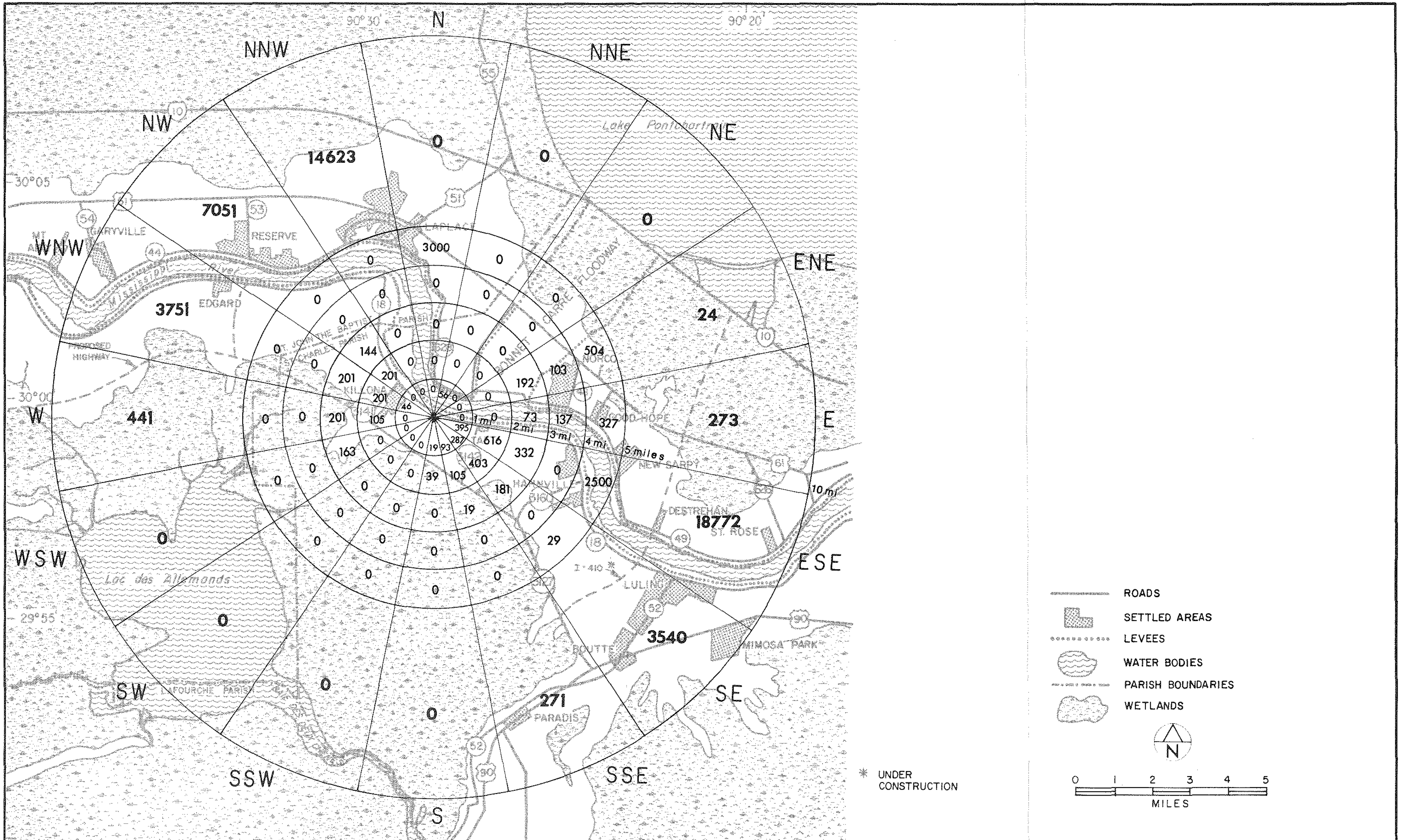
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	1981 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1 - 8 SHEET 3 of 8



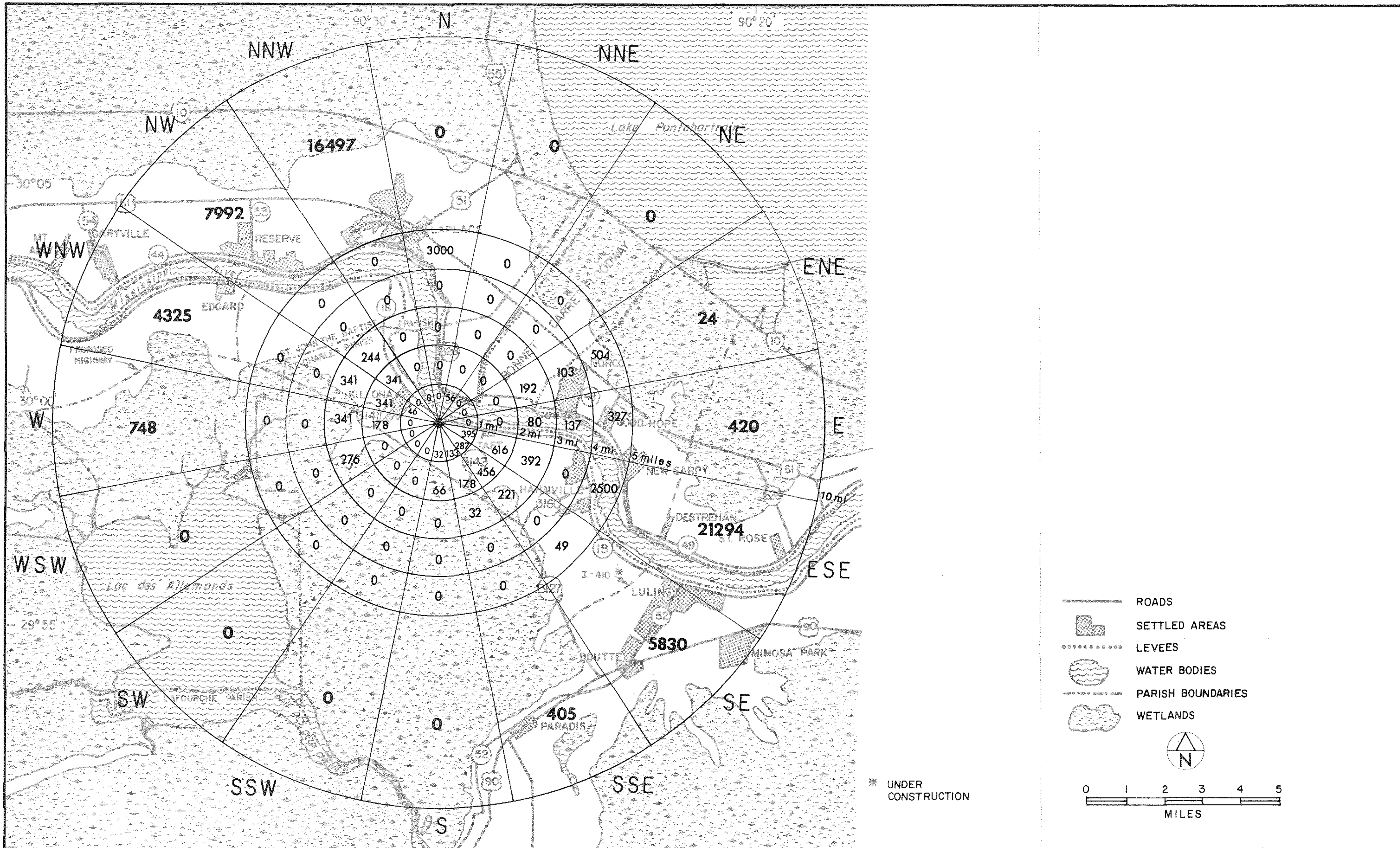
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	1990 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-8 SHEET 4 of 8



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	2000 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-8 SHEET 5 of 8



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	2010 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-8 SHEET 6 of 8

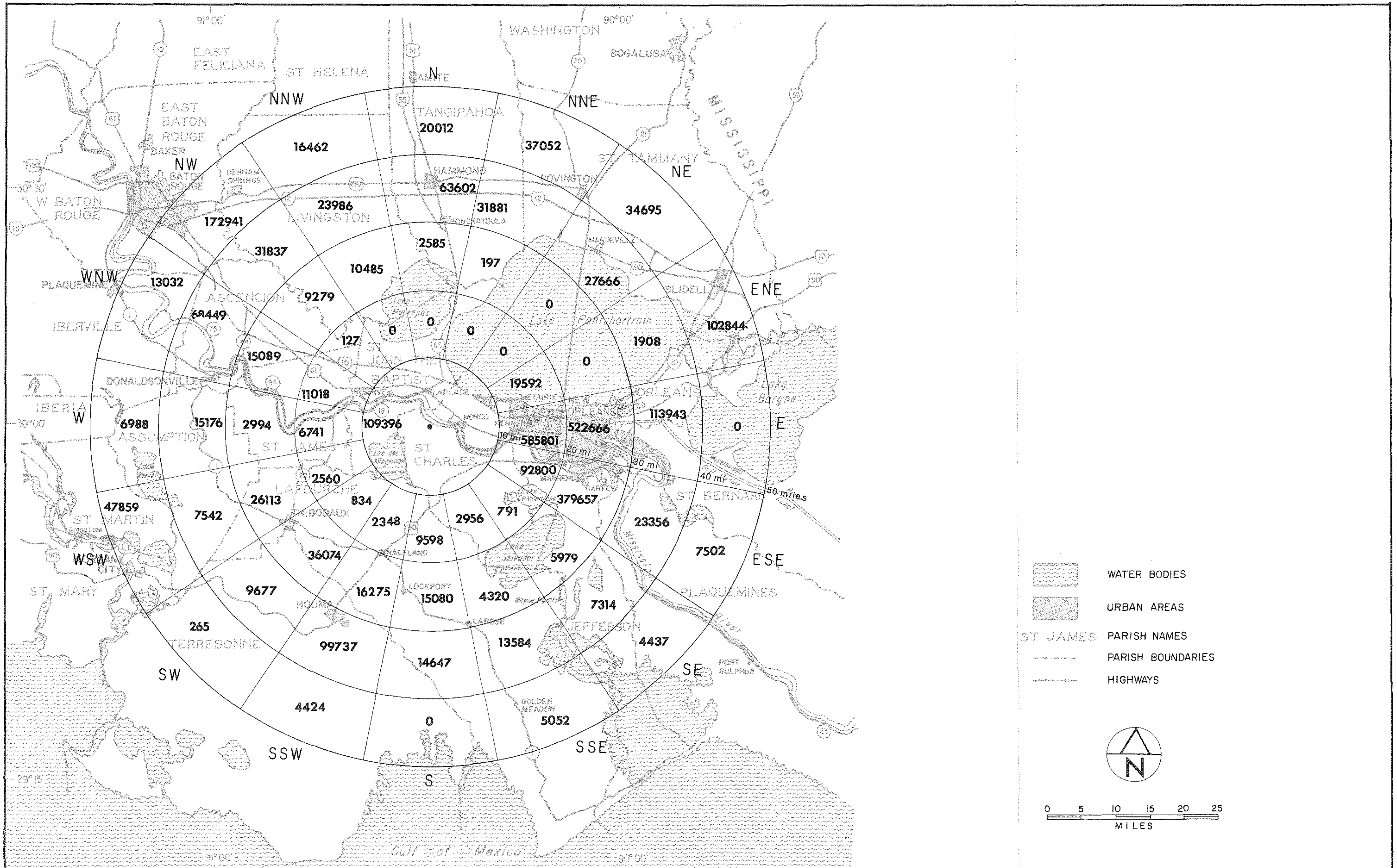


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2020 TRANSIENT POPULATION WITHIN 10 MILES OF WATERFORD 3

FIGURE 2.1-8

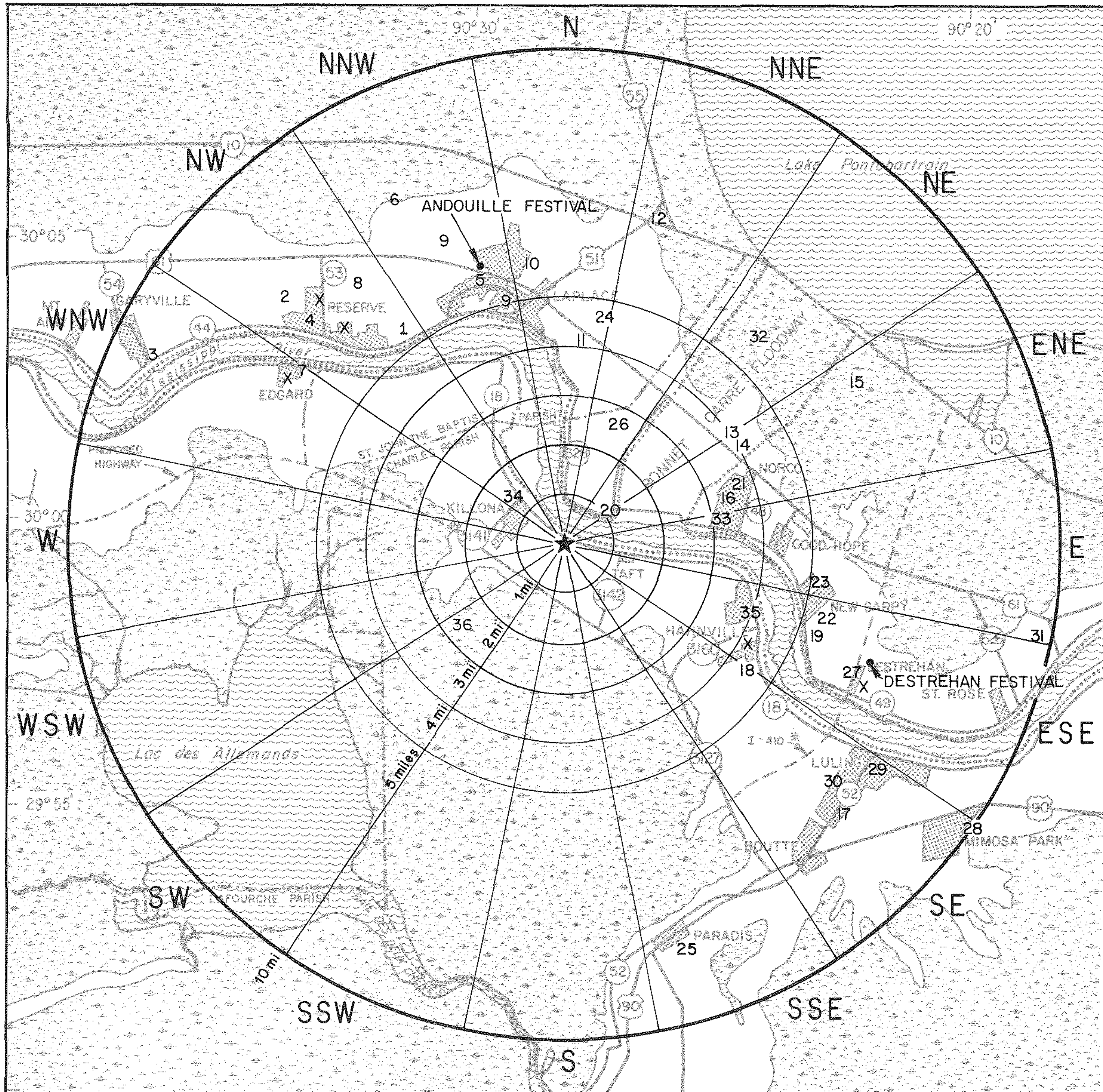
SHEET 7 of 8



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

2030 RESIDENT POPULATION WITHIN 50 MILES OF WATERFORD 3

FIGURE 2.1-7
SHEET 8 of 8



RECREATIONAL FACILITIES WITHIN 10 MILES OF WATERFORD 3.

1 GODCHAUX HENDERSON SWIMMING POOL
2 SAN FRANCISCO ANTE BELLUM HOUSE
3 GARYVILLE LIONS STADIUM
4 RESERVE RECREATION CENTER
5 LAPLACE RECREATION CENTER
6 RIVERLANDS COUNTRY CLUB
7 EDGARD RECREATION CENTER
8 STAR TERRE CIVIC ORGANIZATION
9 DRAG STRIP
10 RIVERLAND HEIGHTS POOL
11 LAPLACE TRAILER PARK AND CAMPGROUND
12 LAPLACE BOAT RAMP
13 ST. CHARLES PARISH BOATING CLUB
14 NORCO BOATING CLUB
15 MARCH DUCK CLUB
16 SUN VILLA SWIM CLUB
17 ELLINGTON SWIM CLUB
18 FASHION GOLF AND COUNTRY CLUB
19 NEW SARPY PARK
20 MONTZ PARK
21 NORCO WOMEN'S PLAYGROUND
22 HILL HEIGHTS COUNTRY CLUB
23 NEW SARPY ASSOC. PLAYGROUND
24 STOCK CAR TRACK
25 PARADIS NATURE STUDY TRAIL
26 SUGARLAND BEAGLE CLUB
27 DESTRAHAN MANOR
28 MIMOSA SWIM CLUB
29 MONSANTO PARK
30 LULING TRAILRIDES
31 LEON ROBERTS RIDING STABLE
32 BONNET CARRE WILDLIFE MGT. AREA
33 BETHUNE PLAYGROUND
34 KILLONA PLAYGROUND
35 HOLY ROSARY PLAYGROUND
36 SEVERAL SMALL HUNTING CLUBS ARE LOCATED IN THIS AREA

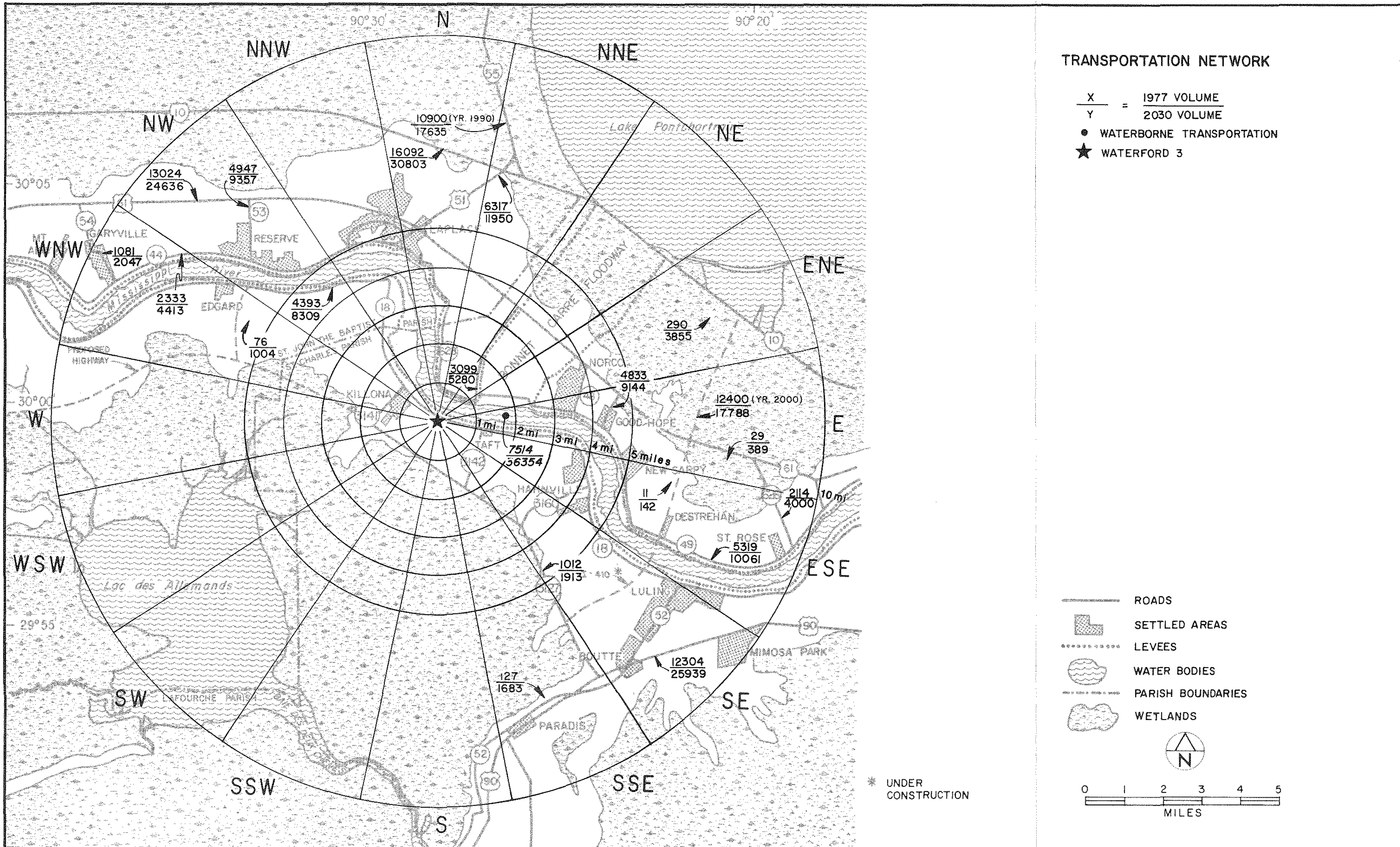
X H.S. FOOTBALL FIELDS
★ WATERFORD 3

ROADS
SETTLED AREAS
LEVEES
WATER BODIES
PARISH BOUNDARIES
WETLANDS

* UNDER CONSTRUCTION

0 1 2 3 4 5
MILES

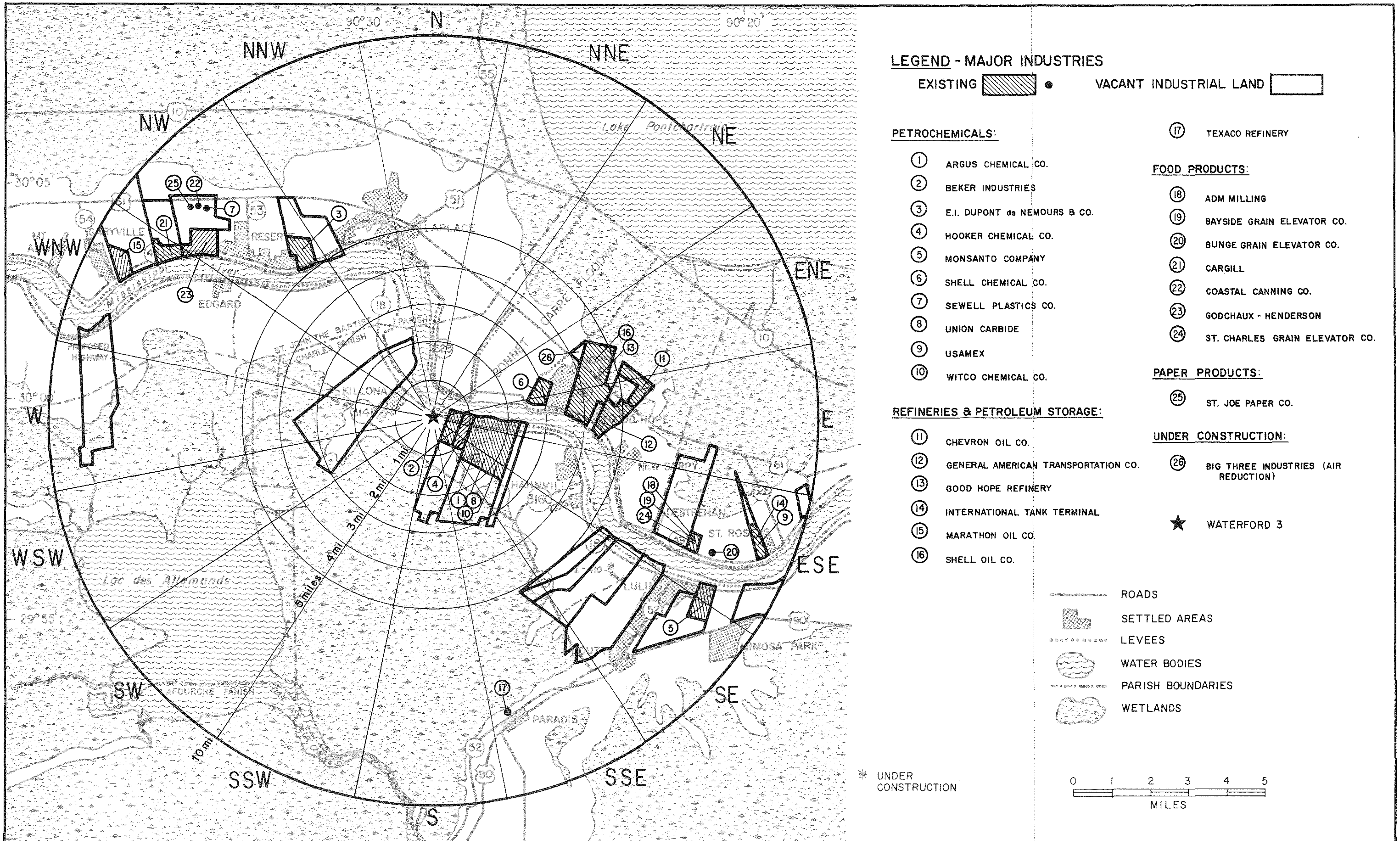
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	RECREATIONAL FACILITIES WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1 - 9



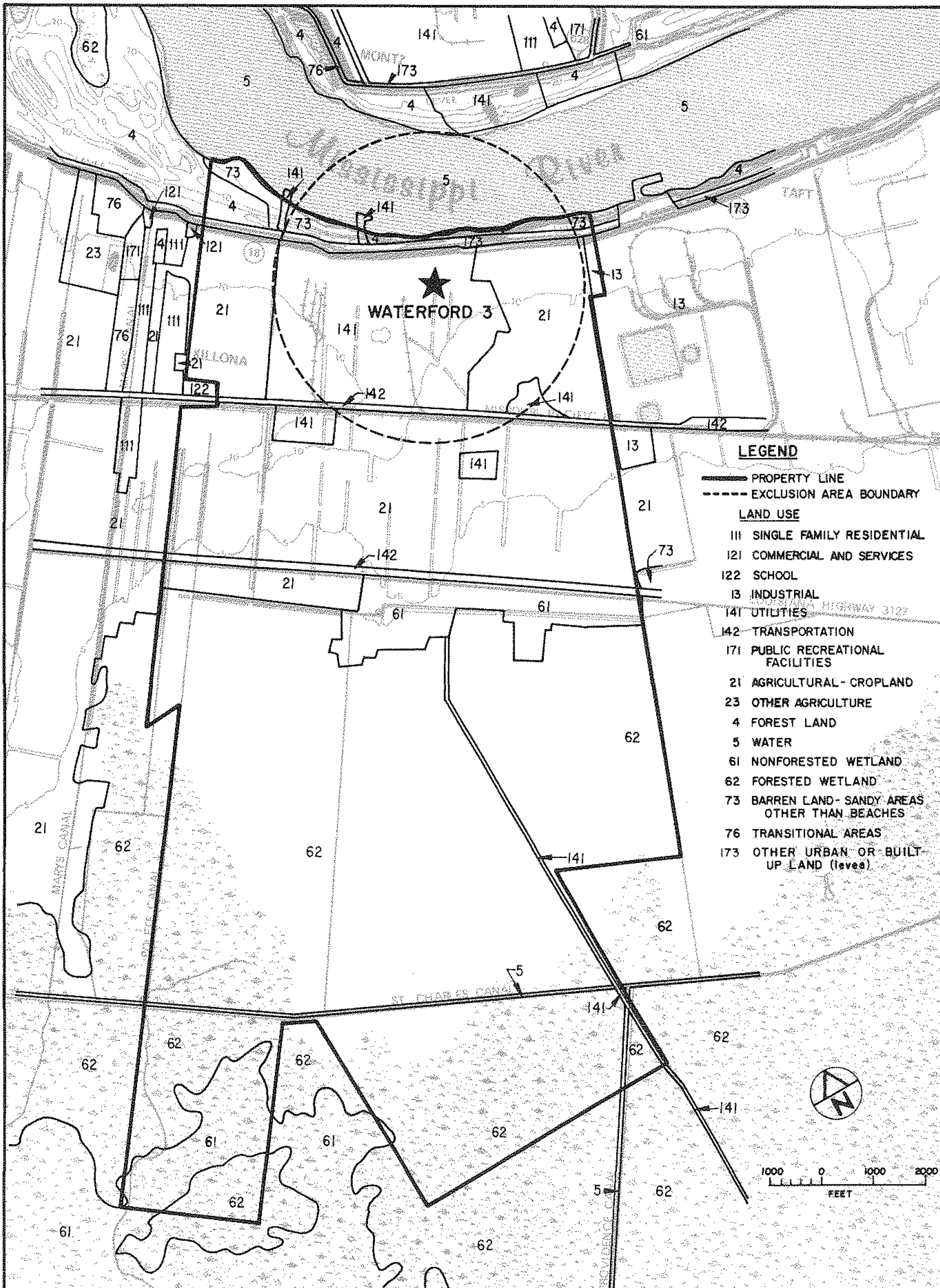
LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

TRANSPORTATION NETWORK WITHIN 10 MILES OF WATERFORD 3

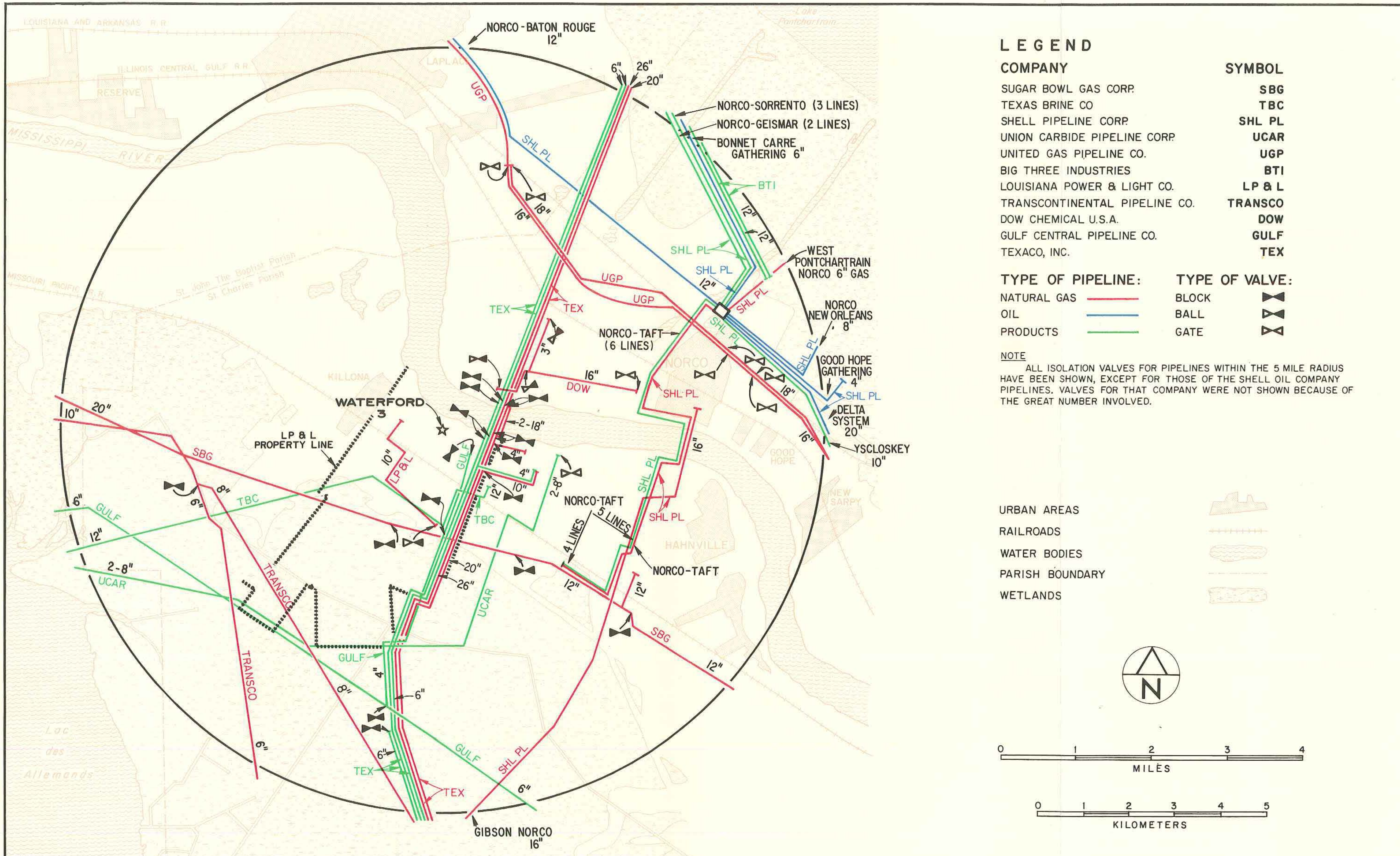
FIGURE 2.1-10



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	MAJOR INDUSTRIAL PROPERTIES WITHIN 10 MILES OF WATERFORD 3	FIGURE 2.1-11



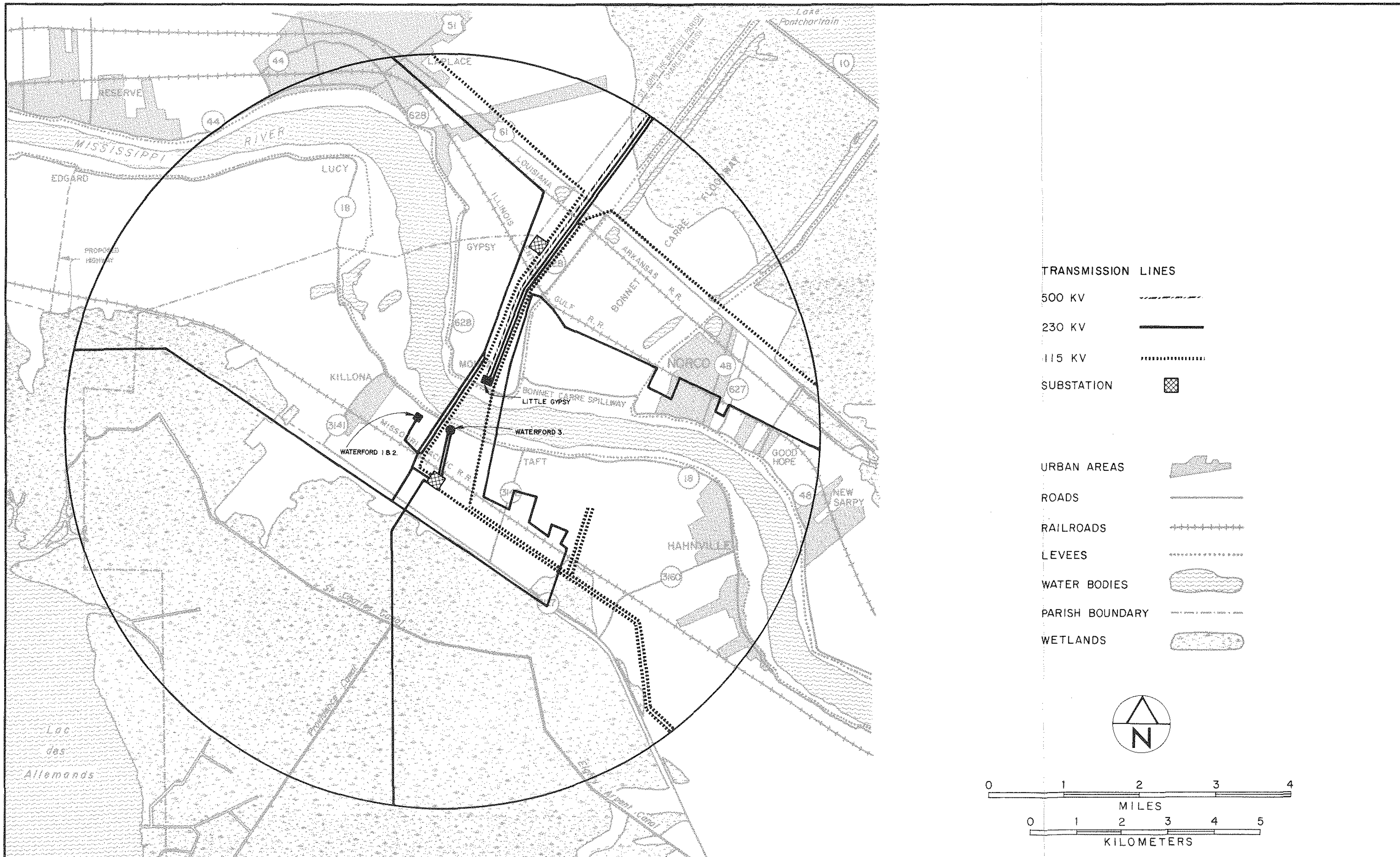
LOUISIANA POWER & LIGHT Co. Waterford Steam Electric Station	LAND USES IN THE VICINITY OF THE APPLICANT'S PROPERTY	FIGURE 2.1-12



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

MAJOR PIPELINES WITHIN 5 MILES OF WATERFORD 3

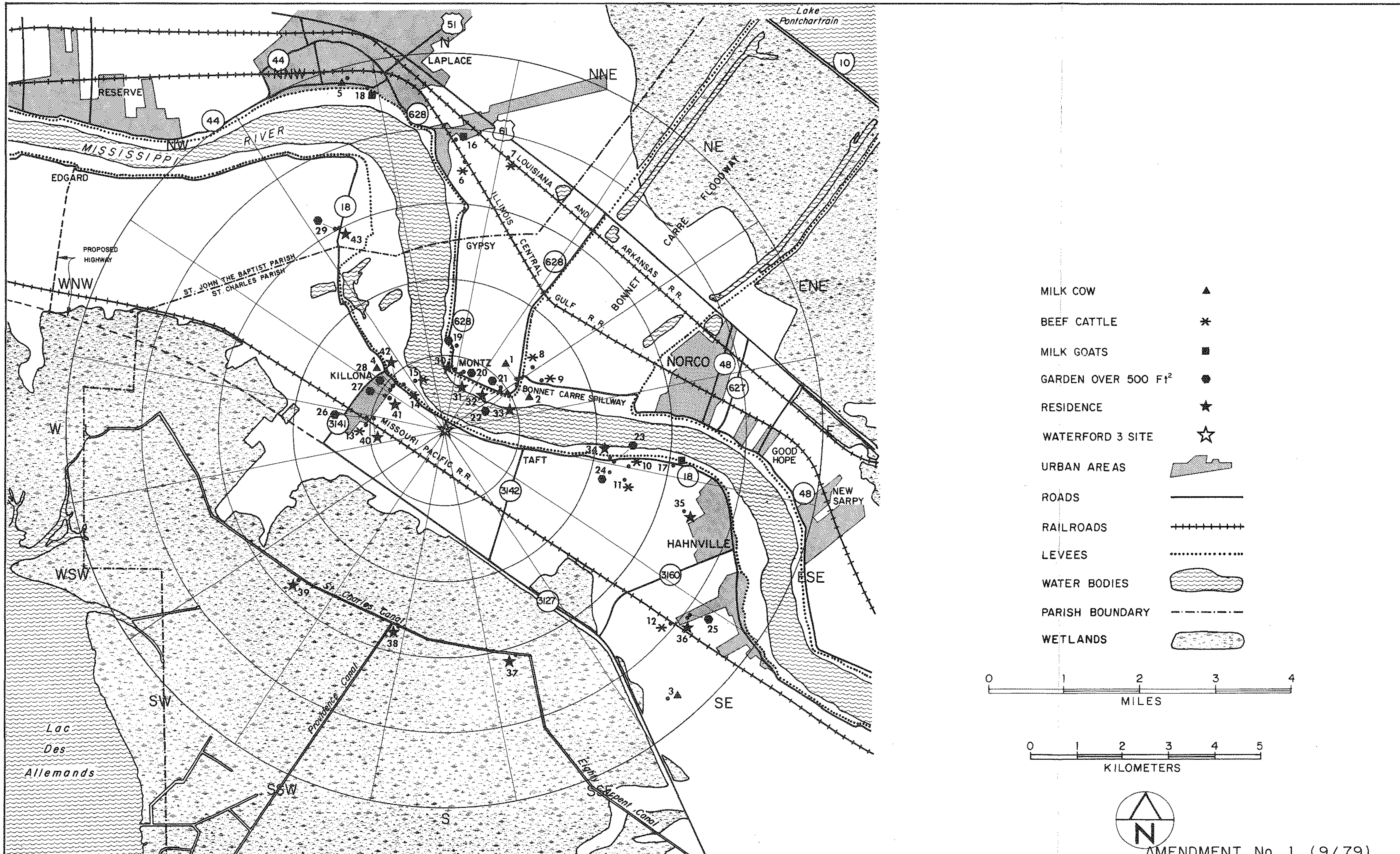
FIGURE 2.1-13



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

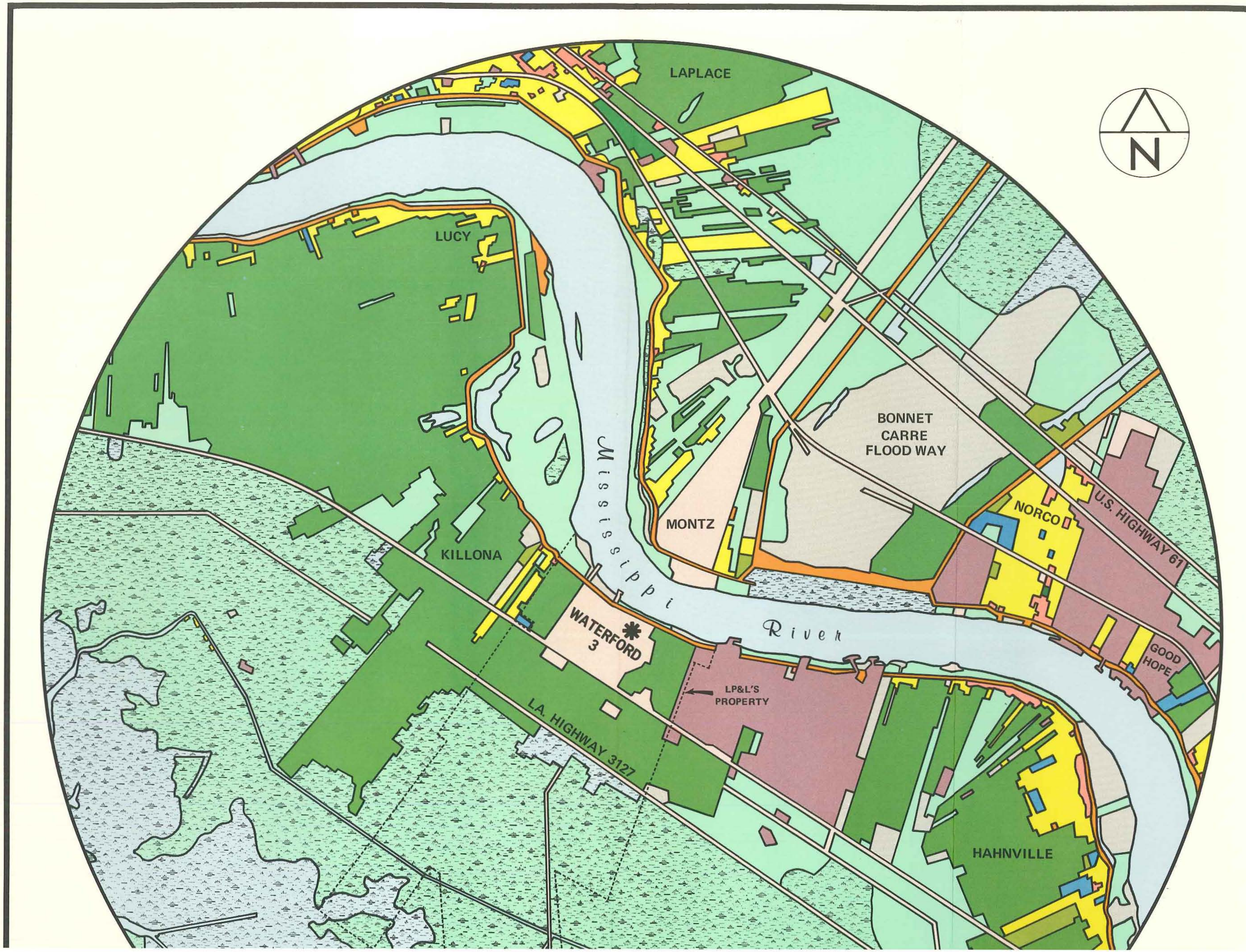
TRANSMISSION LINES WITHIN 5 MILES OF WATERFORD 3

FIGURE 2.1-14

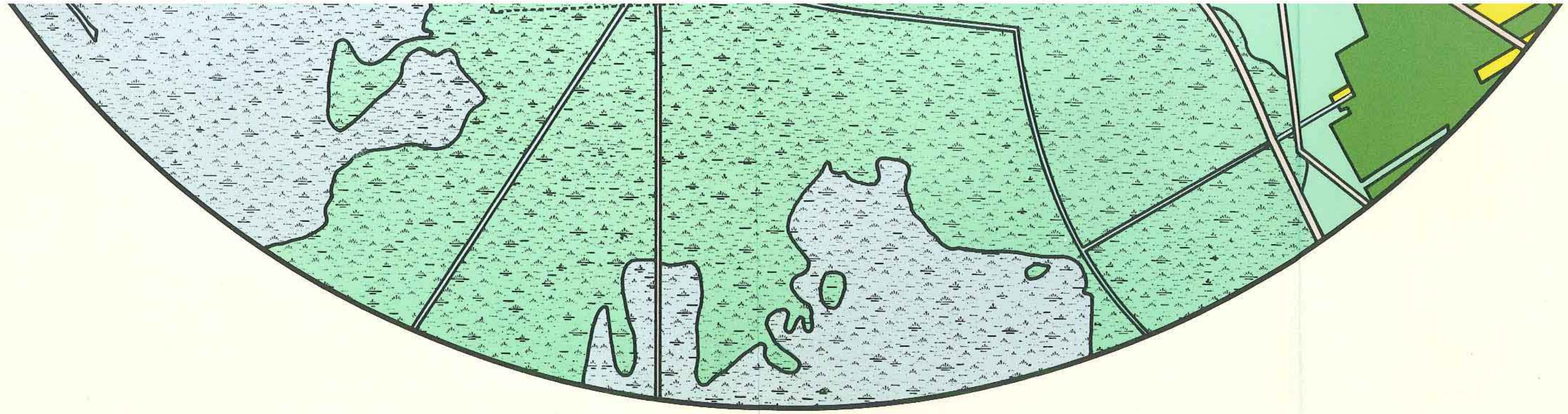


AMENDMENT No. 1 (9/79)

LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	NEAREST LOCATION OF THE FIVE PARAMETERS WITHIN 5 MILES OF WATERFORD 3	FIGURE 2.1-15



LAPLACE
LUCY
MONTZ
BONNET
CARRE
FLOOD WAY
NORCO
U.S. HIGHWAY 61
Mississippi
River
KILLONA
WATERFORD
3
GOOD
HOPE
LP&L'S
PROPERTY
LA. HIGHWAY 3127
HAHNVILLE
N



LEGEND – LAND USE CLASSIFICATION

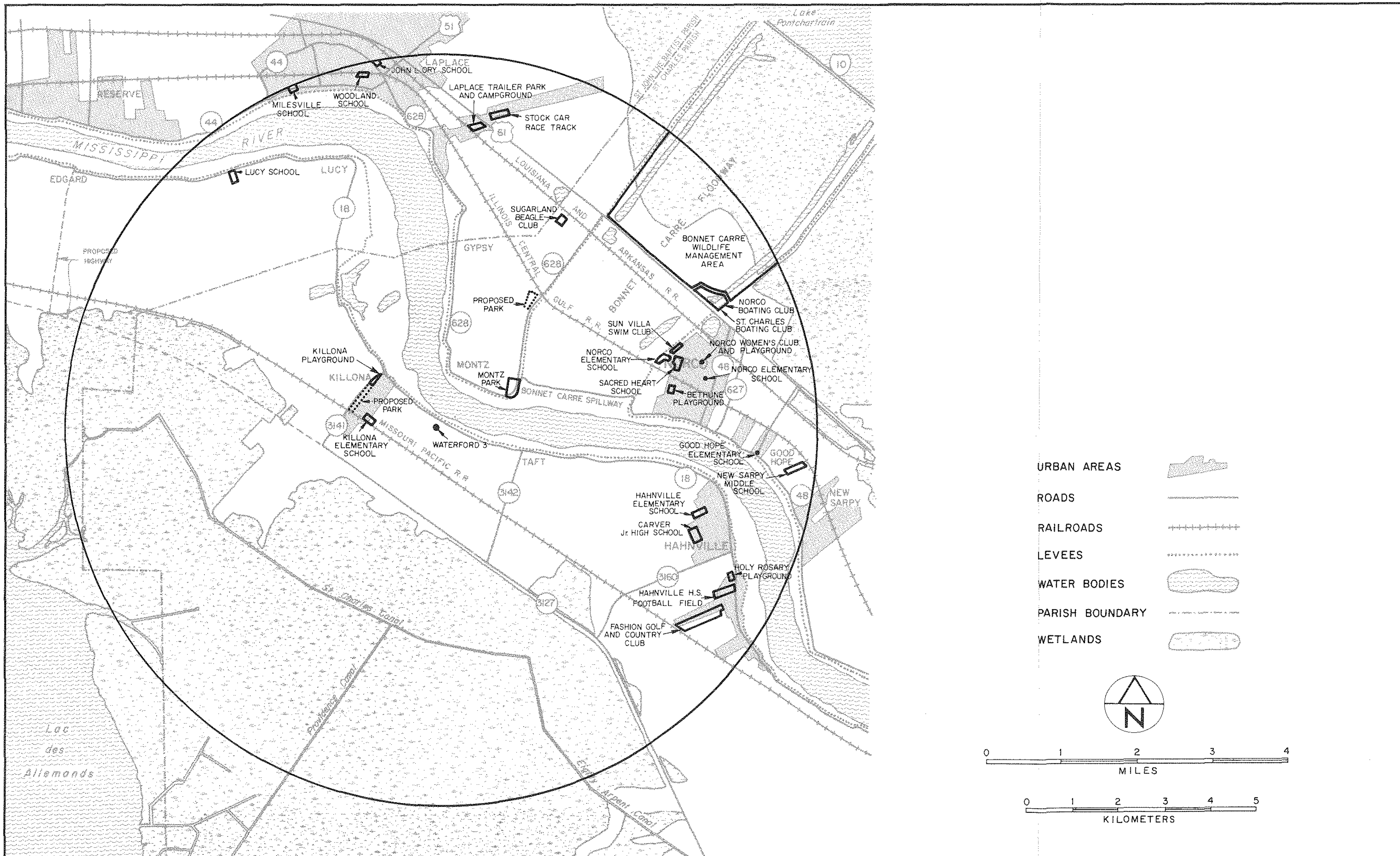
- RESIDENTIAL (11)*
- COMMERCIAL AND SERVICES (121) AND MIXED URBAN OR BUILT-UP LAND (16)
- SCHOOLS (122) AND OTHER INSTITUTIONAL (123)
- INDUSTRIAL (13)
- TRANSPORTATION, COMMUNICATION, AND UTILITIES (14)
- RECREATION FACILITIES (171, 172)
- OTHER URBAN OR BUILT-UP LAND (173)
- AGRICULTURAL LAND (2)
- FOREST LAND (4)
- WATER (5)
- NONFORESTED WETLAND (61)
- FORESTED WETLAND (62)
- BARREN LAND (7)

*NUMBERS REFER TO LAND USE CLASSIFICATIONS SHOWN ON TABLE 2.1-18

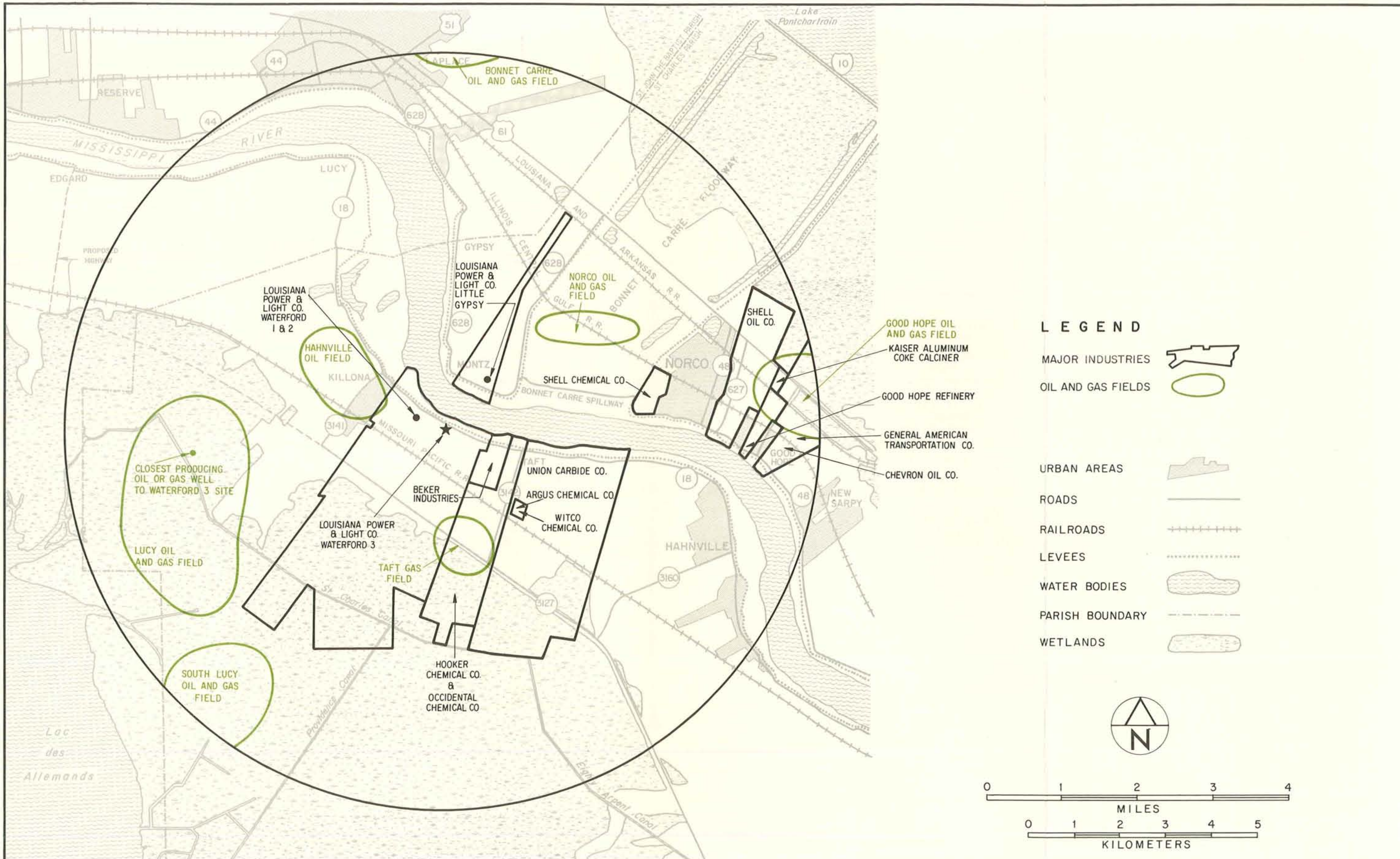
0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000

SCALE (FT)

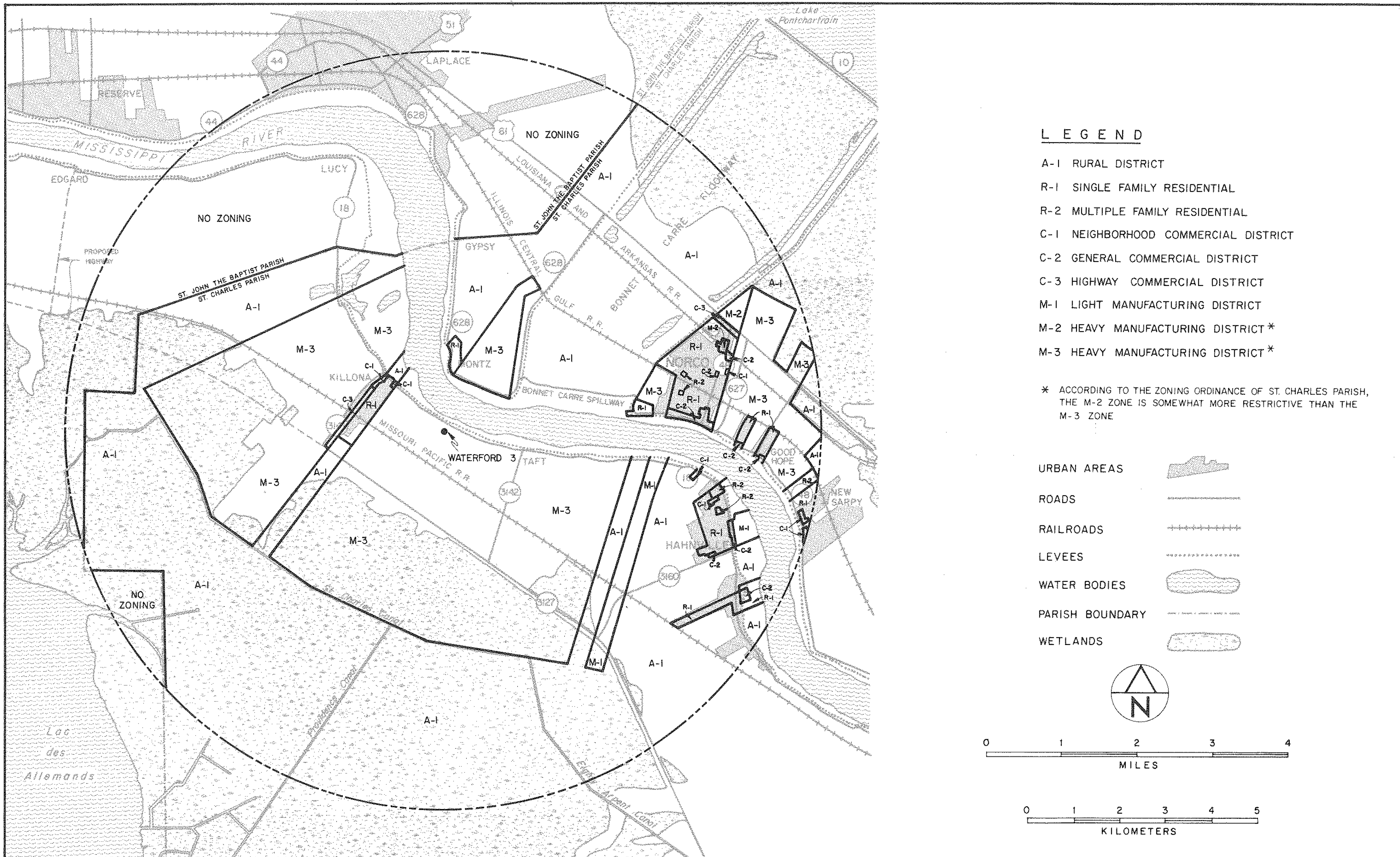
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	LAND USE WITHIN 5 MILES OF WATERFORD 3	Figure 2.1-16



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	SCHOOLS AND RECREATION AREAS WITHIN 5 MILES OF WATERFORD 3	FIGURE 2.1 - 17



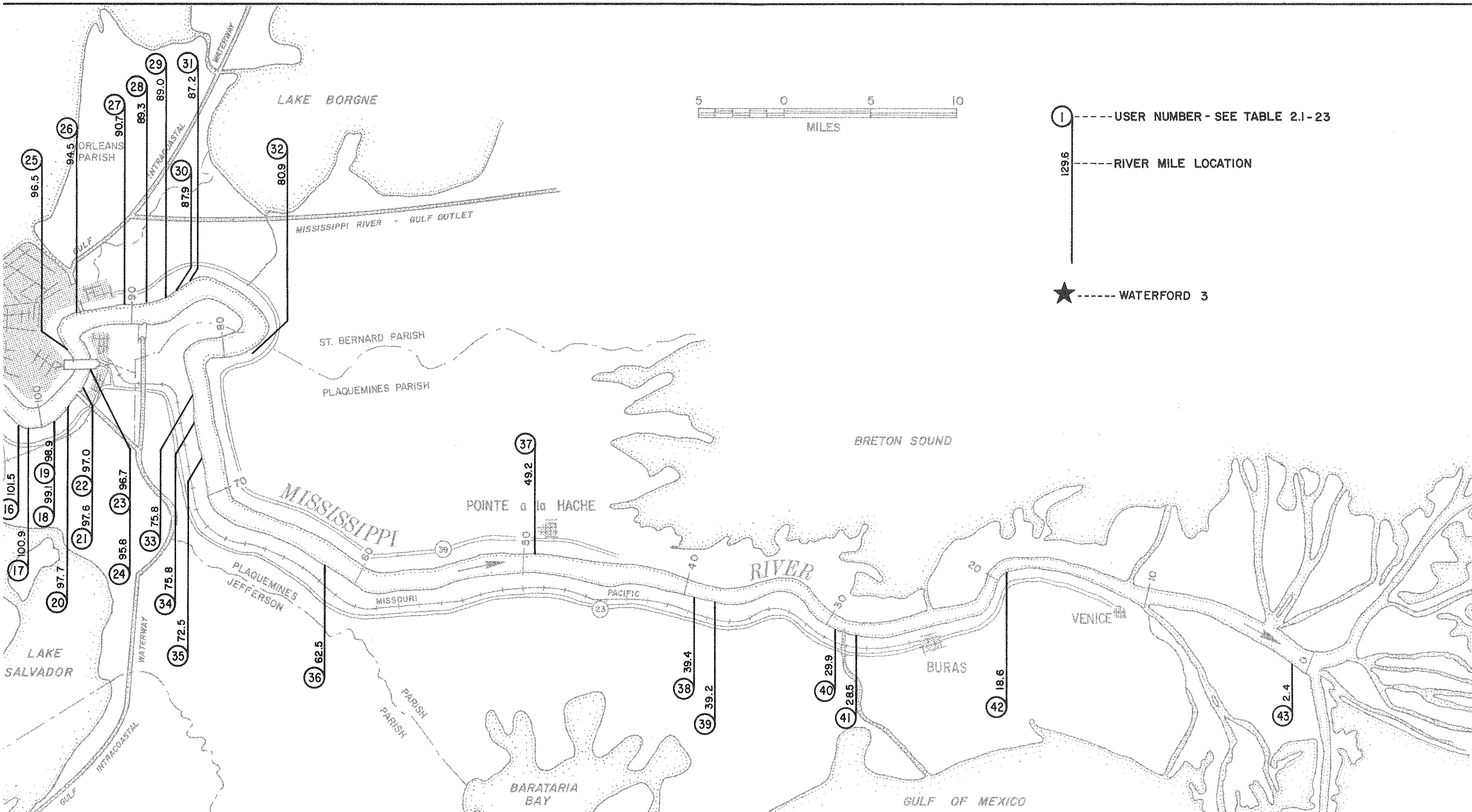
LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	MAJOR INDUSTRIES AND OIL AND GAS FIELDS WITHIN 5 MILES OF WATERFORD 3	FIGURE 2.1 - 18



LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

ZONING DISTRICTS WITHIN 5 MILES OF WATERFORD 3

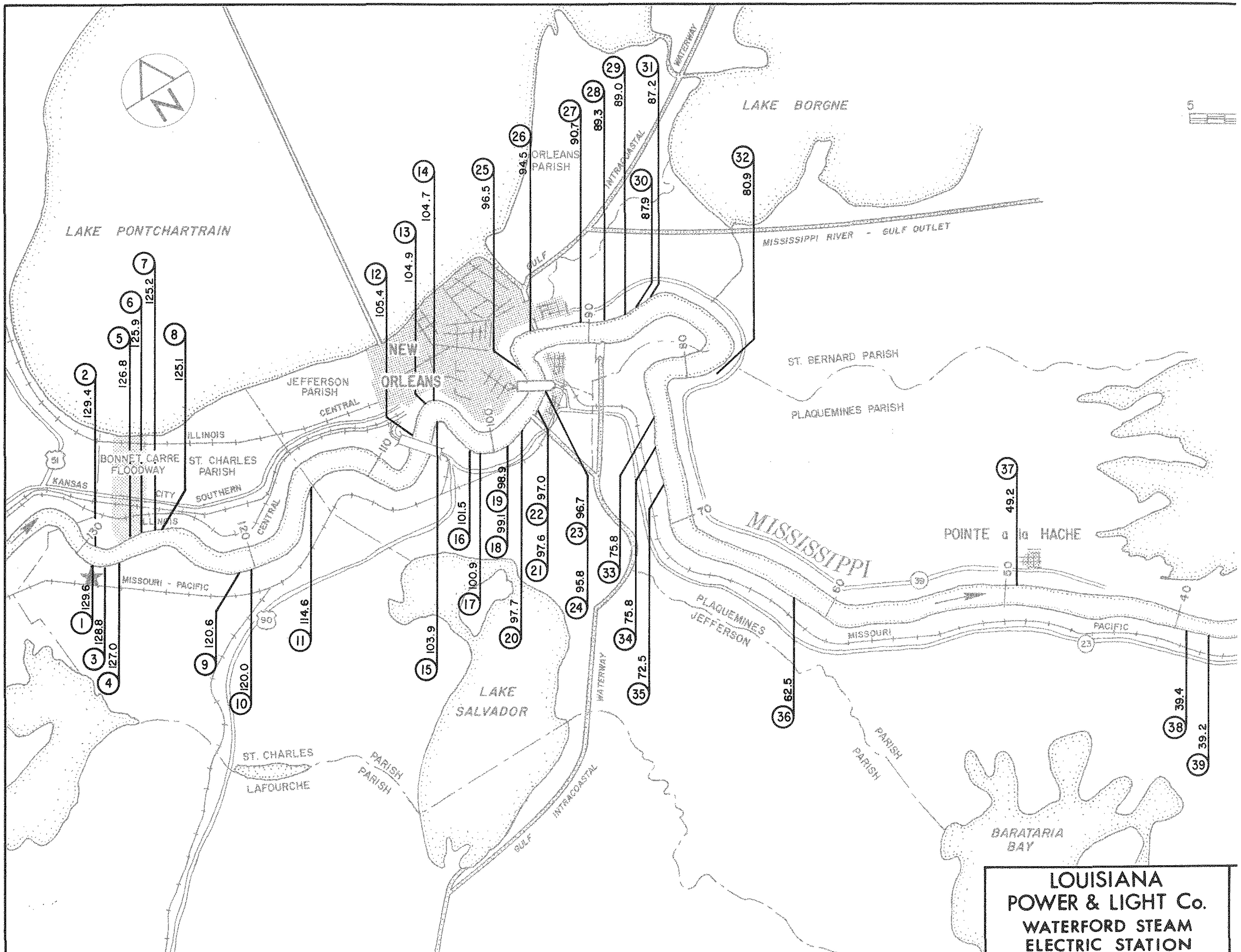
FIGURE 2.1 - 19

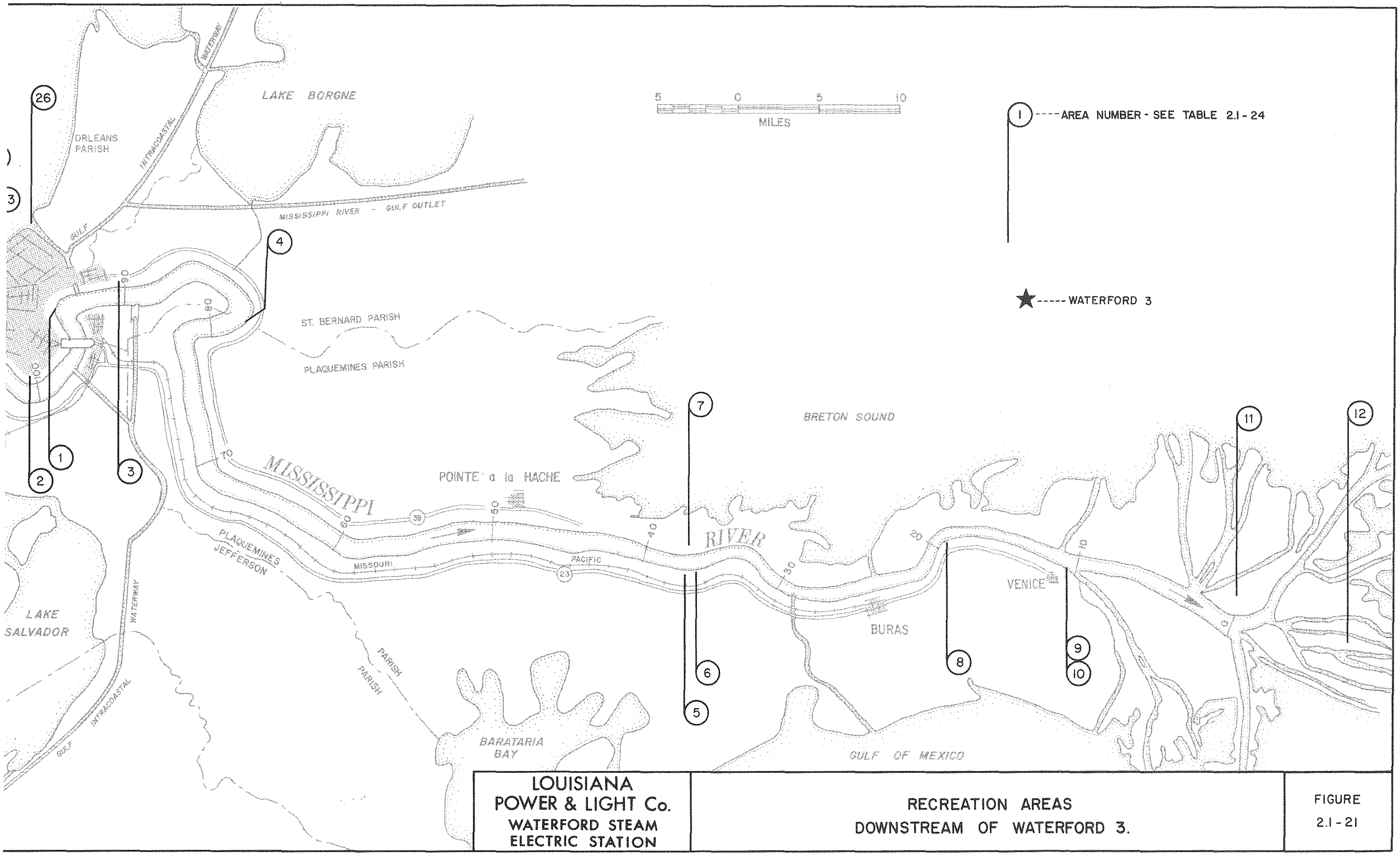


LOUISIANA POWER & LIGHT Co.
WATERFORD STEAM ELECTRIC STATION

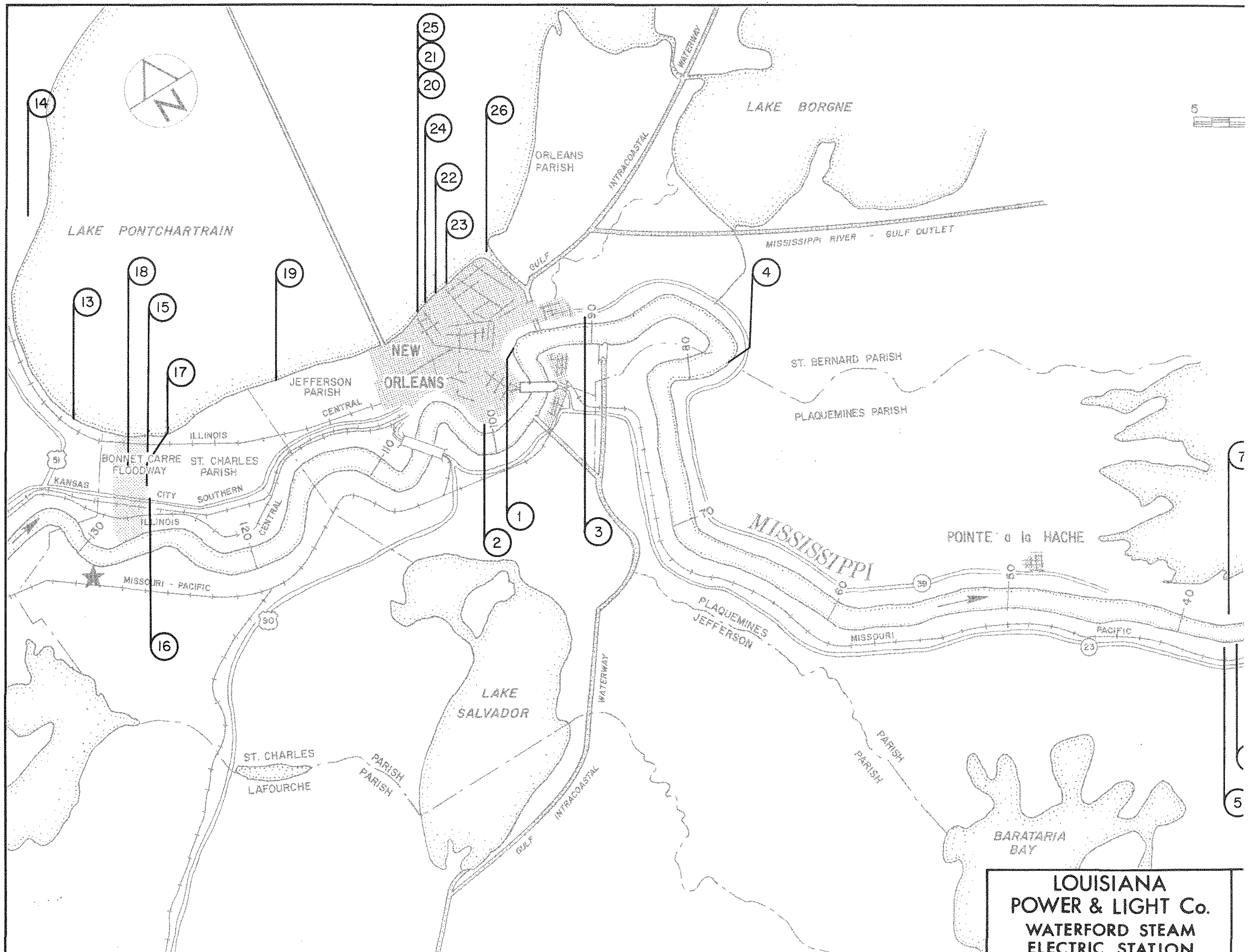
MUNICIPAL AND INDUSTRIAL SURFACE WATER USERS DOWNSTREAM OF WATERFORD 3.

FIGURE 2.1-20


LAKE PONTCHARTRAIN
LAKE BORGNE
LAKE SALVADOR
BARATARIA BAY
NEW ORLEANS
ORLEANS PARISH
JEFFERSON PARISH
ST. CHARLES PARISH
ST. BERNARD PARISH
PLAQUEMINES PARISH
BONNET CARRE FLOODWAY
POINTE a la HACHE
MISSISSIPPI
MISSISSIPPI RIVER - GULF OUTLET
GULF INTRACOASTAL WATERWAY
ILLINOIS CENTRAL
KANSAS CITY SOUTHERN
MISSOURI - PACIFIC
ST. CHARLES PARISH
LAFOURCHE PARISH
PLAQUEMINES PARISH
JEFFERSON PARISH
1 129.6
2 129.4
3 128.8
4 127.0
5 126.8
6 125.9
7 125.2
8 125.1
9 120.6
10 120.0
11 114.6
12 105.4
13 104.9
14 104.7
15 103.9
16 101.5
17 100.9
18 99.1
19 98.9
20 97.7
21 97.6
22 97.0
23 96.7
24 95.8
25 96.5
26 94.5
27 90.7
28 89.3
29 89.0
30 87.9
31 87.2
32 80.9
33 75.8
34 75.8
35 72.5
36 62.5
37 49.2
38 39.4
39 39.2
LOUISIANA
POWER & LIGHT Co.
WATERFORD STEAM
ELECTRIC STATION



LOUISIANA POWER & LIGHT Co. WATERFORD STEAM ELECTRIC STATION	RECREATION AREAS DOWNSTREAM OF WATERFORD 3.	FIGURE 2.1-21


LAKE PONTCHARTRAIN
LAKE BORGNE
ORLEANS PARISH
INTRACOASTAL
WATERWAY
GULF
MISSISSIPPI RIVER - GULF OUTLET
NEW ORLEANS
JEFFERSON PARISH
ST. BERNARD PARISH
PLAQUEMINES PARISH
BONNET CARRE FLOODWAY
ST. CHARLES PARISH
ILLINOIS
CENTRAL
KANSAS
CITY
SOUTHERN
MISSOURI - PACIFIC
MISSISSIPPI
POINTE a la HACHE
PLAQUEMINES
JEFFERSON
LAKE SALVADOR
ST. CHARLES
LAFOURCHE
PARISH
BARATARIA BAY
LOUISIANA
POWER & LIGHT Co.
WATERFORD STEAM
ELECTRIC STATION

2.2 ECOLOGY

2.2.1 TERRESTRIAL ECOLOGY

2.2.1.1 Site Description

2.2.1.1.1 Soils

The Waterford 3 site consists of several distinct soils environments-batture, artificial levee, natural levee, swamp, and marsh. A discussion of these soils in the Waterford 3 area is presented in Section 2.5.2.

The batture is the area between the Mississippi River and the artificial levee. The artificial levee was built to protect the natural levee from flooding.

2.2.1.1.2 Distribution of Principal Plant Communities

The distribution of the principal plant communities at the Waterford 3 site is shown in Figure 2.2-1. The most extensive communities are the cypress-gum swamp and agriculture. In the following discussion, the common names of the organisms found at the Waterford 3 site are used, and scientific names of the species present can be found in the tables presented in Appendix 2-2.

a) Agricultural Land

Historically, most agricultural land was devoted to sugar cane production, but some soybean acreage has recently been planted. Portions of this community have been cultivated for many years and are
an important habitat for mourning doves, bobwhite, rabbits, common 3
snipe, and various rodents.

b) Cypress-Gum Swamp

The cypress-gum swamp community is dominated by bald cypress and
tupelo gum, both of which are very tolerant to extended periods of
flooding. Other characteristic species include button bush and 3
duckweed. There are several reports that seeds of the bald cypress
and tupelo gum species will not germinate under water. Although the tupelo gum and bald cypress dominate in the swamp forest because other species cannot successfully compete under the extreme soil-moisture conditions, it appears that occasional drying periods are required for regeneration. The apparent absence of these two
species in the understory is indicative that this area is flooded
throughout the year. Tables A2.2.1-1 through A2.2.1-4 present 3
a listing of flaural species observed in the cypress-gum swamp
along with approximate cover classes as recorded during the Environmental Surveillance Program in 1979 and 1980.

Cypress-gum swamplands are excellent habitats for a number of small 3
passerine birds, such as Northern Parulas and Prothonotary Warblers and larger nonpasserines, such as Barred Owls, Downy Woodpeckers, Yellow-Billed Cuckoos, and Wood Ducks. Mammals such as swamp rabbits,

raccoons, white-tailed deer, nutria, mink, and muskrat frequent this habitat type.

c) Batture, Wax Myrtle, and Marsh Communities

The batture has a variety of vegetation cover. In some areas, willow is the predominant canopy species. The understory is characterized by asters, peppervine, climbing hempweed, beggars lice and other weedy species. In other areas sugar berry is the predominant canopy species, with a shrub and herbaceous layer typical of disturbed communities. The methodologies utilized in the study of the batture are discussed in detail in Section 6.1.4.3.

The wax myrtle community consists of land formerly under cultivation
which has reverted to natural vegetation in recent times. This com-
munity occupies approximately 420 acres (or about 3 percent) of the
site. Wax myrtle is the predominant species, forming a fairly dense 3
cover. Maple, ash, and dogwood also occur with the wax myrtle.
Giant ragweed and briars are common along the border between the wax
myrtle community and the agricultural land.

The marsh community occurs near the southern border of the Waterford 3 site. This community occupies approximately 808 acres, or about 20 percent of the site. The community is an overflow area of Lac des Allemands. Common plants found in the marsh area are: alligator weed, water hyacinth, giant cutlass, cattail, pennywort, bulltongue, maidencane, waterhyssop, and sprangletop.

A large variety of bird and mammal species also occupies these habi-
tat types. The successional state of the plant communities, in
addition to the animal tolerance of nearby industrial activity, is a
primary force which regulates the species' presence in these habitat
types. Tables A2.2.1-5 through A2.2.1-8 present a listing of floral
species observed in the batture and wax myrtle thicket, along with 3
approximate cover classes, as recorded during the Environmental
Surveillance Program.

d) Utility

Land denoted as utility in Figure 2.2-1 is the area occupied by
the facilities of Waterford 1 and 2 and Waterford 3. No special
plant community characteristics are associated with this category
of land use. This area occupies approximately 402 acres, or 11 3
percent of the site.

2.2.1.1.3 Species Inventory of the Waterford Site

As indicated in the previous section, the most extensive plant communities at the Waterford site are agriculture and the cypress-gum swamp. In a study of the plant communities of southeastern Louisiana, Penfound and Hathaway[1] established a study transect, defined as "Raceland", southeast of Des Allemands, which included plant communities similar to those of the Waterford site marsh and swamp lands.

This fresh-water transect consisted of oak forest, cypress-gum swamp, and a fresh-water marsh. Table A2.2.1-9 in Appendix 2-2 lists the plants found in fresh and near-fresh water (0-0.6% salt) swamps of southeastern Louisiana, and which probably occur on the Waterford site. Field reconnaissance of of the Waterford site swamp indicated that the dominant species is bald cypress.

Common subordinate species are box elder, hackberry, ash, cottonwood, elm, wax myrtle, and willow.

Vegetation sampling was included in the onsite Terrestrial Ecology 3
Monitoring Program portion of the Environmental Surveillance Program which is described in detail in Section 6.1.4.3. Although this sampling effort concentrated on the cypress-gum swamp community, all major communities were sampled.

Wildlife of the Waterford site and vicinity have also been studies during the Waterford 3 Environmental Surveillance Program. These investigations have led to the listing of amphibians present on the site, given in Appendix 2-2, Table A2.2.1-10; and reptiles present on the site, given in Appendix 2-2, 3
Table A2.2.1-11.

An Audubon Society Christmas bird count is made yearly in the vicinity of Reserve, La., across the Mississippi River from the Waterford site. Ob- 3
servations for the years 1969-1976 are summarized in Table A2.2.1-12 in Appendix 2-2. According to Lowery[2], 411 bird species have been observed in Louisiana. About half of these species have been observed in the vicinity of Waterford 3. Additional bird observations have been made during the Environmental Surveillance Program at Waterford 3. Table A2.2.1-13 of Appendix 2-2 presents a description of the status of birds observed during this program and a summary of these observations on a survey by survey basis is presented in Tables A2.2.1-14 through A2.2.1-17. 3

Table A2.2.1-18 in Appendix 2-2 lists the mammals which are likely to occur at the Waterford site. Ten of these species were observed during field studies or reconnaissance trips, as shown in Table A2.2.1-18.

2.2.1.1.4 Ecological Succession

Species distribution at the Waterford site is determined, in part, by natural factors such as elevation, drainage patterns, edaphic and biotic characteristics. A difference in elevation of only several inches often results in different plant cover types. This slight difference in elevation is related to soil texture, drainage, moisture content, and aeration. In addition to the natural factors affecting species distribution, man's activities have had a significant influence. Therefore, the successional stage at any given area is the combined product of man's altering of the physical and biological characteristics, through activities such as lumbering, agriculture, and drainage pattern alteration, as well as the natural processes developing that area into a mature ecosystem component.

The distribution of plant communities at the Waterford site, shown in Figure 2.2-1, reflects the historical interaction of many factors.

Artificial levee construction created new communities on the batture, and provided additional protection from man's activities on the natural levee. Here, the forest was cleared; and roads, houses, agriculture, and industry were established. Aerial photographs of the site indicate evidence of more extensive agricultural activities than are presently undertaken, a finding corroborated by field reconnaissance. Agricultural activities now appear to be confined to an area between the Mississippi River and Louisiana Highway
3127. Several recently abandoned agricultural fields, now dominated by wax 3
myrtle, are located between Highway 3127 and the St. Charles Canal, as shown in Figure 2.2-1.

There is a gradient in the forest vegetation between the road and the St. Charles Canal. Closer to the road, the vegetation consists of early and intermediate successional species such as hackberry, elm, ash, box elder, drummond red maple, sweet-gum, and sycamore. Close to the St. Charles Canal, the trees are almost entirely more mature bald cypress, with an occasional tupelo gum.

Penfound reported the general tendency throughout the southern United States for a marsh to swamp succession [(3)]. It is difficult to identify, with any certainty, the long-term successional trends at the Waterford site. Because of geological subsidence in the Gulf Coast area, there is some indication of the area's becoming wetter. A number of herbaceous species can germinate under water, provided the temperature and oxygen content are adequate. This could lead to a reverse succession of swamp to marsh, because, as mentioned above, the seeds of both the cypress and tupelo gum will not germinate under water.

2.2.1.2 Important Species of the Waterford Site

There are apparently no "important" species, as defined in NRC Regulatory Guide 4.2, breeding at the Waterford site. The discussion in this section focuses on species endangered or threatened in Louisiana, and their distributional relationship to the site region.

The Federal Register of June 16, 1976, listed four plant species proposed for threatened or endangered status in Louisiana. These species are:

Louisiana Quillwort - *Isoetoes louisianensis*

Coreopsis - *Coreopsis intermedia*

Indian Paint Brush - *Castilleja ludoviciana*

Gerardia - *Agalinis caddonensis*.

None of these species is known to occur at or near the Waterford site. The Louisiana quillwort occurs in Washington Parish, while Gerardia occurs only in the extreme northwest part of the state. Indian paint brush was recorded in 1915 in Jefferson Davis Parish, and may now be extirpated from Louisiana. The distribution of Coreopsis is unknown for the state [(4)].

According to the above-mentioned literature and the opinion of local experts, there are no "endangered" birds or mammals that breed or consistently winter at the Waterford site or in St Charles Parish. There are several species of "endangered" birds included in the United States List of Endangered Fauna that might occur in the area of Waterford 3. These endangered species are the Southern Bald Eagle (Haliaeetus leucocephalus leucocephalus), the American Peregrine Falcon (Falco peregrinus anatum), the Arctic Peregrine Falcon (Falco peregrinus tundrius), the American Ivory Billed Woodpecker (Campehilus principalis principalis), Bachman's Warbler (Vermivora bachmanii), and the Brown Pelican (Pelecanus occidentalis). From time to time, the Bald Eagle (see Table A2.2.1-4 in Appendix 2-2) and the Peregrine Falcon may migrate or winter near the site. The existing industrial nature of the area is likely to preclude the site as being critical habitat for each of these two species. Neither species 3
exists as a breeding bird in the study area.

The population of the Southern Bald Eagle has been declining in recent years because of loss of suitable nesting habitats, widespread shooting, and possible reduced reproduction as the result of pesticide ingestion. This bird is known to nest in southern Louisiana, and in 1976, there were eight active nests reported[5]. However, none of these nests and no Bald Eagles were sighted during visits to the area by the Terrestrial Ecology Study Team during March, 1977. Any occurence of either species in the Waterford site would be a seasonal migrant.

The ivory-billed woodpecker and Bachman's Warbler have been rarely seen in Louisiana. Less than a dozen records exist of Bachman's Warbler in Louisiana since the late 1800's, and the Ivory-Billed Woodpecker is near the point of extinction because of reduction in essential habitats. The Brown Pelican nesting population of the state was extirpated in the early 1960's. Birds from Florida were released on several occasions; and although their numbers have increased in several years, the future status of the Brown Pelican in Louisiana is uncertain. None of these species is known or likely to occur on the Waterford site.

Until February 7, 1977, the American alligator was listed as an endangered species in the area of the Waterford site. At that time, an amendment from the US Department of the Interior reclassified the alligator from endangered to threatened status in all of extreme southern Louisiana, including the Waterford site[6]. The cypress-gum swamp area of the Waterford site is excellent habitat for the alligator, and several were seen during reconnaissance trips to the area. The cypress-gum swamp area is not expected to be disturbed during the construction or operation of Waterford 3.

2.2.1.3 Relative Importance of the Waterford Site's Resources

Approximately 800 acres of the Waterford site have been under cultivation, in the past for sugar cane. About 150 acres will actually be lost from cultivation as a result of the construction and operation of Waterford 3.

The approximately 2000 acres of swamp-marsh constitute less than 3 percent of St. Charles Parish's commercial forest land. None of this swamp land will be changed as a result of the activities associated with the site.

2.2.1.4 Species-Environment Relationships

This section discusses the role of various "important" terrestrial species at the Waterford site. Although there are ecologically significant food-web organisms present at the site, there are apparently no "important" species as defined in NRC Regulatory Guide 4.2. That is, no specific causal link can be identified between Waterford 3 and any terrestrial species which is commercially or recreationally valuable, is threatened or endangered, affects the well-being of some other important species, or is a biological indicator of radionuclides in the environment. It is anticipated that there will be no loss or alteration of significant habitat for these species, no damaging chemical emissions, etc, which is solely attributable to the construction and operation of Waterford 3. For example, even though many game birds and animals occur in St Charles Parish (a list of the species and their abundance - as reported by the Louisiana Wildlife and Fisheries Commission - is presented in Table 2.2-1), because of the existing industrial activity around Waterford 3 and the opening of Louisiana Highway 3127 through the Waterford site, terrestrial wildlife are probably less abundant at the site than in less disturbed parts of St Charles Parish.

Because there are no apparent "important" species at the Waterford site and no projected loss of significant habitats, area usage and life histories of such organisms and related ecosystem food chains are not discussed further.

2.2.1.5 Pre-existing Environmental Stresses

The major definable pre-existing environmental stress caused by a change in land use at or near the vicinity of the Waterford site appears to be Louisiana Highway 3127, which traverses LP&L's property. The construction of this roadway has apparently created minor alterations in certain drainage patterns in the area. Furthermore, use of the road by vehicles causes varying forms of pollution. The operation of these vehicles also causes mortality in adjacent wildlife populations. Several "road kills" were observed during site visits.

Another possible source of pre-existing environmental stress is the industrial development surrounding the Waterford site. However, conversations with the Louisiana Health & Human Resources Administration revealed no reports of vegetation damage from air pollution in the area[7].

Biological infestations, epidemics, and catastrophes are a form of environmental stress. The introduction of nutria into Louisiana may be the most important infestation that has occurred in the area. The first appearances of this animal were the result of escapes and releases, the latter representing efforts to control undesirable aquatic plants, such as the water hyacinth. With few natural predators to control the growth of nutria populations, the number of these animals soon reached an estimated 20 million. The importance of nutria has been the subject of considerable controversy, and it has been blamed for significant damage to rice and sugar cane crops. The nutria was also implicated as the cause of the decline in the muskrat population. Presently, however, the nutria is considered a valuable resource, because it is the most important fur bearer in Louisiana. Additionally, several million pounds of its meat are marketed each year.

Natural catastrophes have also had considerable impact on the terrestrial communities in the site area. These disturbances have taken the form of meteorological phenomena, such as tropical storms or hurricanes. Hurricane winds have increased the spread of animals such as nutria, have damaged a great deal of vegetation by blowing over trees and shrubs, and have spread salt or brackish water over large areas of fresh-water marshes or land. In addition, considerable flooding may result from these storms. Unusually cold weather may also impact the natural population. Frost or freezing temperatures can damage vegetation and seeds, as well as serve to restrict growth and distribution of animal populations.

2.2.1.6 Important Domestic Fauna

Because of the potential for radiological exposure of man via the iodine-milk route, it is important to have knowledge of the count and distribution of domestic fauna, in particular, milk cows and milk goats, in the vicinity of the Waterford site. This information is presented in Section 2.1.3.4.

2.2.1.7 Sources of Information

This section presents a list of pertinent published material dealing with the ecology of the region.

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2.2.2 AQUATIC ECOLOGY

2.2.2.1 Aquatic Ecology Summary

Phytoplankton, Attached Algae and Macrophytes

In the lower Mississippi River, turbidity, turbulence, suspended solids, and current velocities limit the productivity of the primary producers (plants containing chlorophyll). High turbidity limits light penetration to very shallow depths, and shallow areas where attached plants can grow are rare. High turbulence in the river also prevents phytoplankton from being exposed to light for long periods of time. A combination of high current velocities and suspended solids cause scouring of the riverbed, which limits attached algae and macrophyte growth. Under these conditions, phytoplankton and macrophytes (large aquatic plants) are relatively unsuccessful. There were no macrophytes found in the Waterford area.

During 1973-1976, average monthly phytoplankton densities in samples collected during the Environmental Surveillance Program in the vicinity of Waterford 3 ranged from 2.5×10^4 to 1.4×10^6/liter. The average monthly density was 2.6×10^5/liter. In lakes, where phytoplankton usually make a more significant contribution to the food web, much higher densities are typically found.

The generally low phytoplankton densities reported in 1973-1976, as well as the several factors limiting production, suggested that this community is of relatively low importance to the Mississippi River ecosystem. Potential nuisance species, such as blue-green algae, never held a dominant position (10 percent or greater of monthly total number/liter) in the phytoplankton community. In seasonal collections made from July 1977 through January 1980, calculated densities of all algae were generally higher than those reported in 1973 - 1976. Blue-green algae comprised up to 70 percent of the samples, averaging about 22 percent. It is not known if this can be attributed to changes in laboratory procedure (see Section 2.2.2.3.5) and instrumentation or whether it reflects true changes in the community possibly within the realm of normal variation. However, both the upstream and the downstream stations were affected equally since the total numbers, diversity and relative abundance of blue-green algae were similar among stations within sampling quarters. 3

Zooplankton

Zooplankton were present in the Mississippi near the Waterford site in relatively low densities, but many appeared to have originated from other habitats. None of the species of zooplankton collected in the Mississippi River near Waterford 3 are considered to be rare, endangered or threatened species.

Average densities of zooplankton during the first sampling year (Year I, from June 1973-May 1974) were 921.1 organisms/m^3, while the third year (Year III, from October 1975-September 1976) average was 298.1/m^3. During the second year (Year II, from June 1974-August 1975), seasonal sampling indicated average densities of 1056/m^3 per sampling date. While these samples probably underestimated zooplankton densities in the river, since the plankton net size used was too large to sample most rotifers, the sampling did retain zooplankton of a size most available to fish.

Subsequent seasonal sampling during 1977, 1978 and 1979 utilized fine mesh plankton nets capable of catching these smaller rotifers. Average zooplankton densities for these three years were 749.1/m^3, 1150.0/m^3 and 356.8/m^3, respectively. Densities for the first sample of 1980 were considerably higher (4458.5/m^3) than previous years. Finer mesh 3
nets probably attributed to the increased catches of rotifers which represented 61 percent of the sample.

Similar zooplankton are present in lakes and in some other rivers in much higher densities than found in the Waterford area. High suspended solids concentrations (which interfere with the filter feeding and respiratory processes of zooplankton), and high current velocities (which restrict the time these organisms have to reproduce and grow in a given section of the lower Mississippi River) limit the population of these organisms.

Benthic and Pelagic Macroinvertebrates

The most abundant benthic macroinvertebrates found in 1973-1976 in the Mississippi in the Waterford area were aquatic worms and asiatic clams (*Corbicula* sp). However, even these organisms were present in relatively low numbers. Average monthly densities for all macroinvertebrates in the first sampling year (1973-74) were 58.9 organisms/m^2. Although third-year (1975-76) samples were not quantitatively evaluated (see Section 6.1.1.2), they did indicate higher densities than those found in the first year. Seasonal sampling from 1977 through 1979 revealed similar composition and densities to the first and second year of benthic sampling data. *Corbicula* sp and the aquatic worms (Oligochaeta and Chironomidae) remained the dominant groups. Slightly higher densities of aquatic worms were observed in the early surveys of 1978 and 1979. Both *Corbicula* and the worms are utilized as food for fish. *Corbicula* has become a nuisance species in some areas. The number, growth, and distribution of benthic macroinvertebrates in the lower Mississippi are principally limited by scouring (caused by high current velocities and suspended solids), and shifting bottom substrate.

None of the benthic macroinvertebrates found near the Waterford 3 site are considered to be rare or endangered species. The only macroinvertebrates of possible commercial importance in the Waterford area were river shrimp and blue crab. Occurrence of blue crab is infrequent. River shrimp are present in greater numbers. River shrimp "in berry" (carrying eggs), and larvae believed to be river shrimp, were found in the river near Waterford 3, indicating that spawning may take place there. The Waterford 3 site is not unique in this respect. The species occurs far upstream and studies of the lower Mississippi River (at a location 400 miles upstream of Waterford site) found evidence of river shrimp spawning activity(8).

Fish

The Waterford area does not contain any unique fish habitats in comparison to other areas in the lower Mississippi. Fish which are abundant in the Waterford area include gizzard shad, threadfin shad, blue catfish, freshwater drum, striped mullet, and skipjack herring. During periods of extremely low river discharge, bay anchovy and gulf menhaden are also relatively abundant. Common commercial and sport fish in the area include freshwater drum and freshwater catfish; gizzard shad are caught and sold as bait.

None of the fish listed on the 1979 US Fish and Wildlife Service's List of Endangered and Threatened Wildlife and Plants were collected from the river in the Waterford area (see Section 2.2.2.4.3).

Life history information suggests that most of the fish present in the lower Mississippi River spawn in shallow areas, sheltered areas, small streams, backwater areas, areas with aquatic vegetation, and areas characterized by sand or gravel bottoms, all of which are typically not found in the Waterford area.

Fish species that might spawn in the Waterford area include river carpsucker, threadfin shad, gizzard shad, blue and channel catfish, freshwater drum, and skipjack herring. The life histories of these species are described in Section A2-3.3, contained in Appendix 2-3.

The following families of fish larvae were found in the Waterford area:

LARVAL FAMILIES	COMPRISING
Herrings	Gizzard shad, threadfin shad and skipjack herring
Minnows and Carps	Chubs, minnows, shiners, and carp
Freshwater Catfish	Blue catfish and channel catfish
Sunfish	Sunfish, bass, and crappies
Drum	Freshwater drum

Fish larvae densities were low in the Waterford area (averaging less than 1 per m^3 water), with the exception of April 1978 when gizzard shad were abundant but patchy ($0.013/m^3$ - $3.673/m^3$ in surface samples). Given the spawning characteristics of most of these species, it seems probable that many of the larvae sampled were washed downstream from other habitats. Additional support for this conclusion can be derived from a study of the types of fish eggs, larvae, and juveniles collected at River Bend, about 120 miles upstream from the Waterford site (see Section 2.2.2.2.4). Although ten species of fish eggs, larvae and juveniles were collected in the Mississippi mainstem at River Bend, only three of these (carpsucker, freshwater drum and chub) were found solely in the mainstem. The other species were also found in a nearby bayou system and may have been washed into the river. Information presented in Section 2.2.2.2.4 shows that spawning sized adults of most of these species were not collected near the Waterford site in 1973-1976. Subsequent samples collected in seasonal surveys conducted from August 1977 through January 1980 continued representatives of many species with lengths ranging from 25.4 to 76.2 cm (10-30 inches). Tables A2-7-7 through A2-7-10 of Appendix 2-7 present data obtained from surveys conducted from 1977 to 1980.

The Mississippi River at the Waterford site does appear to be utilized as a nursery area by blue and channel catfish, freshwater drum, gizzard shad and threadfin shad. Young blue catfish were also among the most abundant fishes caught in the mainstem at River Bend. It appears that these species are fairly ubiquitous in the lower Mississippi River.

Community Structure

In the Mississippi River aquatic community, organic detritus rather than phytoplankton is the cornerstone of the food chain or energy flow. Much of this basic food material is probably derived from sources other than the Mississippi itself. This conclusion is supported by other studies of large riverine systems, and corroborated by low densities of phytoplankton observed from samples taken in the Mississippi River at Waterford 3. Zooplankton and benthic macroinvertebrate densities were also low, as described in the following sections.

Many of the dominant fish species feed on organic detritus and benthic organisms. Others, however, do feed on plankton. The gizzard shad and many young fish are in this category. Certain representative important fish including blue catfish, channel catfish, drum, and skipjack herring are to a degree piscivorous (part of their diet is composed of fish). In that sense they would represent the top carnivores within the aquatic community.

2.2.2.2 Regional Aquatic Ecology in the Lower Mississippi River

There have been very few ecological studies conducted in the lower

Mississippi River in the vicinity of Waterford 3. According to Conners and Bryan(9) and an investigation conducted for this report, the only available studies that pertain to the area are the following:

1) Those sponsored by LP&L, summarized in Section 2.2.2.3

2) The study done by the former Federal Water Pollution Control Administration at the Luling station (River Mile 117-125)(10)

3) The ecological studies(11) sponsored by Gulf South Utilities and performed by Louisiana State University in the vicinity of River Bend, Louisiana (River Mile 256-266)

4) An invertebrate study conducted by Cauthron(12) in the vicinity of Baton Rouge, Louisiana (River Mile 228-236)

5) A US Army Corps of Engineers dredging study of the Mississippi River(13).

The regional aquatic ecology of the lower Mississippi River is described in this section by summarizing the results of these studies and drawing from other relevant literature sources.

2.2.2.2.1 Phytoplankton, Macrophytes, Benthic Algae

The phytoplankton communities of the Mississippi River main channel (defined as deeper than 5 feet) from Cairo, Illinois to the Gulf of Mexico are limited due to high turbidity, according to a study by the Corps of Engineers(13). Diatoms were found to dominate the phytoplankton, and the main channel species were similar in composition to those found in the tributaries and standing water areas. Near New Orleans, at River Mile 105, the dominant phytoplankton species were found by a study sponsored by the Department of Health, Education and Welfare (cited in the Corps of Engineers study(13) to include the following:

ALGAE OTHER THAN DIATOMS	DIATOMS
Trachelomonas	Melosira granulata
Unidentified genus	Melosira ambigua
	Synedra ulna
	Stephanodiscus astraea
	Melosira varians
	Coscinodiscus sp
	Stephanodiscus niagarae
	Diatoma vulgare
	Nitzschia sp
	Fragilaria crotonensis

Chrysophytes generally dominated the phytoplankton samples collected in whole water samples from the surface of the Mississippi River mainstream near St. Francisville (River Mile 256-266), especially in winter and spring; blue-greens were abundant in the summer and early fall(11).

Those genera which occurred most commonly in the samples collected for this study included the following(14):

GREEN ALGAE	DIATOMS	BLUE-GREEN ALGAE
Chlorococcales	Melosira	Microcystis
Chlorella	Cyclotella	Anacystis
Ankistrodesmus	Fragilaria	
Tetraedron	Synedra	
Scenedesmus	Asterionella	
Crucigenia	Navicula	
	Nitzchia	

In a pilot study of the Mississippi River (July 12-July 21, 1971) near the Waterford 3 site (RM 129-131), algal species were found to include Pediastrum, Tribonema, Fragilaria, Gomphosphaeria, Anabaena, Closterium and several unidentified diatoms. This study, which sampled phytoplankton by towing a plankton net at the water's surface, is described in Exhibit 21 in Appendix C of the Construction Permit Environmental Report for Waterford 3.

The above studies(14) found attached aquatic vegetation to be rare in the river, and found rooted plants to be restricted by both high turbidity and widely fluctuating water levels(13).

2.2.2.2.2 Zooplankton

Dominant zooplankton sampled in the lower Mississippi River in the New Orleans area (13) included:

ROTIFERS	CRUSTACEA
Keratella	Cladocera (unidentified)
Brachionus	Bosmina
Kellicottia	Calanoida (unidentified)
Monostyla	Cyclopoida (unidentified)
Platyias	Nauplii
Lecane	Copepodids

In the River Bend study, Bryan et al(11) found zooplankton and drift communities of the lower Mississippi River to "be diverse and seasonally abundant". It was suggested that many of the zooplankton that were present in the mainstem probably originated upstream in areas characterized by slower currents(14). Sampling showed that zooplankton communities were composed of rotifers, cladocerans, copepods, river shrimp and insect larvae(14). Rotifers and anthropods were generally dominant.

The pilot study conducted at the Waterford 3 site in July 1971 revealed similar zooplankton populations at all stations sampled. Zooplankton populations were characterized by copepods, brachiopods, the rotifer Branchionus sp, cladocerans, and the larval river shrimp, Macrobrachium ohione.

2.2.2.2.3 Shellfish/Macroinvertebrates

According to Conner and Bryan(9), the larger invertebrate animals which live in association with the bottom or submerged substrates are the least studied organisms of the lower Mississippi and Atchafalaya Rivers.

Benthic invertebrates, sampled in the River Bend area of the lower Mississippi River, were few and consisted mainly of midges, asiatic clams and worms (tubificids) in the center portion of the river where the substrate was sand (in places scoured down to gravel). The firm clay along the banks contained denser benthic populations and supported populations of mayflies, caddisflies, and worms (tubificid). In organically rich mud, the benthic population also consisted of mayflies, worms (probably tubificids), and caddisflies. In summer, annelids, river shrimp and mayflies were the most abundant taxa, while in winter-spring, annelids were most abundant(14).

According to Bryan et al(11), tubificids dominated the samples with densities as high as 2,000-3,000/m2 recorded at some stations. The second most dominant constituents of the benthos were burrowing mayflies Tortopus primus and Pentagenia vittigera. Caddisflies were represented by Hydropsyche orris, whose numbers may have been underestimated because of the sampling techniques used.

The pelagic macroinvertebrate populations were found by seine netting to be dominated by the river shrimp, which comprised 89 percent of the total numbers sampled(13). Large numbers of river shrimp were collected in the river after flood waters subsided in the summer of 1973.

An invertebrate study was conducted by Cauthron(12) in the Mississippi River near Baton Rouge from January through September 1960, using impingement traps set over hard clay bottom areas. The dominant macroinvertebrates were found to be the dipteran larvae Pentaneura and Tendipes. Other common species collected were Physa pomilia (snail), Gammarus fasciatus (amphipod), Macrobrachium ohione, Stenonema frontale (Ephemeroptera), Culex quinque-fasciatus (Diptera), Machlonyx (Diptera), Tendipes tentans (Diptera), Chrysops (Diptera), Tabanus (Diptera) and Tubifex (Oligochaete). Dominant microinvertebrates were Arcella vulgaris (Sarcodina), Paramecium caudatum (Ciliata), Stentor coeruleus (Ciliata), Carchesium polypinum (Ciliata) and Philodina (Rotifer). It should be noted that most of these species are quiet-water forms.

The high currents of the Mississippi River result in scouring of the river bottom, removing the sheltering substrate needed by many aquatic invertebrates(12). Many of those collected by Cauthron probably originated in sloughs, swamps, and backwaters and were carried downriver. The results of this study, therefore, would not be expected to be similar to those conducted at the Waterford area, where both epi and infauna were directly sampled. Cauthron provided some information concerning the drift fauna, but did not describe actual bottom fauna of the Mississippi mainstem.

River shrimp were also collected by Cauthron(12).

In the 1971 pilot field program conducted in the vicinity of the Waterford site, the dominant invertebrates collected by trawl were river shrimp and oligochaetes. Other invertebrates collected included Corbicula leana, dragonfly larvae, blue crabs (Calinectes sapidus), mayfly larvae (Tortopus sp) and a leech. Blue crabs were also captured in gill nets and beach seines, which also yielded some river shrimp.

The benthic suction sampler supplied some information concerning the quantitative distribution of benthic macroinvertebrates (both epi and infauna).

At stations generally characterized by soft, fine sediments, the dominant taxa were oligochaetes of the family Naididae. At stations where heavy clay sediments were found, the dominant taxa was Tortopus sp (Ephemeroptera). Corbicula leana was found at all stations. Other species collected were snails (including Goniobasis), unionid clams, river shrimp, midges, and Probopyrus bithynsis (an isopod which is parasitic on the river shrimp).

2.2.2.2.4 Fish

In the River Bend study (RM 256-266) during February 1972-April 1973, fish were sampled using straight seines, trammel nets, experimental gill nets, dip nets and meter nets(11). The following list gives the dominant fish found during this study(14):

PREDATORS	GRAZERS-SUCKERS	FORAGE FISHES
(feeding on fishes and larger invertebrates)	(feeding on detritus and/or bottom organisms)	(plankton feeders and/or grazers on detritus and bottom organisms)

PREDATORS	GRAZERS-SUCKERS	FORAGE FISHES
Shortnose gar	Shovelnose sturgeon	Threadfin shad
Bowfin	Carp	Gizzard shad
Blue catfish	Silver chub	Speckled chub
Channel catfish	River carpsucker	Silvery minnow
Flathead catfish	Smallmouth buffalo	Emerald shiner
White bass	Bigmouth buffalo	River shiner
White crappie	Freshwater drum	Silverband shiner
Black crappie		Blacktail shiner
Sauger		Shiner hybrids
		Mimic shiner
		Mosquitofish
		Mississippi silver side

From February through May (during high river stage), greater numbers of individuals and fewer species were observed; but from June through September (low river stage), fish diversity was higher and densities were lower. Low river discharge was characterized by a narrower channel and extensive shoal areas providing a greater variety of habitats(14). Greater diversity was also observed during the spring of 1973, when a flood washed many fish into the river mainstem from tributaries and swamp area(9).

Reproduction occurred from early spring to early fall and was most intense from mid-April to July(14); however, in 1973, reproductive activity of several species was intense as early as February(11).

The Federal Water Pollution Control Administration conducted a three-year (1966 to 1968) census of fish at seven stations on the Mississippi River from Hickman, Kentucky to Luling, Louisiana(10). The Luling station extended from River Mile 117 to 125, and therefore should have had species similar to those found in the Waterford area.

In the Luling section of the Mississippi, sampling was done with fixed gear which tended to select for large fish. Samples were taken 8 times a year. The dominant fish included:

Channel catfish	Threadfin shad
Bigmouth buffalo	Striped mullet
Smallmouth buffalo	Gizzard shad
Carp	Menhaden
Freshwater drum	Black buffalo
Skipjack herring	

Fifty of the 63 species found in this study of the lower Mississippi River were present at the station near Luling, Louisiana. A large proportion of the total number of menhaden, channel catfish, carp, smallmouth buffalo, skipjack herring, striped mullet, flounder and threadfin shad caught in the Mississippi River were captured at the Luling station. However, only two shovelnose sturgeon were captured at Luling, compared to a total of 118 caught at all stations.

In general, there appeared to be quite a few marine or brackish water species at Luling. As Gunter(15) pointed out, "In addition to anadromous fishes that run up rivers to spawn, other marine fishes, as well as crustaceans and mollusks, have long been known to enter fresh water, especially in the tropics." Examples of such species include sharks, stingrays, flounders, mullets, and tarpon(15). Since 1938, the farthest the salt wedge (5,000 ppm chloride) has extended up the Mississippi River was to Kenner Crossing (about River Mile 115)(16).

In the 1971 pilot study of the Mississippi near Waterford 3, the dominant fish sampled by otter trawl and gill net were juvenile catfish (1.3-6.1 cm total length (TL)), freshwater drum, blue catfish (11.8-81 cm), gizzard shad and carp. Other species included hogchokers, channel catfish, cyprinidae, southern flounder, flathead catfish, American eel, herring longnose gar, striped bass, suckers, shortnose gar, and smallmouth buffalo. The greatest number of fish were caught a short distance above River Mile 130. Nearshore fish were sampled in the pilot study by beach seine. Channel catfish, gizzard shad, freshwater drum and members of the family Cyprinidae were captured by this method.

2.2.2.3 Site-Specific Community Description

In April 1973, the Waterford 3 Environmental Surveillance Program, an intensive aquatic ecological sampling program to study the Mississippi River in the vicinity of Waterford 3, was initiated in order to establish baseline data characterizing the site area. At the time this report was initially prepared, data through September 1976 had been collected and analyzed. A detailed compilation of the data collected is presented in Appendix 2-4. Five sampling stations representing low-current, soft-bottomed, shallow areas, and high-current, dense clay sediment areas, were established between River Miles 132 and 126, as shown in Figure 6.1.1-1. A summary of results from the Environmental Surveillance Program, and a general description of the aquatic ecological community are presented in this section. A summary of the methodologies and a description of the sampling areas are presented in Section 6.1.1.2.

Subsequent to the initial preparation of this report, additional seasonal sampling of the aquatic ecology of the Mississippi River was conducted. With few exceptions, this additional sampling utilized the methods and materials of the earlier (1973-1976) program. The results of the 3 subsequent sampling are discussed in Section 2.2.2.3.5 and the actual sampling data is presented in Appendix 2-7. 3

2.2.2.3.1 Phytoplankton and Attached Algae

Phytoplankton

A list of all the phytoplankton species collected during the sampling is given in Table 2.2-2.

Samples collected during the June 1973 to May 1974 study year (Year I) as shown in Table 2.2-3, demonstrated that phytoplankton density was low (averaging approximately 1.3 x 10^5/liter). Only 18 genera were represented, and the species composition was similar at all stations. Densities were lowest in June 1973 and May 1974 (averaging 2.7 - 2.9 x 10^4/liter) but peaked in August 1973 and September 1973 (3 - 7 x 10^5/liter) with a Coscinodiscus bloom. The monthly number of genera represented at all stations typically ranged from 3 to 5, except in August and September when 15 and 11 genera, respectively, were identified. Diatoms were generally the dominant genera (June 1973 - April 1974), and included Cyclotella, Melosira, Scenedesmus, Coscinodiscus and Trachelomonas. Cyclotella and/or Melosira were dominant(20 percent or greater) in every month except August.

Productivity during Year I ranged from 5.95 mgC/m^3/hr in December, 1973 to 131.5 mgC/m^3/hr in September, 1973.

During September and August, the river's discharge, ammonia, nitrogen, turbidity, and TSS were the lowest of the year (Year I). The August-September Coscinodiscus bloom was probably due to a combination of high temperatures (28 - 29^{o}C), lower turbidities, and lower flows.

Data collected during Year II (1974 to 1975) indicated slightly higher phytoplankton densities. Phytoplankton sample densities, given in Table 2.2-4, for June and August, 1974 and April and February, 1975 averaged 3.9 x 10^5/liter. Of the 4 months sampled, February 1975 had the highest densities (5 x 10^5/liter, or about one order of magnitude higher than the densities measured in February of the previous year). Dominant genera were Chrysococcus sp and the diatoms Melosira sp. and Coscinodiscus sp. Chrysococcus (a yellow-brown algae), which was not found at all in Year I or Year III, reached high densities in Year II.

The number of phytoplankton genera collected during Year II was also higher than the number collected during Year I. Twenty-one genera were found on the four sampling dates in Year II, compared to 18 for Year I.

Productivity during Year II ranged from 13.97 $mgC/m^3/hr$ (June 1974) to 144 $mgC/m^3/hr$ (August 1974).

The sampling program in Year III (October 1975 - September 1976) found an annual average phytoplankton density of 3.2×10^5 organisms/liter. This was slightly higher than the average density recorded during Year I, but similar to Year II. Average monthly densities, given in Table 2.2-5, were lowest in November (2.5×10^4 organisms/liter) and highest in April (1.4×10^6 organisms/liter), when the density of Melosira sp. accounted for more than half the total density. The number of genera represented by month at all stations ranged from 6 (December 1975) to 19 (April 1976). Dominant genera (20 percent or more of total monthly density) were similar to those of Year I. They included Melosira, Coscinodiscus, Cyclotella and Scenedesmus.

Productivity during Year III ranged from 20.2 $mgC/m^3/hr$ in February 1976 to 62.1 $mgC/m^3/hr$ in June 1976.

The July sampling during Years I and III showed that the phytoplankton communities were quite different from those encountered in the 1971 pilot study at Waterford. However, sampling methods were different and not all species collected during the pilot study were identified.

The dominant plankton genera (except Chrysococcus sp) found in the Mississippi near Waterford 3 were similar to those listed by Hynes(17) as being the most frequently encountered true plankton in larger rivers. They were also similar (excepting Chrysocossus) to those found in other studies in the Mississippi River, such as the USDHEW Study near New Orleans and the River Bend study, described in Section 2.2.2.2.1. However, blue-green algae, which were encountered in abundance in the summer and early fall in the River Bend study, were not encountered in abundance in the Waterford study. Also, Coscinodiscus was not so dominant at River Bend.

Although densities seemed slightly higher in the vicinity of the Waterford site than at River Bend, they were still extremely low when compared to phytoplankton densities in lakes or water bodies where phytoplankton is the base of the food chain. For example, in lakes, diatoms alone may reach densities as high as 20 million individuals/liter(18); the highest average monthly density of total phytoplankton in the site area was 1.4 million/liter (April 1976). As pointed out in the Corps of Engineers study(13), phytoplankton in the Mississippi mainstem is limited, in part, by high turbidity.

Attached Algae

In the Waterford area, the attached algal community is probably limited by a scarcity of suitable substrate, high turbidity, and scouring. Common forms encountered during sampling included Scenedesmus sp, and

Oscillatoria sp. A list of the attached algae species found is given in Table 2.2-6.

Because the phytoplankton genera and attached alga genera were similar, it is possible that some of the phytoplankton collected may have originated as attached algae which was scoured or washed off its original substrate.

2.2.2.3.2 Zooplankton

An inventory of the zooplankton species found during the Waterford 3 Environmental Surveillance Program is given in Table 2.2-7. During the Year I sampling program (June 1973 - May 1974), zooplankton in the vicinity of the Waterford site was sampled in the Mississippi on a monthly basis.

Year I

The Year I data did not indicate any noticeable station or depth differences in zooplankton densities (Tables 2.2-8 and 2.2-9), although there were monthly differences. Average total densities were highest in June 1973 and May 1974 (2044 and 2410/m^3 respectively) as shown in Table 2.2-8. Lowest densities were recorded in July and August 1973 (147 and 161/m^3, respectively). Species composition was similar at all the areas sampled.

Eucopepoda and Cladocera dominated the Year I zooplankton samples, as indicated in Table 2.2-10. The dominant copepods were the Calanoida and the Cyclopoida; common Cladoceran species were *Daphnia* sp, *Ceriodaphnia* sp, and *Bosmina* sp. *Daphnia* and *Ceriodaphnia* reached peak densities in June 1973, September 1973 and May 1974 (*Daphnia* only), while *Bosmina* sp peaked in September 1973. Calanoida and Cyclopoida (Copepods) reached peak densities in July 1973, March 1974, April 1974 (Cyclopoida only) and May 1974. Decapod larvae appeared in the zooplankton from May to September, peaking in July 1973. This corresponded with the spawning period for river shrimp.

Year II

During the Year II sampling program, zooplankton were collected in June 1974, August 1974, November 1974, February 1975, April 1975 and August 1975. Total monthly zooplankton densities, given in Table 2.2-8, were higher in June 1973, February 1974 and April 1974, than in June 1974, February 1975 and April 1975. However, for the other 3 months sampled in Year II, total densities were higher than they were in the corresponding months during Year I. Average total monthly densities for the six months sampled were highest in August 1974 and November 1974 (3428/m^3), and lowest in June 1974 (100/m^3). This seasonal variation was the reverse of the pattern found in Year I, when June 1973 had one of the highest total densities and August had one of the lowest.

Decapod larvae were again collected in the June and August zooplankton samples.

During Year II, dominant zooplankton taxa (10 percent or greater of total number during any month sampled) included Calanoida, Cyclopoida, Daphnia sp, Ceriodaphnia sp, Bosmina sp and Diaphanosoma sp.

Year III

Zooplankton were collected during Year III on a monthly basis from October 1975 through September 1976. Again there were no noticeable differences in zooplankton densities by station or depth (Tables 2.2-8 and 2.2-9) but there were monthly differences (Table 2.2-8).

Average total monthly zooplankton densities, given in Table 2.2-8, were highest in early September (1363/m3) and lowest in January and February (8.4 and 2.3/m3, respectively). This seasonal pattern was quite different from the one characterizing Year I. Except for July and early September (compared to August), monthly densities for the zooplankton were much higher during Year I than during Year III.

Dominant zooplankton taxa during Year III were similar to the dominant ones found during the other two sampling years, except that Moina was found only in Year III. Year III dominant taxa included: Calanoida, Cyclopoida, Daphnia sp, Moina sp, Bosmina sp and diptera larvae. Calanoida peaked in March 1976 and June 1975; Cyclopoida peaked in early September 1976. Daphnia sp and Bosmina sp peaked in September 1976; Moina sp peaked in July 1976 and diptera larvae (in the zooplankton) peaked February 1976 and March 1976, as shown in Table 2.2-10. Although Years I and III were dissimilar with regard to monthly densities and peak months, their dominant taxa were similar, as were the months of their (the dominant taxa's) peak occurrences (except for Cyclopoida).

In general, the zooplankton data were quite variable and therefore no statistical analysis of temporal distribution was attempted. However, densities among the different stations appeared to remain stable, ie, although densities fluctuated greatly in time, relationships between station densities remained constant. For example, when densities dropped during certain months of Year III, they dropped at all stations. The same held true during times of "peak densities." Non-parametric statistical analysis of spatial data in Table 2.2-8 (sampling station averages by date) and Table 2.2-9 (sampling depth averages by date)
revealed that there were no statistically significant differences among 1
sampling locations (Table 2.2-11, stations; Table 2.2-12, depths).

Densities of zooplankton in the Mississippi near the Waterford area would be considered low when compared to densities of zooplankton species in lakes or in other rivers. Cyclops alone can reach densities of 2,000/liter[18] in lakes and crustacean zooplankton in Lake Erie have been reported to range from 2,000 - 200,000/m^3 (19). Copepoda densities in the Danube range from 0 to 300/m^3 up to 357,000/m^3 (17).

Rotifers are a dominant component of the zooplankton of larger rivers including the Mississippi River, according to Hynes[17], Bryan et al[11], and the USDHEW study[13]. The low densities of rotifers in the zooplankton samples taken during the Waterford study were probably a function of the large mesh size (243 microns) of the plankton nets used. Rotifers usually range in size from 100 microns to 500 microns(20). Likens and Gilbert[21] indicate that a smaller mesh size (35 microns) is needed to accurately sample rotifer populations.

The River Bend study, when using plankton nets with a mesh size which sampled for larger zooplankton, indicated a high relative abundance of cladocerans (especially Daphnidae), copepods (especially Cyclopidae), and insect larvae[11], which is similar to the results of the Waterford studies. However, insect larvae appeared to be present in noticeable numbers only in September of the Year I samples and in the samples taken in June, November and August of Year II.

Many of the zooplankton occurring in the River Bend area of the Mississippi River had originated "upstream in a more gently flowing habitat"[14]. At the Waterford area, some of the common zooplankton found, such as Daphnia and Ceriodaphnia, which are not listed by Hynes[17] as being found in rivers, were probably strays from other habitats. These species are probably not contributing to the secondary productivity of the lower Mississippi River ecosystem.

2.2.2.3.3 Benthic and Pelagic Macroinvertebrates

Benthic Invertebrates

A list of the benthic organisms found during the three-year Environmental Surveillance Program conducted in the Mississippi River near Waterford 3 is given in Table 2.2-13. Since the Year I study included a period of 1
extensive flooding, it is possible that the samples collected may not have been indicative of the "normal" benthic population.

During Year I (June 1973 - April 1974), the average density of the benthic macroinvertebrate sample population was 58.9 organisms/m^2 (those retained in a number 10 and/or 30 seine). Yearly densities given in Table 2.2-14 (the location of the sampling stations is shown on Figure 1
6.1.1-1), were found to be highest at Station B_t and lowest at Station B_{tl}. Highest monthly densities (Table 2.2-15) were observed on June 8, 1973 (350/m^2), July 29, 1973 (140/m^2) and January 21, 1974

(52/m^2). Oligochaetes generally accounted for the higher densities on these dates. Dominant taxa included Oligochaeta, Corbiculidae, Ephemeroptera larvae and Diptera larvae. Densities of oligochaetes appeared to be maximum on June 8, 1973, July 29, 1973 and on January 21, 1974. Corbicula densities were highest on July 29, 1973 and September 29, 1973 and Ephemeroptera were present on August 22, 1973 and September 29, 1973; Diptera larvae were present throughout the Year I sampling.

Benthic microinvertebrates (those retained in a number 80 sieve) peaked on July 29, 1973, July 11, 1973, August 22, 1973 and November 29, 1973 (Table 2.2-17). Oligochaetes peaked on November 29, 1973; Corbiculidae 1
on July 11, 1973 and Diptera larva on July 29, 1973. The microbenthic average density for Year I was 26.5 organisms/m2.

The sampling undertaken during Year II (1974-1975) found that densities were higher during August 1974 and 1975, February 1975, and April 1975 than during the corresponding months of Year I. The highest average monthly density (320/m^2) was found on February 27, 1975. Average densities are shown in Tables 2.2-14 and 2.2-16 by sampling station, and Table 2.2-15 by month. During Year II, benthic macroinvertebrates were 1
also sampled with a Smith-McIntyre sampler. Densities of invertebrates in samples collected by this gear type are presented in Table 2.2-18. 1

In Year III, as in other years, oligochaetes and Corbiculidae were dominant.

Oligochaetes, as a group, were the most abundant benthic macroinvertebrates collected at sampling stations. High numbers provided the opportunity for comparison of stations on the basis of concentrations of these organisms. Friedman's two-way analysis of variance[22] yielded the result of no significant difference among stations (Table 2.2-19). Although densities of oligochaetes may differ between stations, possibly in response to differences in the habitat at these stations, these differences were not shown to be statistically significant.

A comparison between data collected before and after start-up of Waterford 1 and 2 was limited to the two months of data collected after startup (see Section 6.1.1.2 for an explanation of limitations of Year III data): August 1975 (Year II) and October 1975 (Year III) (Table 2.2.2-16). During August 1975 densities dropped at A_t but were higher at all other stations than during August 1973 and 1974. During October 1975 densities at all stations were higher than during October 1973. No conclusions regarding the effect of the operation of Waterford 1 and 2 can be made based on these differences.

The densities of the benthic organisms were found to be extremely low. The lower densities encountered during Year I may be attributed to higher flows which scoured the bottom during the floods occurring in the spring of 1973.

Oligochaetes and burrowing mayflies were found to be the dominant benthic organisms in the Mississippi River in both the River Bend study and the 1971 pilot study near the Waterford site. However, only Year I Waterford samples contained mayfly larvae in dominant numbers; data from all three years of sampling near the Waterford site confirmed the dominance of the oligochaetes.

Overall, benthic invertebrate data from the Year I to Year III sampling of the Mississippi near Watarford 3 did not appear to indicate a relationshlp between sediment type and the species or total number of organisms. The 1971 pilot study and the River Bend study, however, did indicate such a relationship.

Pelagic Macroinvertebrates

The only commercial macroinvertebrate found in noticeable numbers in the Mississippi in the vicinity of the Waterford site was the river shrimp, Macrobrachium ohione. The results of impingement studies(23) conducted at Waterford 1 and 2 indicate that river shrimp were present every month in which impingement sampling was done (ie, February 1976 - January 1977). The greatest number of river shrimp were impinged in the beginning of July, the end of April, and the beginning of October 1976.

In the River Bend study of the Mississippi, described in Section 2.2.2.2, river shrimp dominated the seine catches of invertebrates (in the December 1971 - May 1973 data). Although data collected after spring 1973 had not been analyzed at the time the report was written, Bryan et al(11) commented on the large numbers of shrimp which were observed in the summer of 1973 after floodwaters subsided. River shrimp was the dominant invertebrate species in the trawl samples collected during the 1971 pilot study in the Waterford area (Section 2.2.2.2). River shrimp were also common in the impingement traps set by Cauthron(12).

Decapod larvae, probably river shrimp, were found in the zooplankton samples taken near the Waterford site from May to September, with a peak in June. River shrimp larvae were abundant in the River Bend zooplankton samples in early June and increased in relative abundance through mid-August(11).

2.2.2.3.4 Fish

A listing of the fish species collected, and the number and weight of each species caught during each of the 3 years of sampling near the Waterford site is given in Tables 2.2-20 and 2.2-21. A summary of the numbers and biomass (weight) of common species and total fish collected each month per unit effort (per 48 hr gill net set, per 1 hr | 1 electrofishing effort) is given in Tables 2.2-22 and 2.2-23. The number and weight of the dominant fish and all fish captured per unit effort during each year, at each station utilized, are given in Tables 2.2-24 and 2.2-25. 1

Sixty-one species of fish were collected during the 3 years of study at Waterford. The number of species represented in fish collections during Years I, II, and III was 45, 34, and 49, respectively. Dominant species (among the five most abundant in at least 2 out of 3 sample years) were the gizzard shad, threadfin shad, blue catfish, freshwater drum and the striped mullet. These were similar to the dominant species collected during other studies of the lower Mississippi River.

Table A2.4-7 in Appendix 2-4 presents the number of fish caught per unit effort by month, by station, for each of the five dominant species given above. Seasonal trends in the abundance of gizzard shad, freshwater drum, and striped mullet were either nonexistent or were obscured by high month-to-month variability in the numbers of these species caught by gill netting and electroshocking (Table A2.4-7).

During Years I and III, the number of the blue catfish caught by electroshocking is higher during the fall and winter months than during the spring and summer (Table A2.4-7). This trend was consistent among all stations. The number of blue catfish caught by electrofishing was consistently low in all months in Year II, with the exception of November 1975. No such trend was observed in gill net catches. The number of threadfin shad caught by electroshocking appeared to decrease during the winter months, either due to decreasing effectiveness of the sampling gear at this time or to a decrease in the size of the local population. The low numbers of threadfin shad caught by gill netting through the year prohibited the confirmation of this observation by seasonal trends in gill net catches.

In Figure 2.2-2 the numbers of the five most common species caught per unit effort of gill netting and electrofishing are plotted in relation to the date of sampling. High month-to-month variability in these numbers may obscure any seasonal or yearly trends in the abundance of these fishes.

The shocking and gill netting data in Table 2.2-24 indicate that neither the blue catfish nor threadfin shad show a preference for shoal (A Stations) as opposed to channel areas (B Stations). The freshwater drum, gizzard shad, and striped mullet, however, appeared either to favor channel stations or to be more susceptible to sampling methods at these locations. On a per unit effort basis, highest numbers and weights of these fish are associated primarily with B Stations for Years I, II, and III. 1

Table 2.2-25 indicates that the overall number of fish caught per unit effort at Station B_c during Year II exceeded that for all stations during all years. The highest weight of fish per unit effort was also observed at Station B_c; however, this occurred during Year III. The lowest number of fish caught during any year occurred at Station A_c during Year II, while the lowest weight was observed at Station B_t during Year I. 1

In terms of the number of fish caught, channel stations yielded slightly higher catch per effort figures than did shoal stations during Year II, although no such trend was observed for Years I and III. In terms of the total weight of fish caught, channel stations exhibited slightly higher catch per unit effort figures than did shoal stations during Years I and II, although not in Year III. Control Stations (A_c, B_c) yielded a slightly higher catch per effort during Year III in terms of both the number and the total weight of fish caught. No such trend was observed for Years I or II.

Spatial and temporal trends in the abundance of common species are of interest in light of questions typically posed in an environmental assessment (ie, What are the effects of plant operation?). The abovementioned observations of differences in the catch of fish at control stations (those not affected by thermal discharge) vs treatment stations (those affected by thermal discharge) (see Section 6.1.1.2) or at channel vs shoal stations, and changes in these relationships between years were tested for statistical significance using Friedman's two-way analysis of variance[22]. Friedman's two-way analysis of variance is a statistical test which analyzes the variability in observations between types of stations in relation to the variability within a single type of station. For this, ranks were assigned from one through five to the five sampling stations according to the yearly average catch per unit effort for a given species at that station. Five such sets of ranks were assigned, one for each of the five common species: blue catfish, freshwater drum, gizzard shad, threadfin shad, and striped mullet. For the purpose of Friedman's analysis of variance, the five species were considered independent trials and the stations were considered treatments. The hypothesis of no difference in yearly catch between stations was tested for Year I data and could not be rejected at any level greater than $\alpha = .40$. (Under the hypothesis of no difference between stations, values as extreme as those observed could be expected, purely by chance, forty percent of the time.) The same test for Year III data yielded similar results (Tables 2.2-26 and 2.2-27). Again, the 1
hypothesis of no difference between stations could not be rejected. In addition, the sums of ranks produced by Year III data were nearly identical to those produced by Year I data. These results imply that no difference between stations existed, or at least differences, if they existed in the population, could not be detected from the samples taken. Thermal plume models (described in Appendix 5-1) for Waterford 1 and 2 suggest that sampling station A_t experienced pronounced post-operational

thermal effects (ie, temperature elevations) during Year III. However, the fact that the sum of ranks (Friedman's test) for this station did not change any noticeable degree between Year I and III suggests that this station did not experience a change in the abundance of fish relative to other stations. The hypothesis of no difference between Years I and III was examined using the sign test[22]. Catch per unit effort for Year I was subtracted from that for Year III at Station A_t for each of the five common species. Given that no difference between Years I and III existed, the occurrence of plus and minus signs was equally likely. These signs did occur in approximately equal numbers, suggesting no difference in the abundance of common species between Years I and III; that is the hypothesis of no difference between Years I and III could not be rejected at any level of significance greater than $\alpha = 0.5$.

In summary, significant differences between stations within years could not be detected. The relationship between stations did not vary between Years I and III. Catch per unit effort at Station A_t was not found to vary significantly between Years I and III.

<u>Ichthyoplankton</u>

During Year I (June 1973 - May 1974), ichthyoplankton (fish eggs and larvae) were separated from zooplankton samples, but were not identified. Thereafter, ichthyoplankton were sampled in No 0 nets (see Section 6.1.1.2) and were identified to the family taxa level.

During Year II, ichthyoplankton were sampled in November 1974 and
February April, and August 1975. Highest densities were encountered in
November 1974 (.024/m^3) and August 1975 (.027/m^3), as shown in Table
2.2-28. Dominant families represented in the ichthyoplankton samples 1
collected during Year II, shown in Table 2.2-29, included Centrarchidae
and Clupeids. The Clupeids were probably gizzard and threadfin shad.

During Year III, ichthyoplankton were sampled on a monthly basis from
October 1975 through September 1976, using the techniques described in
Section 6.1.1.2. Additional ichthyoplankton samples were taken on one
extra sampling day each month from June to August 1976 (June 8, July 7
and August 12, as shown in Table 2.2-28). Ichthyoplankton appeared in 1
samples only from March through August, with peaks occurring in April
(.026/m^3) and May (.021/m^3) (routine samples) and in June (.106/m^3)
and July (.017/m^3) (extra samples). Dominant classes in the routine
samples consisted of Cyprinidae and Centrarchidae, as shown in Table
2.2-29. Dominant classes collected in the extra ichthyoplankton samples 1
are also given in Table 2.2-29 and consisted of Clupeidae and Sciaenidae.

Densities of ichthyoplankton by depth and by date are given in Table 1
2.2-30.

Spatial variation by station in total ichthyoplankton concentration was examined by Friedman's two-way analysis of variance(22) using Year III data, since they were the most complete. A plot of the average density of ichthyoplankton (number per cubic meter) caught at each station on eight dates, shown in Figure 2.2-3, suggests the possibility of such variation. For each date, ranks are assigned to each station according
to the average ichthyoplankton concentration observed there (Table 1
2.2-31). These ranks are then summed, and an overall rank is assigned to each station.

The shallower Stations A_c and A_t are ranked 1 and 5, respectively, and B Stations are ranked 2, 3, and 4. Affected by thermal discharge, Stations A_t, B_t, and B_{t1} occupy ranks 1, 2, and 3, while the two controls rank 4 and 5. On the basis of data presented in this form, A stations (shallower) and B stations (deeper) do not differ with respect to ichthyoplankton concentration. Stations affected by thermal discharge do appear to differ from control stations. The statistical significance of these observations was tested using the Friedman's two-way analysis of variance(22). The hypothesis of no difference between any of the five stations could not be rejected at any level of significance below $\alpha = .40$. Therefore, these data indicated no significant spatial differences in ichthyoplankton densities in the Mississippi in the Waterford vicinity. Similarly, a Friedman test of the data in Table 2.2-30 on average ichthyoplankton densities by depth revealed no
significant differences. Table 2.2-32 presents the results of the 1
Friedman's test. Thus it appears that ichthyoplankton are distributed fairly homogeneously in the Mississippi River at Waterford.

In a study conducted near St Francisville, Louisiana(24), 10 species of ichthyoplankton were found to be common in the Mississippi River mainstem. These included Dorosoma sp (March - July), Cyprinus carpio (April - June), Hybopsis sp (May - August), Carpiodes carpio (May - August), Poxomis sp (April - June) and Aplodinotus grunniens (May - September). Carpiodes carpio, Aplodinotus grunniens and Hybopsis sp ichthyoplankton were found only in the mainstem.

Approximate estimates of ichthyoplankton densities in the Mississippi in the vicinity of St Francisville included(25):

a) 25-50 shad/$100m^3$ of water sampled in daylight tows (April - July); less than 10 drum/$100m^3$ from May - June; 20-30 drum/$100m^3$ in July and August. Maximum densities for total ichthyoplankton were encountered in May, June and early July and usually ranged from 50 - 90/$100m^3$ in the main channel of the Mississippi.

b) Highest ichthyoplankton densities were encountered in the main channel which tended to be the areas of greatest turbulence.

Conner[25] feels that this may have been due to decreased ability of larvae to avoid the sampling net in those more turbulent areas.

c) Total ichthyoplankton densities seemed to be slightly lower in the Waterford area of the Mississippi than in the main channel in the St Francisville area. Ichthyoplankton collected during the Waterford study were identified only to family while those collected at St Francisville were identified to species. However, a comparison of densities of families to corresponding species reveals lower densities in the Waterford area. These differences are probably due to the presence of backwater areas in the St Francisville area. These areas probably provide spawning habitat not available in the Waterford area.

2.2.2.3.5 Subsequent Observations, 1977 - 1980

2.2.2.3.5.1 Background

Preoperational sampling for Waterford 3 was continued from July 1977 through January 1980 on a seasonal basis. This sampling was done at the same stations which were sampled from 1973 - 1976. Likewise, the methods and materials were the same as those used in the earlier surveys with the exception that a Smith-McIntyre benthic sampler was used instead of a Shipek, and an inverted microscope was used for phytoplankton laboratory analyses. In general, the basic difference between these surveys and those of 1973 - 1976 was increased attention to quantification and finer taxonomic identification. The following sections summarize results of these subsequent surveys. Detailed data are presented in Appendix 2-7. 3

2.2.2.3.5.2 Phytoplankton

Phytoplankton densities were much higher than reported previously (Table A2-7-1) as discussed in Section 2.2.2.1. Also, blue-green algae usually comprised much higher sample proportions in the 1977-1980 period, with only two dates recording zero (ϕ) relative abundance (Table A2-7-2). Reasons for this are unclear; however, the trend was evident at all stations, upstream (A_c, A_t, B_c) and downstream (B_t, B_{t1}) of the operating Waterford 1 and 2.

2.2.2.3.5.3 Zooplankton

Zooplankton densities were similar to previous years with the exception of the January 1980 sample (Table A2-7-3). The higher measured densities are probably attributable to the use of finer mesh nets (76 μ) resulting in increased numbers of zooplankton being captured than in previous years. Specifically, the smaller mesh size nets retain rotifers which were largely excluded in previous sampling. Densities were similar among depths with the exception of the August 1977 and April 1979 samples where a slight increase at the Station Bt bottom depth was observed. Composition, diversity and dominance were similar to previous years with the calanoid and cyclopoid copepods dominating the majority of the samples (Table A2-7-3).

2.2.2.3.5.4 Benthos

Benthic densities were similar to previous years with the exceptions of the April 1978, January 1979 and April 1979 samples (Table A2-7-4). The elevation in densities during these periods were entirely from the increased catch in oligochaetes. This group represented 94 percent and 99 percent of the 1978 and 1979 sampling respectively. Composition and densities were similar among stations and years (Table A2-7-4).

2.2.2.3.5.5 Fish

Fisheries data are presented in Tables A2-7-5 through A2-7-11.
Comparison of Tables 2.2-21 and A2-7-5 indicate that 18 species found in
low abundance from 1973-1976 (1-35 individuals over the three-year
period) were not captured in the ten sampling surveys between July 1977
and January 1980. Five additional species were captured in the latter
period that were not taken in the 1973-1976 period. Dominant species
remained similar, both in absolute and relative abundance. Catch per
effort of major fish species was similar, as it was from 1973-1976, among 3
stations (Table A2-7-6).

2.2.2.3.5.6 Ichthyoplankton

With the exception of two occasions (August 1977, Station A_t, and April 1978 Stations A_c, B_c, B_t) total ichthyoplankton densities were below 1/ m^3 (Table A2-7-12). Spatially, however, more ichthyoplankton were found in surface waters than either mid or bottom waters. The sum of ichthyoplankton densities at Station B_c and B_t, for all dates, as an example, for the average densities at surface, middle and bottom depths were 0.47/ m^3, 0.27/ m^3, and 0.17/ m^3, respectively.

2.2.2.3.5.7 Water Chemistry

Water quality data presented in Table A2-7-13 show wide variability among seasonal sampling surveys, but not between the two stations sampled (B_c and B_t). Concentrations of copper, cadmium, zinc, chromium, and lead measured during 1977, 1978, and the first half of 1979, often exceeded water quality criteria for aquatic life and/or drinking water.

Results reported for October 1979 and January 1980 were contradictory; probably reflecting expected variability in grab samples representing an instantaneous point in time and space.

2.2.2.3.5.8 Conclusions

The fish community, usually regarded as the ultimate barometer of the ecosystem from the standpoint of most resource users, due to its visibility, appears adapted to the wide variability in existing environmental conditions. Fish community composition remains the same as 3
in 1973-1976 and no upstream (of Waterford 1 and 2 and Waterford 3) or downstream differences in plankton, fish, or water chemistry were detected in 1977-1980. Spatial differences were noted for ichthyoplankton and benthos however; the former demonstrating bathymetric differences and the latter most likely being a function of habitat (substrate and scouring).

2.2.2.4 <u>Commercial, Sport and Endangered Species</u>

2.2.2.4.1 Commercial Species

Valuable commercial fish species in the lower Mississippi River include buffalo fish, freshwater catfish, gar and freshwater drum. The commercial catches from the Mississippi River from Baton Rouge to the mouth are shown in Table 2.2-33 (in both pounds and dollar values) for the period 1971 to 1975. This information, from the U.S. Department of Commerce[26], shows that freshwater catfish had the highest dollar value of all of the commercial species, reaching a high of $401,903 in 1975. The only valuable commercial species which were common in the Waterford area were the freshwater catfish and freshwater drum.

Commercial catches of river shrimp in the lower Mississippi River from 1971 to 1975 are shown (Table 2.2-33) to have ranged from 900 to 4,200 pounds and to be valued from $297 to $2,940.

2.2.2.4.2 Sport Species

Fish sought by sport fishermen in the River Bend area include blue catfish, channel catfish, flathead catfish, white bass, yellow bass, white crappie, sauger and freshwater drum[14]. Although all these species are present in the Waterford area, the only ones that can be considered common (more than 200 collected during any sampling year during the Waterford 3 study) are blue catfish and freshwater drum. Largemouth bass, another valued sport fish, was collected only occasionally during the Waterford 3 Environmental Surveillance Program
(Table 2.2-21). 1

2.2.2.4.3 Endangered Species

None of the fish species actually found in the area sampled in the Waterford study, or expected to be present in the area, are included in the January 1979 Fish and Wildlife Service's <u>List of Endangered and Threatened Wildlife and Plants</u>[27].

There are some species collected in the Waterford area which may be considered rare, or whose number have been recently decreasing. These include the pallid sturgeon, shovelnose sturgeon and paddlefish. Their life histories are included in the discussion in Appendix 2-3. Personal communication with the Louisiana Wildlife and Fisheries Commission has indicated, however, that the shovelnose sturgeon and paddlefish are still relatively common in the State of Louisiana[28]. Of the species listed by Miller[29] as threatened and/or rare in the State of Louisiana, only the brown bullhead, pallid sturgeon and suckermouth minnow were found in the Waterford area. However, as discussed below, the suckermouth minnow and brown bullhead do not appear to be endangered if their entire range and not just the State of Louisiana is considered. Brown bullhead are able to withstand conditions of pollution, ie, high CO_2, low dissolved oxygen, many toxic substances, etc. The reason they are considered rare in Louisiana is probably that they have only recently been introduced there[30].

While suckerouth minnows were not encountered in the sampling programs of either the Waterford study, the River Bend study, or the 1971 pilot study, the impingement study conducted at Waterford 1 and 2 from February through July 1976, did recover one suckermouth minnow[23]. Because its habitat consists of riffle areas and it is characterized as "sedentary"[31], it would not have been expected to occur in the Waterford area. It is possible that the specimen was washed downstream from another area.

The suckermouth minnow is common in states other than Louisiana. For example, it occurs throughout Kansas and is abundant in several small tributaries of the Missouri River. Trautman (cited by Cross[31]) noted that the eastward expansion of the suckermouth minnows' range in the Ohio River system correlated with increased stream siltation and a decline of other riffle species which require firm rock bottoms and clear water.

The habitat preference and life history of the pallid sturgeon are described in the life history discussions contained in Appendix 2-3.

Miller also described the bluntface shiner and bluntnose minnow as rare in Louisiana[29], and neither species was encountered in the studies near Waterford 3. They were caught in the Mississippi River in the River Bend study, however, after probably being washed into the Mississippi by the spring floods of 1973[11]. The bluntface shiner is rarely found in creeks with mud or sand bottoms, while bluntnose minnow principally inhabit streams with rocky bottoms[31]. They would not be expected, therefore, to be found in the Waterford 3 area.

2.2.2.4.4 River Habitat Utilization in the Waterford Area

From the description of the life histories of the fish species that occur in the Waterford area, contained in Appendix 2-3, it appears that most species spawn in shallow areas, sheltered areas, smaller streams, backwaters, areas of aquatic vegetation, or over gravel and sand bottoms. The only abundant (A), commercial (C), sport (S), or threatened (T) species that might spawn over the clay or mud substrate in the waters found in the vicinity of the Waterford area are threadfin shad (A), possibly gizzard shad (A), possibly blue (A and C) and channel (C) catfish (though not likely), and freshwater drum (A and C) (although some vegetation may be necessary). The ichthyoplankton data gathered for the River Bend study and the Waterford 3 Environmental Surveillance Program support these conclusions.

Based on the length distribution of the abundant, commercial, sport or threatened fish species collected in the Waterford area, given in Table 2.2-34 and Figure A2.2.2-1, it would appear that blue catfish, freshwater drum, gizzard shad and threadfin shad juveniles utilize the area as a nursery area during specific times of the year.

Life history information on sport, commercial, abundant or threatened species in the Waterford area suggests that some species may undertake spring or summer migrations through the Waterford area. These include longnose gar (C), gizzard shad (A), bigmouth buffalo (C), channel catfish (C) and striped mullet (A). Actual data collected in the Waterford area indicated, however, that longnose gar and bigmouth buffalo do not pass through the area in sizable numbers.

Comparison of other studies of fishery resources in the lower Mississippi River (which are described in Section 2.2.2.2) with the Waterford study, in addition to consideration of life histories of fish collected in the area, suggests that the Mississippi River in the Waterford area is not a unique fish habitat. In fact, it appears to be especially unsuitable as a spawning area for most species.

2.2.2.5 Community Interactions

2.2.2.5.1 Preexisting Environmental Stresses

The information presented above shows that the Mississippi River supports a viable aquatic community, including numerous commercial finfish. However, its biological resources are limited when compared to other riverine environments.

The populations of aquatic organisms in the lower Mississippi River appear to be limited mainly by heavy river traffic, high turbidity, chemical pollutants, high concentrations of total suspended solids, high current velocities, and fluctuating water levels.

The high turbidities (49-625 JTU during the Waterford study as given in Section 2.4), can restrict phytoplankton and periphyton growth due to light limitation. Productivity of the phytoplankton is further limited by the high turbulence and mixing in the Mississippi, which may prevent phytoplankton from remaining in the euphotic zone for sufficient lengths of time. High concentrations of suspendad solids (reaching values as high as 345 ppm in the Waterford study) and high current velocities (2.78 to 7.01 fps in the April 1973 to September 1976 study period) result in scouring of fish eggs and larvae (in nests or attached to submerged objects), scouring of benthic and periphyton communities, clogging of fish gills and the filter-feeding mechanisms of invertebrates, and shifting bottom sediments. Resultant sediment deposition in areas with slower currents smothers fish eggs and larvae as well as benthic organisms (both fauna and flora), further limiting their composition and density.

The variation of the flow regime in the lower Mississippi River appears to make it a difficult habitat for fish. (The total discharge during the Waterford Environmental Surveillance Program is given in Table 2.2-35, 1
excluding those values reached during the spring 1973 flood, showing that flows ranged from 222,000 to 1,086,000 cfs.) For certain species, high water favors spawning, and breeding fails in its absence; however, if water levels are too high, "much oviposition occurs on flooded land away from the riverbed, and young fish become stranded"[17]. However, this probably would not occur in the Waterford area, since the levee system results in a relatively steep shoreline. High water after spawning may lead to the displacement of eggs and larvae[17].

Other stresses placed on the aquatic organisms in this reach of the Mississippi include:

a) low levels of dissolved oxygen in the warmer months (D O dropped to 4 ppm in the summer of 1973)

b) low pH; dropped to 4.0 in May 1976 (most of the wastes discharged to the Mississippi River between Baton Rouge and New Orleans are acidic[32])

c) high mercury levels (reached 2.9 ppb in April, 1974).

d) high cadmium levels (reached 20 ppb in August, 1973).

The Year III study, however, did indicate some amelioration of these conditions. The average yearly concentration of iron dropped from 0.26 ppm for Year I to 0.06 ppm for Year III; cadmium levels dropped from a yearly mean of 5.1 ppb (Year I) to 3.5 ppb (Year II) to less than 1.0 ppb in Year III; mercury levels dropped to less than 0.3 ppb (Year III) from 0.61 ppb (Year I); dissolved oxygen levels never fell below 5.5 ppm during Year III.

According to a 1969-1971 Environmental Protection Agency study of the lower Mississippi River[33], sixty industrial plants between St

Francisville, Louisiana and Venice, Louisiana discharged wastes containing high quantities of heavy metals and organics into the river. Pollutants discharged included lead, copper, zinc, cadmium, chromium, arsenic, mercury, cyanide, phenols, and solids.

At the time the EPA report was completed, "substantial improvement in the quality of the waste discharges" was expected for the near future(33). However, as indicated by the Waterford study, concentrations of at least two of these substances, cadmium and mercury, in 1973 and 1974 were still in excess of those considered safe for freshwater organisms(34).

According to conclusions reached by the Federal Water Pollution Control Administration(10), endrin, a pesticide, was responsible for extensive fish kills in the lower Mississippi River from 1963-1964. At the time the FWPCA report was written in 1969, endrin levels in the lower Mississippi River had dropped to concentrations which were not harmful to fish. The concentrations were expected to remain at these lower levels(10). During the 1973 to 1976 Waterford 3 Environmental Surveillance Program, pesticide levels were found to be below detectable levels.

2.2.2.5.2 Trophic Relationships

As a result of its unstable substrates, high turbidity values, high concentrations of suspended solids, high current velocities, and industrial discharges along its banks (as described in Section 2.2.2.5.1), the lower Mississippi River mainstem would not be expected to be a "productive" area. The Waterford studies seem to support the prediction of low productivity for certain biotic communities in the area. The three-year study conducted in the vicinity of Waterford has indicated extremely low concentrations of phytoplankton and attached algae, low zooplankton densities, and an absence of macrophytes. The dominant benthic invertebrates collected, i.e., Corbicula and oligochaetes, are prey for fish and also play a role in processing organic matter. However, their numbers are so low as to make their contribution minimal. River shrimp (Macrobrachium ohione), however, is probably an important forage species. Although its feeding habits are not known completely, river shrimp are believed to be primarily carnivorous(35).

A stomach contents analysis of fish captured during the River Bend study(11) indicated that benthic invertebrates such as burrowing mayfly larvae, diptera larvae, and mollusks play a role as fish food items. It is expected that oligochaetes also serve as food for certain fish species. In addition to being prey for fish species (acting as a link between detrital level and higher trophic levels), benthic macroinvertebrates are also important in flowing water ecosystems because of their role in processing organic material, i.e. they aid in the degradation of detritus(36). Aquatic oligochaetes, which were the dominant benthic fauna collected in the Waterford samples, feed on bottom mud and mix it "much as earthworms effectively mix the surface layers of gardens and meadow soils"[20]. However, as indicated in Section 2.2.2, benthic invertebrate densities are quite low in the Waterford area, and their contribution to the productivity of the Waterford area is probably limited.

The fish population, in general, has been limited to few if any specialized feeders due to the highly dynamic environment of the Mississippi River[14]. Most of the important fish species found in the Waterford area, including blue catfish, channel catfish, and gizzard shad, feed on organic detritus, as well as on plankton and insect larvae and Corbicula. Gizzard shad, in turn, is an important forage species while they are small[37]. The habitats, spawning areas, migration routes, and food of fish species found in the Mississippi near Waterford 3 are summarized in Table 2.2-36. 1

Given the low densities of the other components of the ecosystem (phytoplankton, zooplankton, benthic invertebrates), it is logical to assume that organic detritus, probably allocthonous, plays a significant role in the trophic relationships of the lower Mississippi River ecosystem. Stream ecosystems, in general, usually rely on allochthonous production[38].

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TABLE 2.2-1
(Sheet 1 of 2)

ABUNDANCE OF GAME ANIMALS FOUND IN ST CHARLES PARISH*

Species	Abundance
American Alligator	1 per 9 acres of swamp; 1 per 5 acres of fresh marsh
Doves	1 per 3.1 acres of pasture and 1 per 0.5 acre of crop land
Bobwhite	1 per 16.7 acres of pasture and 1 per 3.1 acres of crop land
King Rail	1 per acre of fresh marsh
Common Snipe	1 per 5 acres of marsh; 1 per 5 acres of pasture; 1 per 10 acres of crop land
Turkey	None in parish at present time. Area has a potential for restocking
Resident Waterfowl	1 per 100 acres of woodland
Migratory Waterfowl	1 per 10 acres of woodland; 1.5 per acre of marsh
Woodcock	1 per 5 acres of woods
Deer	1 per 30 acres of woodland
Squirrel	1 per 0.4 acre of woodland
Raccoon	1 per 2.4 acres of woods; 1 per 8 acres of marsh
Fox	1 per 100 acres of woods
Bobcat	1 per 160 acres of woods
Nutria	1 per 3 acres of woods; 2 per acre of fresh marsh
Muskrat	1 per 2.4 acres of woods; 0.83 acre of fresh marsh
Otter	1 per 600 acres of woods; 1 per 300 acres of fresh marsh
Mink	1 per 150 acres of woods; 1 per 100 acres of fresh marsh
Opossum	1 per 2.4 acres of woods

TABLE 2.2-1
(Sheet 2 of 2)

ABUNDANCE OF GAME ANIMALS FOUND IN ST CHARLES PARISH

Species	Adundance
Rabbit (Swamp and Cottontail)	1 per 2.5 acres of woodland; 1 per 12.5 acres of fresh marsh; 1 per 16.7 acres of pastures; 1 per 2.5 acres of cropland

* Adapted from report prepared for Louisiana Power & Light Co. by R.A Beter, Louisiana Wildlife and Fisheries Commission, contained in Louisiana Power & Light Co., "Applicant's Environmental Report, Construction Permit Stage for Waterford Steam Electric Station, Unit No. 3." Docket No. 50-382. Feb. 24, 1972. p. II-G-4.

TABLE 2.2-2

SPECIES LIST OF PHYTOPLANKTON COLLECTED IN THE MISSISSIPPI RIVER IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 TO SEPTEMBER 1976
(Sheet 1 of 5)

Chlorophyta

Chlorophyceae

Volvocales

Volvocaceae

Eudorina

Pandorina

Gonium pectorale

Chlorococcales

Cocystaceae

Ankistrodesmus

Ankistrodesmus falcatus

Scenedesmaceae

Actinastrum

Actinastrum hantzschii

Coelastrum

Scenedesmus sp

Scenedesmus acuminatus

Scenedesmus armatus

Scenedesmus dimorphus

Scenedesmus obliquus; Scenedesmus quadricauda

Tetrastrum

Hydrodictyaceae

Pediastrum

Pediastrum duplex

TABLE 2.2-2 (Cont'd)

SPECIES LIST OF PHYTOPLANKTON COLLECTED IN THE MISSISSIPPI RIVER IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 TO SEPTEMBER 1976
(Sheet 2 of 5)

Chlamydomonadaceae

Chlamydomonas sp

Chrysophyta

Chrysophyceae

Chrominales

Chrysococcaceae

Chrysococcus

Ochromonadales

Dinobryaceae

Dinobryon

Bacillariophyceae

Centrales

Coscinodiscaceae

Coscinodiscus

Coscinodiscus rothu

Melosira

Melosira distans

Melosira granulata

Melosira herzogii

Melosira ambigua

Melosira variens

Melosira islandica

Cyclotella

Cyclotella meneghiniana

TABLE 2.2-2 (Cont'd)

SPECIES LIST OF PHYTOPLANKTON COLLECTED IN THE MISSISSIPPI RIVER IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 TO SEPTEMBER 1976
(Sheet 3 of 5)

Stephanodiscus

Stephanodiscus astrea

Pennales

Cymbellacea

Amphora

Cymbella

Fragilariaceae

Fragilaria

Synedra

Diatoma sp

Asterionella formosa

Eunotiaceae

Eunotia

Achnanthaceae

Achnanthes

Cocconeis

Naviculaceae

Gyrosigma sp

Gyrosigma kutziingii

Navicula

Navicula exigua

Pinnularia sp

Pleurosigma

Stauroneis

TABLE 2.2-2 (Cont'd)

SPECIES LIST OF PHYTOPLANKTON COLLECTED IN THE MISSISSIPPI RIVER IN THE VICINITY OF
WATERFORD 3 FROM JUNE 1973 TO SEPTEMBER 1976
(Sheet 4 of 5)

Gomphonemaceae

Gomphonema

Gomphonema constrictum

Nitzschiaceae

Nitzschia

Surirellaceae

Surirella

Cyanophyta

Chroococcales

Chroococcaceae

Anacystis

Merismopedia

Oscillatoriales

Oscillatoriaceae

Oscillatoria sp

Nostocales

Nostocaceae

Anabaena

Euglenophyta

Euglenales

Euglenaceae

Euglena sp

Euglena acus

Trachelomonas

TABLE 2.2-2 (Cont'd)

SPECIES LIST OF PHYTOPLANKTON COLLECTED IN THE MISSISSIPPI RIVER IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 TO SEPTEMBER 1976

(Sheet 5 of 5)

Trachelomonas hispida

Trachelomonas lacustris

Trachelomonas volvocina

TABLE 2.2-3

AVERAGE PHYTOPLANKTON DENSITIES IN SAMPLES COLLECTED IN THE MISSISSIPPI RIVER IN THE WATERFORD VICINITY FROM JUNE 1973 THROUGH MAY 1974 (YEAR I)

Month	Avg Total Density #/Liter	Dominant Taxa *
June, 1973	27,200	Cyclotella, Melosira
July, 1973	57,800	Cyclotella, Melosira, Scenedesmus
August, 1973	299,200	Coscinodiscus
September, 1973	719,100	Coscinodiscus, Melosira
October, 1973	59,500	Coscinodiscus, Scenedesmus, Cyclotella, Melosira
November, 1973	52,700	Coscinodiscus, Cyclotella, Melosira
December, 1973	34,000	Cyclotella, Melosira
February, 1974	40,800	Cyclotella, Melosira
March, 1974	51,000	Cyclotella, Melosira
April, 1974	45,960	Melosira, Trachelomonas
May, 1974	28,900	Cyclotella, Melosira
Average	128,742	

*20% or greater of average total density or most abundant

From: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-4

AVERAGE PHYTOPLANKTON DENSITIES IN SAMPLES COLLECTED IN THE MISSISSIPPI RIVER IN THE WATERFORD VICINITY FROM JUNE 1974 THROUGH FEBRUARY 1975 (YEAR II)

Month	Avg Total Density (#/Liter)	Dominant Taxa *	Number of Genera
June 1974	230,814	Chrysococcus Melosira	13
August 1974	479,417	Coscinodiscus	15
April 1975	348,098	Chrysococcus	9
February 1975	501,201	Chrysoccoccus	12
AVERAGE	389,882		

*20% or greater of average total density or most abundant.

From: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-5

AVERAGE PHYTOPLANKTON DENSITIES IN SAMPLES COLLECTED IN THE MISSISSIPPI RIVER IN THE WATERFORD VICINITY FROM OCTOBER 1975 THROUGH SEPTEMBER 1976 (YEAR III)

Month	Avg. Total Density (#/Liter)	Dominant Taxa*	Number of Genera
October 1975	56,751	Melosira	12
November 1975	24,541	Coscinodiscus; Melosira, Scendesmus quadricauda	9
December 1975	59,816	Coscinodiscus	6
January 1976	152,349	Coscinodiscus; Melosira	7
February 1976	119,636	Coscinodiscus; Melosira	11
March 1976	162,574	Coscinodiscus; Melosira	8
April 1976	1,446,815	Melosira	19
May 1976	320,548	Coscinodiscus; Melosira	9
June 1976	326,699	Melosira	15
July 1976	440,189	Coscinodiscus	12
September 1976	608,919	Coscinodiscus; Cyclotella; Melosira:	14
September 1976	162,579	Melosira; Cyclotella	14
AVERAGE	323,451		

* 20% or greater of average total density or most abundant.

From: Waterford 3 Environment Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-6

ATTACHED ALGAE COLLECTED IN THE MISSISSIPPI RIVER
IN THE VICINITY OF WATERFORD 3
FROM SPRING 1973 THROUGH SUMMER 1976
(Sheet 1 of 4)

Chlorophyta

Chlorophyceae

Chaetophorales

Chaetophoraceae

Stigeoclonium sp.

Chlorococcales

Chlorococcaceae

Chlorococcum sp.

Kentrosphaera gloeophia

Scenedesmaceae

Scenedesmus sp.

Hydrodictyaceae

Pediastrum

Chlamydomonadaceae

Chlamydomonas sp.

Oedogoniales

Oedogoniaceae

Bulbochaete sp.

Chrysophyta

Chrysophyceae

Chrominales

Chrysococcaceae

Chrysococcus sp.

TABLE 2.2-6 (Cont'd)

ATTACHED ALGAE COLLECTED IN THE MISSISSIPPI RIVER
IN THE VICINITY OF WATERFORD 3
FROM SPRING THROUGH SUMMER 1976
(Sheet 2 of 4)

Xanthophyceae

Tribonematales

Tribonemataceae

Tribonema sp.

Bacillariophyceae

Centrales

Coscinodiscaceae

Coscinodiscus

Cyclotella sp.

Melosira

Melosira herzogii

Melosira varians

Stephanodiscus sp.

Pennales

Cymbellacea

Amphora sp.

Cymbella sp.

Epithemiaceae

Epithemia sp.

Fragilariaceae

Diatoma sp.

Fragilaria sp.

Synedra sp.

TABLE 2.2-6 (Cont'd)

ATTACHED ALGAE COLLECTED IN THE MISSISSIPPI RIVER
IN THE VICINITY OF WATERFORD 3
FROM SPRING 1973 THROUGH SUMMER 1976
(Sheet 3 of 4)

Achnanthaceae

Achnanthes sp.

Cocconeis sp.

Rhoicosphenia sp.

Naviculacea

Diploneis sp.

Gyrosigma sp.

Navicula sp.

Pinnularia sp.

Stauroneis sp.

Gomphonemaceae

Gomphonema olivaceum

Gomphonema sp.

Nitzchiaceae

Hantzschia sp.

Nitzschia sp.

Nitzschia paradoxa

Surirellaceae

Surirella sp.

Cyanophyta

Chroococcales

Chroococcaceae

Anacystis sp.

Chroococcus sp.

TABLE 2.2-6 (Cont'd)

ATTACHED ALGAE COLLECTED IN THE MISSISSIPPI RIVER
IN THE VICINITY OF WATERFORD 3
FROM SPRING 1973 THROUGH SUMMER 1976
(Sheet 4 of 4)

Oscillatoriales

Oscillatoriaceae

Lyngbya sp.

Lyngbya aerugineo-caeulea

Lyngbya epiphytica

Lyngbya martensiana

Lyngbya putealis

Microcoleus sp.

Oscillatoria sp.

Porphyrosiphon sp.

Phormidium sp.

Nostocales

Nostocaceae

Anabaena sp.

Scytonemataceae

Plectonema sp.

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-7

ZOOPLANKTON COLLECTED IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 1 of 3)

Hydrozoa

Rotifera

Class Monogononta

Order Ploima

Asplanchna sp.

Brachionus sp.

Keratella sp.

Platyias quadricornis

Platyias sp.

Nematoda

Artnropoda

Class - Crustacea

Subclass - Brachiopoda

Order - Anostraca

Order - Cladocera

Sub Order - Calyptomera

Daphnia longiremis

Daphnia magna

Daphnia sp.

Ceriodaphnia recticulata

Ceriodaphnia sp.

Moina brachiata

Moina sp.

TABLE 2.2-7 (Cont'd)

ZOOPLANKTON COLLECTED IN THE VICINITY OF WATERFORD 3 FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 2 of 3)

Bosmina longirostris

Bosmina coregoni

Bosmina sp.

Alona sp.

Alonella rostrata

Alonopsis sp.

Camptocercus rectirostris

Chydorus sp.

Diaphanosoma branchyurum

Diaphanosoma sp.

Subclass - Ostracoda

Subclass - Copepoda

Order - Eucopepoda

Suborder - Calanoida

Eurytemora affinis

Diaptomus pallidus

Diaptomus siciloides

Diaptomus stagnalis

Diaptomus sicilis

Diaptomus sp.

Suborder - Cyclopoida

Cyclops bicuspidatus

Cyclops vernalis

Order - Harpacticoida

TABLE 2.2-7 (Cont'd)

ZOOPLANKTON COLLECTED IN THE VICINITY OF
WATERFORD 3 FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 3 of 3)

Subclass - Malacostraca

  Order - Decapoda

    Larvae

  Order - Amphipoda

    Family - Gammaridae

Class - Arachnida

  Order - Acarina

    Family - Pionidae

  Order - Hydracarina

Class - Insecta (Larvae)

  Order - Ephemeroptera

  Order - Coleoptera

  Order - Odonata

  Order - Plecoptera

  Order - Diptera

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-8

AVERAGE ZOOPLANKTON DENSITIES*, NUMBER PER M^3, BY STATION BY DATE IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3

YEAR	DATE	STATION Ac	At	Bc	Bt	Btl	Average Density
I	73 JUN 08**	2151.734	1580.130	1803.907	2005.236	2679.522	2044.106
	73 JUL 17	126.281	140.528	97.441	214.526	158.607	147.477
	73 AUG 22**	62.817	99.730	73.826	295.303	272.853	160.906
	73 SEP 28	647.594	1385.887	1944.685	2087.479	1901.405	1593.410
	73 OCT 25**	210.468	77.352	460.079	336.389	223.060	261.469
	73 NOV 30	201.474	314.514	239.250	221.261	248.244	244.949
	73 DEC 19	250.441	229.720	314.981	225.287	252.158	254.518
	74 FEB 13	980.525	744.519	701.260	873.192	459.180	751.735
	74 MAR 27	1475.952	1528.514	1384.779	1806.556	1448.072	1528.774
	74 APR 20	478.675	227.956	319.404	391.012	488.194	381.048
	74 APR 23	1181.860	1284.395	1576.604	1214.239	1118.899	1275.199
	74 MAY 17	3890.018	1991.789	743.248	3291.852	2133.284	2410.038
Average Year I		971.487	800.420	804.96	1080.194	948.623	
II	74 JUN 04	282.044	229.545	223.501	225.018	150.570	222.136
	74 JUN 24	95.196	100.219	148.189	79.112	77.409	100.025
	74 AUG 22	1727.880	4398.961	2395.663	7689.520	928.038	3428.012
	74 NOV 13	483.673	1189.501	508.609	7873.902	2774.520	2566.041
	75 FEB 26	756.809	247.172	399.953	416.015	825.766	529.143
	75 APR 23**	100.409	263.693	160.395	439.766	214.347	235.722
	75 AUG 08	268.163	168.986	297.409	443.718	380.032	311.662
Average Year II		530.596	942.582	590.531	2452.436	764.383	
III	75 OCT 30	123.350	52.613	436.986	314.618	38.785	193.270
	75 NOV 20	62.821	83.003	44.854	20.066	75.966	57.342
	75 DEC 22	32.400	108.214	59.537	28.711	208.136	87.400
	76 JAN 30	5.173	18.819	5.151	9.339	3.593	8.415
	76 FEB 26	.000	5.505	1.033	3.156	1.746	2.288
	76 MAR 25	327.820	233.666	402.086	407.337	7.238	275.629
	76 APR 29**	19.055	132.969	109.459	83.841	141.732	97.411
	76 MAY 27	113.404	225.532	197.259	153.344	182.504	174.408
	76 JUN 24	68.690	150.226	157.960	103.963	150.243	126.217
	76 JUL 29	225.149	69.174	632.122	925.233	504.507	471.237
	76 SEP 10	1434.406	527.145	1985.596	1571.616	1297.066	1363.166
	76 SEP 26	622.113	528.958	792.617	706.768	951.573	720.406
Average Year III		252.865	177.985	402.055	360.666	296.921	

* Densities do not include exoskeletons or fish larvae
** Sampled on more than one sampling day

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-9

AVERAGE ZOOPLANKTON DENSITIES*, NUMBER PER M^3, BY DEPTH BY DATE IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3

YEAR	DATE	DEPTH BOTTOM	MIDDLE	SURFACE
I	73 JUN 08**	1873.647	1912.684	2610.825
	73 JUL 17	208.676	*** .	86.277
	73 AUG 22**	114.624	*** .	142.384
	73 SEP 28	1859.862	1533.778	1386.583
	73 OCT 25**	236.113	213.706	334.590
	73 NOV 30	289.258	226.485	219.102
	73 DEC 19	237.823	246.508	279.222
	74 FEB 13	581.117	805.472	868.617
	74 MAR 27	1297.430	1460.969	1827.916
	74 APR 20	379.086	461.601	302.458
	74 APR 23	909.869	1279.451	1636.270
	74 MAY 17	2623.901	2066.302	2539.909
Average for Year I		884.283	1020.694	1019.512
II	74 JUN 04	135.468	221.683	309.256
	74 JUN 24	108.332	76.722	115.021
	74 AUG 22	4795.270	1886.575	3131.446
	74 NOV 13	3989.266	1032.594	2754.666
	75 FEB 26	295.934	401.913	849.549
	75 APR 23**	423.632	126.678	134.706
	75 AUG 08	307.107	426.168	201.709
Average for Year II		1436.428	596.047	1070.906
III	75 OCT 30	100.819	35.262	422.642
	75 NOV 20	81.333	35.082	40.479
	75 DEC 22	130.086	48.887	74.657
	76 JAN 30	5.000	6.462	12.126
	76 FEB 26	.979	.914	4.236
	76 MAR 25	310.475	181.519	295.204
	76 APR 29**	110.553	117.070	81.034
	76 MAY 27	189.538	192.468	150.419
	76 JUN 24	136.841	212.820	55.137
	76 JUL 29	468.616	958.820	310.938
	76 SEP 10	2000.256	1496.035	799.306
	76 SEP 26	794.923	1076.422	490.228
Average for Year III		360.785	363.480	228.034

* Densities do not include exoskeletons or fish larvae
** Samples on more than one sampling date
*** No sample taken
Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-10

AVERAGE DENSITIES*, NUMBERS PER M^3, OF DOMINANT ZOOPLANKTON TAXA IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3

ZOOPLANKTON GROUP

YEAR	DATE	BOSMINA SP.	CERIODAPHNIA SP.	DAPHNIA SP.	DECAPODA LARVAE	DIAPHANOSOMA SP.	MOINA SP.	SUBORDER CALANOIDA	SUBORDER CYCLOPOIDA
I	73 JUN 08**	85.278	101.692	228.935	9.091	.000	.000	820.476	862.410
	73 JUL 17	.000	1.025	.993	33.027	.000	.000	39.033	68.962
	73 AUG 22**	.000	.000	.000	7.771	.000	.000	66.486	60.195
	73 SEP 28	591.511	109.854	259.865	.720	.000	.000	185.701	412.575
	73 OCT 25**	1.770	.360	2.446	.000	.000	.000	220.801	34.682
	73 NOV 30	44.785	8.145	29.868	.000	.000	.000	99.607	62.183
	73 DEC 19	44.423	12.975	44.842	.000	.000	.000	79.727	70.577
	74 FEB 13	68.815	38.909	103.283	.000	.000	.000	214.031	325.845
	74 MAR 27	119.268	56.026	84.571	.000	.000	.000	680.059	585.786
	74 APR 20	61.025	4.881	9.588	.000	.000	.000	81.812	220.428
	74 APR 23	138.744	37.867	48.577	.000	.000	.000	323.532	722.367
	74 MAY 17	299.345	15.592	237.192	1.212	.000	.000	848.203	1006.413
II	74 JUN 04	.000	1.798	7.425	11.990	.000	.000	97.714	99.979
	74 JUN 24	.860	.687	38.277	2.873	.000	.000	37.397	19.223
	74 AUG 22	139.324	232.268	135.890	.867	.000	.000	13.804	2961.953
	74 NOV 13	146.515	11.969	19.369	.000	10.627	.000	2207.900	402.447
	75 FEB 26	88.771	70.821	6.903	.000	.187	.000	88.171	270.836
	75 APR 23**	37.728	57.007	9.475	.000	2.083	.000	31.052	94.815
	75 AUG 08	1.609	7.158	.000	1.516	36.442	.000	56.724	205.923
III	75 OCT 30	127.194	1.146	6.023	.000	1.284	.000	39.736	32.127
	75 NOV 20	7.937	.459	7.056	.000	.000	.000	16.861	22.429
	75 DEC 22	13.409	.003	4.230	.000	.000	.000	16.166	41.009
	76 JAN 30	.000	.000	4.131	.000	.000	.000	3.208	.402
	76 FEB 26	.040	.165	.447	.000	.000	.000	.486	.656
	76 MAR 25	41.992	7.526	27.146	.000	.567	.000	62.310	133.386
	76 APR 29**	39.660	.145	7.656	.000	.000	.000	18.877	33.791
	76 MAY 27	7.941	1.137	5.631	.000	.410	.000	18.921	135.513
	76 JUN 24	.000	1.581	.213	.000	11.551	.000	57.615	49.072
	76 JUL 29	.000	4.552	1.539	.000	6.403	456.646	17.088	31.480
	76 SEP 10	124.016	.274	9.861	.000	2.436	164.476	25.917	1093.319
	76 SEP 26	413.466	2.247	45.346	.000	2.158	155.645	12.567	111.096

* Densities do not include exoskeletons
** Samples on more than one sampling day

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-11

RANK* OF AVERAGE ZOOPLANKTON DENSITIES, BY STATION BY DATE
COLLECTED IN THE VICINITY OF WATERFORD 3

Year/Date		Station Rank Ac	At	Bc	Bc	Btl
I	June 8, 1973	4	1	2	3	5
	July 17, 1973	2	3	1	5	4
	August 22, 1973	1	3	2	5	4
	September 28, 1973	1	2	4	5	3
	October 25, 1973	2	1	5	4	3
	November 30, 1973	1	5	3	2	4
	December 19, 1973	3	2	5	1	4
	February 13, 1974	5	3	2	4	1
	March 27, 1974	3	4	1	5	2
	April 20, 1974	4	1	2	3	5
	April 23, 1974	2	4	5	3	1
	May 17, 1974	5	2	1	4	3
II	June 4, 1974	5	4	2	3	1
	June 24, 1974	3	4	5	2	1
	August 22, 1974	2	4	3	5	1
	November 13, 1974	1	3	2	5	4
	February 26, 1975	4	1	2	3	5
	April 23, 1975	1	4	2	5	3
	August 8, 1975	2	1	3	5	4
III	October 30, 1975	3	2	5	4	1
	November 20, 1975	3	5	2	1	4
	December 22, 1975	2	4	3	1	5
	January 30, 1976	3	5	2	4	1
	February 26, 1976	1	5	2	4	3
	March 25, 1976	3	2	4	5	1
	April 29, 1976	1	4	3	2	5
	May 27, 1976	1	5	4	2	3
	June 24, 1976	1	3	5	2	4
	July 29, 1976	2	1	4	5	3
	September 10, 1976	3	1	5	4	2
	September 26, 1976	2	1	4	3	5
Sum of Ranks		76	90	95	109	95
Sum of Ranks Squared		5776	8100	9025	11881	9025

1

$X_r^2 = 7$

Fail to Reject H_0: i.e., stations were not significantly different with respect to the number of zooplankters per cubic meter.

*Stations were ranked by date, according to the average number of zooplankton per cubic meter.

Source: Siegel S. Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill Book Company Inc., 1956.

TABLE 2.2-12

RANK* OF AVERAGE ZOOPLANKTON DENSITIES, BY DEPTH BY DATE COLLECTED IN THE VICINITY OF WATERFORD 3

		DEPTH		
	Year/Date	Bottom	Middle	Surface
I	June 8, 1973	1	2	3
	September 28, 1973	3	2	1
	October 25, 1973	2	1	3
	November 30, 1973	3	2	1
	December 19, 1973	1	2	3
	February 13, 1974	1	2	3
	March 27, 1974	1	2	3
	April 20, 1974	2	3	1
	April 23, 1974	1	2	3
	May 17, 1974	3	1	2
II	June 4, 1974	1	2	3
	June 24, 1974	2	1	3
	August 22, 1974	3	1	2
	November 13, 1974	3	1	2
	February 26, 1975	1	2	3
	April 23, 1975	3	1	2
	August 8, 1975	3	2	1
III	October 30, 1975	2	1	3
	November 20, 1975	3	1	2
	December 22, 1975	3	1	2
	January 30, 1976	1	2	3
	February 26, 1976	2	1	3
	March 25, 1976	3	1	2
	April 29, 1976	2	3	1
	May 27, 1976	2	3	1
	June 24, 1976	2	3	1
	July 29, 1976	2	3	1
	September 10, 1976	3	2	1
	September 26, 1976	2	3	1
Sum of Ranks		61	53	60
Sum of Ranks Squared		3721	2809	3600

$\chi_r^2 = 1.49$

Fail to Reject H_0: i.e., depths were not significantly different with respect to the number of zooplankton per cubic meter.

*Depths were ranked by date, according to the average number of zooplankton per cubic meter (ties were averaged).

Source: Siegel S. Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill Book Company Inc., 1956.

1

TABLE 2.2-13 | 1

MACRO AND MICROBENTHIC ORGANISMS COLLECTED
IN THE VICINITY OF WATERFORD 3
FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 1 of 4)

PROTOZOA

Order - Foraminiferida

COELENTERATA

Class - Hydrozoa

Order - Hydroida

Family - Hydridae

Hydra sp.

PLATYHELMINTHES

Class - Turbellaria

Order - Tricladia

Family - Planariidae

Dugesia trigena

Order - Rhabdocoela

Family - Catenulidae

Stenostomum sp

NEMATODA

ANNELIDA

Class - Oligochaeta (Clitellata)

Order - Plesiopora

Family - Naididae

Family - Enchytraeidae

Family - Tubificidae

Branchiura sowerbyi

Class - Hirundinea

TABLE 2.2-13 (Cont'd) 1

MACRO AND MICROBENTHIC ORGANISMS COLLECTED
IN THE VICINITY OF WATERFORD 3
FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 2 of 4)

Order - Pharyngobdellida

Family - Erpobdellidae

Erpobdella punctata

MOLLUSCA

Class - Gastropoda

Order - Ctenobranchiata

Family - Viviparidae

Viviparus intertextus

Family - Amnicolidae

Amnicola sp.

Family - Pleuroceridae

Goniobasis sp.

Pleurocera sp.

Order - Pulmonata

Family - Physidae

Physa sp.

Family - Planorbidae

Parapholyx sp.

Gyraulus sp.

Family - Lymnaeidae

Limnaea sp.

Class - Pelecypdoda

Order - Herterodonta

Family - Corbiculidae

TABLE 2.2-13 (Cont'd) | 1

MACRO AND MICROBENTHIC ORGANISMS COLLECTED
IN THE VICINITY OF WATERFORD 3
FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 3 of 4)

Corbicula sp.

Corbicula manillensis

Family - Sphaeriidae

Musculium sp.

Pisidium sp.

ARTHROPODA

Class - Arachnida

Class - Crustacea

Subclass - Malacostraca

Order - Isopoda

Order - Amphipoda

Gammarus sp.

Order - Decapoda

Family - Palaemonidae

Subclass - Copepoda

Class - Insecta

exoskeleton

larvae

Order - Hymenoptera

Order - Ephemeroptera

Order - Odonata

Suborder - Anisoptera

Order - Coleoptera

Order - Hemiptera

TABLE 2.2-13 (Cont'd) 1

MACRO AND MICROBENTHIC ORGANISMS COLLECTED
IN THE VICINITY OF WATERFORD 3
FROM JUNE 1973 THROUGH SEPTEMBER 1976
(Sheet 4 of 4)

Family - Corixidae

Order - Trichoptera

Order - Diptera

adult

larvae

Family - Chironomidae

Family - Culicidae

Order - Dermaptera

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-14 | 1

DENSITY* OF BENTHIC MACROINVERTEBRATES COLLECTED BY SHIPEK SAMPLER
IN THE VICINITY OF WATERFORD 3
BEFORE START-UP OF WATERFORD 1 AND 2
(Sheet 1 of 4)

	DATE	STATION Ac	At	Bc	Bt	Bt1
YEAR I	73 JUN 08	. (1)	.	350.00	.	.
	73 JUL 11**	100.00	25.00	12.50	.	25.00
	73 JUL 29	.	.	.	140.00	.
	73 AUG 22**	.00 (2)	29.17	37.50	4.17	4.17
	73 SEP 29	12.50	15.00	55.00	62.50	31.25
	73 OCT 27**	20.83	16.67	8.33	.00	8.33
	73 NOV 29	66.67	29.17	16.67	.	4.17
	73 DEC 21	25.00	105.00	33.33	8.33	8.33
	74 JAN 21	.00	79.17	.00	183.33	.00
	74 FEB 14	.00	.00	.00	.00	.00
	74 MAR 26	4.17	.00	.00	8.33	4.17
	74 APR 24	.	25.00	15.00	.	.00
YEAR II	74 JUN 26	.00	500.00	25.00	4.17	35.00
	74 AUG 20	25.00	.00	37.50	58.33	416.67
	74 NOV 13**	16.67	29.17	29.17	.00	.00
	75 FEB 27	20.83	50.00	1258.33	91.67	191.67
	75 APR 22	12.50	79.17	937.50	116.67	179.17
	AVERAGE***	21.73	65.50	175.99	52.12	60.53

* Density expressed in terms of number/m^2
** Samples taken over more than one date
*** Density excluded adult and terrestrial insects, exoskeletons, and shell fragments

(1) . = no sample collected
(2) .00 = no organisms in sample

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-14 | 1

DENSITY* OF BENTHIC MACROINVERTEBRATES COLLECTED BY SHIPEK SAMPLER IN THE VICINITY OF WATERFORD 3 BEFORE START-UP OF WATERFORD 1 AND 2
(Sheet 2 of 4)

DIPTERA***

DATE	STATION Ac	At	Bc	Bt	Bt1
73 JUL 11**	.00 (1)	.00	6.25	.	.00
73 JUL 29	. (2)	.	.	5.00	.
73 SEP 29	6.25	5.00	5.00	4.17	25.00
73 OCT 27**	8.33	4.17	4.17	.00	.00
73 NOV 29	16.67	.00	.00	.	.00
73 DEC 21	.00	5.00	4.17	.00	.00
74 JAN 21	.00	4.17	.00	8.33	.00
74 APR 24	.	12.50	.00	.	.00
74 JUN 26	.00	.00	.00	4.17	.00
75 FEB 27	.00	.00	4.17	25.00	4.17
75 APR 22	.00	.00	.00	8.33	.00
AVERAGE	2.23	2.06	1.48	4.23	1.94

* Density expressed in terms of number/m^2
** Samples taken over more than one date
*** Only dates with organisms collected are listed. For all dates sampled see Sheet 1 of this Table.

(1) 00 = no organisms in sample
(2) . = no sample collected

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-14 | 1

(Sheet 3 of 4)

DENSITY* OF BENTHIC MACROINVERTEBRATES COLLECTED BY SHIPEK SAMPLER
IN THE VICINITY OF WATERFORD 3
BEFORE START-UP OF WATERFORD 1 AND 2

OLIGOCHAETES***

	STATION				
DATE	Ac	At	Bc	Bt	Bt1
73 JUN 08	. (1)	.	350.00	.	.
73 JUL 11**	50.00	16.67	.00 (2)	.	.00
73 JUL 29	.	.	.	85.00	.
73 SEP 29	.00	5.00	.00	12.50	.00
73 OCT 27**	.00	12.50	.00	.00	.00
73 NOV 29	33.33	.00	4.17	.	.00
73 DEC 21	.00	90.00	4.17	8.33	8.33
74 JAN 21	.00	75.00	.00	175.00	.00
74 MAR 26	.00	.00	.00	4.17	.00
74 JUN 26	.00	475.00	25.00	.00	30.00
74 AUG 20**	16.67	.00	33.33	54.17	391.67
74 NOV 13	12.50	29.17	.00	.00	.00
75 FEB 27	16.67	45.83	1120.83	50.00	187.50
75 APR 22	12.50	79.17	929.17	104.17	175.00
AVERAGE	10.12	55.22	154.17	37.95	52.83

* Density expressed in terms of number/m^2
** Samples taken over more than one date
*** Only dates with organisms collected are listed. For all dates sampled, see Sheet 1 of this Table.

(1) . = no sample collected
(2) .00 = no organisms in sample

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-14

(Sheet 4 of 4)

DENSITY* OF BENTHIC MACROINVERTEBRATES COLLECTED BY SHIPEK SAMPLER
IN THE VICINITY OF WATERFORD 3
BEFORE START-UP OF WATERFORD 1 AND 2

CORBICULIDAE***

DATE	STATION Ac	At	Bc	Bt	Btl
73 JUL 29	.(1)	.	.	40.00	.
73 SEP 29	.00(2)	.00	25.00	20.83	6.25
73 OCT 27**	4.17	.00	.00	.00	.00
73 NOV 29	4.17	8.33	4.17	.	4.17
73 DEC 21	.00	.00	4.17	.00	.00
74 MAR 26	.00	.00	.00	4.17	.00
74 NOV 13	.00	.00	16.67	.00	.00
75 FEB 27	.00	.00	116.67	.00	.00
75 APR 22	.00	.00	.00	.00	4.17
AVERAGE	0.60	0.56	10.42	5.00	0.97

EPHEMEROPTERA***

DATE	STATION Ac	At	Bc	Bt	Btl
73 AUG 22**	.00	29.17	25.00	4.17	.00
73 SEP 29	.00	.00	15.00	.00	.00
AVERAGE	0	1.94	2.50	0.32	0

* Density expressed in terms of number/m^2
** Samples taken over more than one date
*** Only dates and stations with organisms collected are listed. For all dates and stations sampled, see Sheet 1 of this Table.

(1) . = no sample collected
(2) .00 = no organisms in sample

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

1

TABLE 2.2-15

AVERAGE DENSITIES [a] OF BENTHIC MACROINVERTEBRATES BY DATE
IN SAMPLES COLLECTED BY SHIPEK SAMPLER
IN THE VICINITY OF WATERFORD 3

	DATE	BENTHIC GROUP					
		CORBICULIDAE	DIPTERA	EPHEMEROPTERA	OLIGOCHAETES	OTHER [d]	TOTAL
YEAR I	73 JUN 08 [b]	.00	.00	.00	350.00	.00	350.00
	73 JUL 11 [b,c]	.00	1.56	.00	16.67	20.31	38.54
	73 JUL 29 [b]	40.00	5.00	.00	85.00	10.00	140.00
	73 AUG 22 [c]	.00	.00	11.67	.00	3.33	15.00
	73 SEP 29	10.42	9.08	3.00	3.50	6.33	32.33
	73 OCT 29	.83	3.33	.00	2.50	2.50	9.17
	73 NOV 29 [b]	5.21	4.17	.00	9.37	8.33	27.08
	73 DEC 21 [b]	.83	1.83	.00	22.17	10.17	35.00
	74 JAN 21	.00	2.50	.00	50.00	.00	52.50
	74 FEB 14	.00	.00	.00	.00	.00	.00
	74 MAR 26	.83	.00	.00	.83	.00	1.67
	74 APR 24 [b]	.00	4.17	.00	.00	1.39	5.56
YEAR II	74 JUN 26	.00	.83	.00	106.00	6.00	112.83
	74 AUG 20 [c]	.00	.00	.00	99.17	5.83	105.00
	74 NOV 13	3.33	.00	.00	8.33	2.50	14.17
	75 FEB 27	23.33	6.67	.00	284.17	5.83	320.00
	75 APR 22	.83	1.67	.00	260.00	1.67	264.17
	75 AUG 07	.00	3.33	.00	55.83	.00	59.17
YEAR III	75 OCT 28 [c]	79.17	8.33	.00	75.00	.83	163.33

(a) Densities expressed in terms of number/m^2
(b) At least one sample taken on these dates was not verifiable (see Sections 6.1.1.2 and 2.2.2).
(c) Samples taken on more than one date
(d) Other excluded adult and terrestrial insects, exoskeletons and shell fragments

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-16 1
(Sheet 1 of 2)

DENSITIES* OF BENTHIC MACROINVERTEBRATES IN SAMPLES COLLECTED BY SHIPEK SAMPLER IN THE VICINITY OF WATERFORD 3 AFTER START-UP OF WATERFORD 1 AND 2

TOTALS***

	DATE	STATION Ac	At	Bc	Bt	Btl
	75 AUG 07	.00	.00	70.83	216.67	8.33
	75 OCT 28**	25.00	62.50	220.83	237.50	275.00

OLIGOCHAETES+

	DATE	STATION Ac	At	Bc	Bt	Btl
OLIGOCHAETES	75 AUG 07	.00	.00	70.83	200.00	8.33
	75 OCT 28**	12.50	41.67	.00	45.83	275.00

CORBICULIDAE+

	DATE	STATION Ac	At	Bc	Bt
CORBICULIDAE	75 OCT 28**	4.17	8.33	208.33	175.00

*Density expressed in terms of number/m^2
**Samples taken on more than one date
***Total excluded terrestrial and adult insects, exoskeletons, and shell fragments.

+ Only dates and stations where organisms were collected are listed, however, "TOTALS" includes all dates and stations sampled.

TABLE 2.2-16 | 1
(Sheet 2 of 2)

DENSITIES* OF BENTHIC MACROINVERTEBRATES IN SAMPLES COLLECTED BY SHIPEK SAMPLER IN THE VICINITY OF WATERFORD 3 AFTER START-UP OF WATERFORD 1 AND 2

DIPTERA LARVAE+

		STATION			
	DATE	Ac	At	Bc	Bt
DIPTERA	75 AUG 07	.00	.00	.00	16.67
	75 OCT 28**	8.33	8.33	12.50	12.50

*Density expressed in terms of number/m^2
**Samples taken on more than one date.
***Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

+ Only dates and Stations where organisms were collected are listed, however "TOTALS" (given on Sheet 1) includes all dates and stations sampled.

TABLE 2.2-17

AVERAGE DENSITIES [(a)] OF BENTHIC MICROINVERTEBRATES [(b)] BY DATE
IN SAMPLES COLLECTED BY SHIPEK SAMPLER
IN THE VICINITY OF WATERFORD 3

BENTHIC GROUP

	DATE	CORBICULIDAE	DIPTERA	EPHEMEROPTERA	INSECTA-OTHER	OLIGOCHAETES	OTHER[(d)]	TOTAL
YEAR I	73 JUN 08	.00*	.00	.00	.00	.00	.00	.00
	73 JUL 11[(c)]	54.17	.00	.00	.00	4.17	.00	58.33
	73 JUL 29	16.67	12.50	.00	2.08	18.75	14.58	64.58
	73 AUG 22[(c)]	.83	8.50	15.00	6.33	6.67	13.33	50.57
	73 SEP 29	.00	.00	.00	8.33	.00	.00	8.33
	73 OCT 27[(c)]	.00	3.33	.00	.00	23.33	1.67	28.33
	73 NOV 29	.00	3.00	.00	.00	42.00	7.00	52.00
	73 DEC 21	.00	4.83	.00	.00	8.17	1.00	14.00
	74 JAN 21	.00	7.50	.00	.00	27.50	.00	35.00
	74 FEB 14	.00	.00	.00	.00	1.67	.00	1.67
	74 MAR 26	.00	.00	.00	2.50	.00	.00	2.50
	74 APR 24	.00	.00	.00	.00	.00	3.13	3.13
YEAR II	74 JUN 26	.00	4.17	.00	.00	4.17	.00	8.33
YEAR III	75 OCT 28[(c)]	7.50	.00	.00	.00	17.50	2.50	27.50
	76 JAN 28	.00	.00	.00	.00	.00	.00	.00
	76 APR 27[(c)]	2.50	.00	.00	.00	7.50	.00	10.00
	76 JUL 27	.00	.00	.00	.00	117.50	2.50	120.00

(a) Density expressed in terms of number/m^2
(b) Those invertebrates collected in a #80 sieve (see Section 6.1.1.2)
(c) Samples collected on more than one date
(d) Excludes adult and terrestrial insects, exoskeletons, and shell fragments

* .00 = No organisms in sample.

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

1

TABLE 2.2-18

AVERAGE DENSITIES[(a)] OF BENTHIC MACROINVERTEBRATES BY DATE IN SAMPLES COLLECTED BY SMITH-MCINTYRE SAMPLER IN THE VICINITY OF WATERFORD 3

	BENTHIC GROUP				
DATE	CORBICULIDAE	DIPTERA	OLIGOCHAETES	OTHER[(c)]	TOTAL
74 AUG 20[(b)]	.00*	.00	603.33	16.67	62.000
74 NOV 13	.00	.00	.67	2.00	2.67
75 APR 22	.00	1.00	340.67	.33	342.00
75 AUG 07	.33	.00	41.00	1.00	42.33
75 OCT 28[(b)]	66.00	8.33	9.33	3.00	86.67

(a) Density expressed in terms of number/m^2
(b) Samples taken on more than one date
(c) Excluding adult and terrestrial insects, exoskeletons and shell fragments

* .00 = no organisms in sample

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-19 1

FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE; TESTING THE NULL HYPOTHESIS (H_o) of EQUAL OLIGOCHAETE CONCENTRATIONS AT 5 WATERFORD STATIONS

ALL DATA

Year I	Station* Ac	At	Bc	Bt	Bt_1
Aug 22, 1973	3	3	3	3	3
Sept 29, 1973	2	4	2	5	2
Oct 27, 1973	2.5	5	2.5	2.5	2.5
Dec 21, 1973	1	5	2	3.5	3.5
Jan 21, 1974	2	4	2	5	2
Feb 14, 1974	3	3	3	3	3
March 26, 1974	2.5	2.5	2.5	5	2.5
Sum of Ranks	16	26.5	17	27	18.5
Sum of Ranks Squared	256	702.25	289	729	342.25

$$X_r^2 = 6.15$$

Fail to Reject H_o: i.e., stations were not significantly different with respect to the number of oligochaete per sq. meter.

* Stations were ranked by date, according to the average number oligochaete per square meter (ties were averaged). Source: Siegel S. Nonparametric Statistics For the Behavioral Sciences. McGraw Hill Book Company, Inc. 1956.

TABLE 2.2-20 | 1

SPECIES OF FISH COLLECTED IN THE VICINITY OF WATERFORD 3 APRIL 1973 THROUGH SEPTEMBER 1976
(Sheet 1 of 4)

Osteichtyes

Acipenseriformes

Acipenseridae

Scaphirhynchus albus (Pallid Sturgeon)
Scaphirhynchus platorynchus (Shovenlose Sturgeon)

Polyodonitidae

Polyodon spathula (Paddlefish)

Semionotiformes

Lepisosteidae

Lepisosteus oculatus (Spotted Gar)
Lepisosteus osseus (Longnose Gar)
Lepisosteus platostomus (Shortnose Gar)
Lepisosteus spatula (Alligator Gar)

Amiiformes

Amiidae

Amia calva (Bowfin)

Elopiformes

Elopidae

Elops saurus (Lady Fish)

Anguilliformes

Anguillidae

Anguilla rostrata (American Eel)

Clupeiformes

Clupeidae

Alosa chysochloris (Skipjack Herring)
Brevoortia patronus (Gulf Menhaden)
Dorosoma cepedianum (Gizzard Shad)
Dorosoma petenense (Threadfin Shad)

TABLE 2.2-20 | 1

SPECIES OF FISH COLLECTED IN THE VICINITY OF WATERFORD 3 APRIL 1973 THROUGH SEPTEMBER 1976
(Sheet 2 of 4)

Engraulidae

Anchoa mitchilli (Bay Anchovy)

Osteoglossiformes

Hiodontidae

Hiodon alosoides (Goldeye)
Hiodon tergisus (Mooneye)

Cypriniformes

Cyprinidae

Cyprinus carpio (Carp)
Hybognathus nuchalis (Silvery Minnow)
Hybopsis aestivalis (Speckled Chub)
Hybopsis amblops (Bigeye Chub)
Hybopsis storeriana (Silver Chub)
Notemigonus crysoleucas (Golden Shiner)
Notropis atherinoides (Emerald Shiner)
Notropis blennius (River Shiner)
Notropis emiliae (Pugnose Minnow)
Notropis fumeus (Ribbon Shiner)
Notropis shumardi (Silverband Shiner)
Notropis venustus (Blacktail Shiner)
Pimephales vigilax (Bullhead Minnow)

Catostomidae

Carpiodes carpio (River Carpsucker)
Carpiodes cyprinus (Quillback)
Ictiobus bubalus (Smallmouth Buffalo)
Ictiobus cyprinellus (Bigmouth Buffalo)

Siluriformes

Ictaluridae

Ictalurus furcatus (Blue Catfish)
Ictalurus melas (Black Bullhead)
Ictalurus natalis (Yellow Bullhead)
Ictalurus nebulosus (Brown Bullhead)
Ictalurus punctatus (Channel Catfish)
Pylodictis olivaris (Flathead Catfish)

Atheriniformes

TABLE 2.2-20 1

SPECIES OF FISH COLLECTED IN THE VICINITY OF WATERFORD 3 APRIL 1973 THROUGH SEPTEMBER 1976
(Sheet 3 of 4)

Poeciliidae

Gambusia affinis (Mosquito Fish)

Atherinidae

Menidia audens (Mississippi Silverside)

Perciformes

Percichthyidae

Morone chrysops (White Bass)
Morone mississippiensis (Yellow Bass)
Morone saxatilis (Striped Bass)

Centrarchidae

Elassoma zonatum (Banded Pygmy Sunfish)
Lepomis cyanellus (Green Sunfish)
Lepomis gulosus (Warmouth)
Lepomis macrochirus (Bluegill)
Lepomis megalotis (Longear Sunfish)
Lepomis microlophus (Redear Sunfish)
Micropterus punctulatus (Spotted Bass)
Micropterus salmoides (Largemouth Bass)
Pomoxis annularis (White Crappie)
Pomoxis nigromaculatus (Black Crappie)

Percidae

Percina sciera (Dusky Darter)
Stizostedion canadense (Sauger)

Sciaenidae

Aplodinotus grunniens (Freshwater Drum)

Mugilidae

Mugil cephalus (Striped Mullet)

Pleuronectiformes

Bothidae

TABLE 2.2-20 1

SPECIES OF FISH COLLECTED IN THE VICINITY OF WATERFORD 3 APRIL 1973 THROUGH SEPTEMBER 1976
(Sheet 4 of 4)

Paralichthys lethostigma (Southern Flounder)

Soleidae

Trinectes maculatus

1

TABLE 2.2-21
TOTAL NUMBERS AND WEIGHTS OF FISH COLLECTED BY ALL GEARS
DURING YEARS I, II, AND III, IN THE VICINITY OF WATERFORD 3
(Sheet 1 of 2)

COMMON NAME	YEAR I		YEAR II		YEAR III	
	NUMBER	WEIGHT*	NUMBER	WEIGHT	NUMBER	WEIGHT
ALLIGATOR GAR	2	856.1	0	.	2	9,706.2
AMERICAN EEL	7	3,444.3	2	276.3	2	363.3
BAY ANCHOVY	1	2.5	0	.	133	301.4
BIGEYE CHUB	3	3.7	0	.	0	.
BIGMOUTH BUFFALO	5	2,755.2	7	3,415.0	1	1,866.0
BLACK BULLHEAD	1	33.8	6	552.4	0	.
BLACK CRAPPIE	10	871.6	6	763.3	12	2,324.2
BLACKTAIL SHINER	0	.	0	.	1	.6
BLUE CATFISH	553	66,320.4	76	20,708.1	1451	142,947.8
BLUEGILL	40	1,305.4	20	1,045.7	42	1,024.8
BOWFIN	1	1,918.0	0	.	0	.
BROWN BULLHEAD	5	2,202.8	0	.	0	.
BULLHEAD MINNOW	1	3.4	0	.	1	1.7
CARP	17	12,933.6	34	50,575.6	20	37,230.1
CHANNEL CATFISH	82	12,140.2	15	2,984.8	41	9,192.8
DUSKY DARTER	1	259.6	0	.	0	.
EMERALD SHINER	0	.	1	6.1	2	4.9
FLATHEAD CATFISH	10	7,468.4	8	2,528.4	11	6,948.3
FRESHWATER DRUM	368	9,336.9	24	2,624.9	403	25,381.3
GIZZARD SHAD	2451	97,214.6	799	75,096.6	1111	199,627.3
GOLDEYE	10	320.7	3	763.7	5	647.9
GREEN SUNFISH	0	.	35	764.4	0	.
GULF MENHADEN	6	168.1	0	.	91	3,163.1
HOGCHOKER	0	.	0	.	3	9.5
IMMATURE SUCKER	0	.	0	.	2	1.2
LADYFISH	0	.	1	86.4	4	675.8
LARGEMOUTH BASS	8	1,957.7	9	4,000.8	7	3,873.9
LONGEAR SUNFISH	1	13.9	0	.	5	162.1
LONGNOSE GAR	5	1,481.3	5	2,647.2	5	5,951.7
MISSISSIPPEE SILVERSIDE	0	.	2	6.4	1	4.7
MOONEYE	1	4.1	0	.	0	.
MOSQUITOFISH	0	.	1	.7	0	.
PADDLEFISH	6	261.1	0	.	1	1,289.1
PALLID STURGEON	3	360.4	0	.	1	144.4
PUGNOSE MINNOW	0	.	0	.	1	0.7
PYGMY SUNFISH	1	0.1	0	.	0	.
QUILLBACK CARPSUCKER	0	.	0	.	1	274.2
REDEAR SUNFISH	1	45.0	0	.	0	.
RIBBON SHINER	0	.	0	.	3	2.9
RIVER CARPSUCKER	50	9,918.6	7	1,758.5	13	5,567.1
RIVER SHINER	0	.	0	.	3	4.0
SAUGER	8	683.8	0	.	3	1,238.8
SHORTNOSE GAR	3	3,371.0	3	1,816.5	3	1,620.5

TABLE 2.2-21 (Cont'd) 1

TOTAL NUMBERS AND WEIGHTS OF FISH COLLECTED BY ALL GEARS DURING YEARS I, II, AND III, IN THE VICINITY OF WATERFORD 3

(Sheet 2 of 2)

COMMON NAME	YEAR I NUMBER	YEAR I WEIGHT*	YEAR II NUMBER	YEAR II WEIGHT	YEAR III NUMBER	YEAR III WEIGHT
SHOVELNOSE STURGEON	22	1,954.3	2	2.0	5	1,796.310
SILVER CHUB	20	92.4	1	9.9	7	43.800
SILVERBAND SHINER	3	4.8	0	.	1	2.000
SILVERY MINNOW	0	.	0	.	3	5.230
SKIPJACK HERRING	130	13,697.4	48	5,364.0	71	9,227.530
SMALLMOUTH BUFFALO	24	7,802.2	14	10,229.0	10	12,950.270
SOUTHERN FLOUNDER	0	.	0	.	10	7,157.790
SPECKLED CHUB	3	4.1	0	.	1	.400
SPOTTED BASS	0	.	1	1.9	0	.
SPOTTED GAR	4	4,237.7	5	1,991.9	8	3,837.600
STRIPED BASS	20	3,589.7	6	3,685.5	10	10,626.680
STRIPED MULLET	233	49,229.2	497	75,656.2	467	84,013.085
THREAD FIN SHAD	1058	6,434.5	387	2,078.7	222	2,796.610
WARMOUTH	0	.	1	38.6	1	6.770
WHITE BASS	10	782.0	7	1,044.1	14	4,036.290
WHITE CRAPPIE	19	2,200.2	4	226.6	1	156.670
YELLOW BASS	2	94.7	2	203.7	1	111.900
YELLOW BULLHEAD	1	1.3	0	.	0	.

* Expressed in grams

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

1

TABLE 2.2-22

TOTAL NUMBERS AND WEIGHTS OF FISH COLLECTED PER UNIT EFFORT* EACH MONTH DURING YEARS I, II, III IN THE VICINITY OF WATERFORD 3

YEAR AND MONTH	AVERAGE NUMBER**	AVERAGE WEIGHT***
73 APR(1)	1.0	379.7
73 JUN	14.3	9,741.8
73 JUL(2)	12.6	897.1
73 AUG	25.4	4,875.9
73 SEP	92.4	12,754.4
73 OCT	32.2	3,955.6
73 NOV	62.7	9,119.4
73 DEC	27.1	5,968.7
74 JAN	19.5	4,687.8
74 FEB	11.8	2,637.6
74 MAR(1)	34.3	8,791.2
74 APR	96.6	10,572.5
74 JUN	41.4	8,209.7
74 AUG	33.4	11,743.6
74 NOV	139.4	16,274.4
75 FEB	100.4	14,158.5
75 JUN	10.2	1,423.1
75 AUG	8.4	2,210.0
75 OCT	48.2	9,845.2
75 NOV	25.0	6,699.7
75 DEC	57.1	15,681.8
76 JAN(2)	14.0	4,038.4
76 FEB	65.2	16,922.2
76 MAR	80.4	15,330.1
76 APR	42.5	11,375.3
76 MAY	26.1	5,945.5
76 JUN	15.1	5,953.5
76 JUL	21.9	6,301.9
76 AUG	54.6	12,150.0
76 SEP	40.1	8,143.3

* In 2 nours of electroshocking and 48 hours of gill netting
** Number of individuals
*** Expressed in grams

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

(1) 48 hrs gill netting only

(2) 2 hrs electroshocking only

1

TABLE 2.2-23

AVERAGE NUMBER AND WEIGHT PER UNIT EFFORT* OF REPRESENTATIVE SPECIES OF FISH COLLECTED EACH MONTH DURING YEARS I, II, III IN THE VICINITY OF WATERFORD 3

YEAR and MONTH	BLUE CATFISH AVERAGE NUMBER**	BLUE CATFISH AVERAGE WEIGHT**	FRESHWATER DRUM AVERAGE NUMBER	FRESHWATER DRUM AVERAGE WEIGHT	GIZZARD SHAD AVERAGE NUMBER	GIZZARD SHAD AVERAGE WEIGHT	STRIPED MULLET AVERAGE NUMBER	STRIPED MULLET AVERAGE WEIGHT	THREADFIN SHAD AVERAGE NUMBER	THREADFIN SHAD AVERAGE WEIGHT
73 APR(1)	1.0	379.7	.(3)	.	.	.	.	.	.	.
73 JUN	4.0	926.4	.3	26.4	4.0	476.8	.7	23.7	1.3	11.4
73 JUL(2)	.8	1.2	.8	3.0	3.0	254.0	2.6	253.3	2.4	5.1
73 AUG	.5	457.9	1.5	832.6	12.0	1,387.5	4.0	827.0	1.6	7.7
73 SEP	3.0	741.2	.4	120.6	53.4	3,926.1	19.4	4,680.4	6.0	48.3
73 OCT	6.6	322.6	.8	122.7	9.8	637.2	3.6	1,039.8	2.0	12.6
73 NOV	1.8	692.9	.3	46.6	49.6	4,952.4	4.0	983.4	.2	.9
73 DEC	8.3	3,200.9	.2	.2	15.4	2.584.0	1.2	55.4	.4	1.3
74 JAN	5.2	1,134.8	.	.	12.3	2,306.7	.6	81.3	.2	.7
74 FEB	2.4	475.7	.	.	7.4	1,239.0	.	.	.4	1.3
74 MAR(1)	2.0	542.8	.	.	1.7	288.6	.	.	16.3	1,033.1
74 APR	5.0	2,269.8	1.0	36.3	47.5	2,010.3	13.0	2,382.5	15.2	274.3
74 JUN	.4	799.2	.8	118.0	17.4	837.6	12.0	2,300.3	1.8	29.8
74 AUG	.8	1,251.3	.6	116.3	3.8	206.6	20.2	5,996.4	1.6	4.7
74 NOV	7.2	1,055.6	1.0	96.1	67.6	4,433.7	38.8	4,931.2	4.4	33.3
75 FEB	.2	45.3	1.0	99.2	65.0	9,264.1	26.4	1,633.1	.	
75 JUN	.8	298.0	.2	46.3	1.0	86.4	1.6	227.7	4.8	27.2
75 AUG	2.4	625.1	.	.	1.6	155.5	.4	42.4	.4	4.7
75 OCT	1.6	669.5	.	.	27.6	5,475.5	11.0	3,104.8	1.8	24.7
75 NOV	1.2	601.9	.	.	15.4	1,849.1	2.2	365.5	.	.
75 DEC	10.2	4,473.1	1.4	196.3	30.6	4,534.3	5.8	1,366.7	.2	1.5
76 JAN(2)	.3	270.1	.	.	13.8	3,768.3	.	.	.	.
76 FEB	7.2	2,838.0	.8	227.8	50.6	11,932.1	.2	117.8	1.0	6.9
76 MAR	9.0	4,480.6	.6	204.1	56.2	7,834.2	2.6	304.9	7.2	129.2
76 APR	4.3	2,661.6	1.9	619.7	8.3	727.3	15.0	2,008.6	6.9	124.9
76 MAY	1.4	65.4	1.3	331.6	4.0	672.9	6.6	705.3	6.2	63.7
76 JUN	2.5	2,174.5	.2	50.3	3.7	569.1	6.2	789.0	.5	.3
76 JUL	1.7	1,621.5	.5	88.8	1.7	253.6	12.0	1,801.1	2.8	26.9
76 AUG	3.2	2,855.4	1.0	421.8	4.4	1,340.4	23.2	4,812.6	4.2	58.2
76 SEP	4.3	2,065.1	2.0	462.0	5.4	2,045.4	12.0	1,830.1	3.0	78.9

*In 2 hours of electroshocking and 48 hours of gill netting
**Number of individuals
***Expressed in grams

(1) 48 hrs gill netting only

(2) 2 hrs electroshocking only

(3) Species not found during sampling

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

WSES 3
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TABLE 2.2-24 1

NUMBER AND WEIGHT OF REPRESENTATIVE FISH SPECIES CAPTURED PER UNIT EFFORT*
AT EACH STATION DURING YEARS I, II, III IN THE VICINITY OF WATERFORD 3

		BLUE CATFISH YEARLY AVERAGE		FRESHWATER DRUM YEARLY AVERAGE		GIZZARD SHAD YEARLY AVERAGE		STRIPED MULLET YEARLY AVERAGE		THREADFIN SHAD YEARLY AVERAGE	
STATION	YEAR	NUMBER**	WEIGHT***	NUMBER	WEIGHT	NUMBER	WEIGHT	NUMBER	WEIGHT	NUMBER	WEIGHT
Ac	I	5.4	898.3	.5	141.4	24.5	1974.0	2.4	527.3	1.5	16.5
	II	.3	138.2	.2	35.2	7.2	452.7	9.8	2465.4	1.0	16.6
	III	5.0	1612.6	.4	76.2	20.1	1911.8	9.0	1901.0	3.0	40.7
At	I	5.2	1050.0	.3	84.7	15.4	1814.4	4.1	974.3	7.8	224.7
	II	2.3	601.8	.8	113.7	14.5	1646.4	10.2	1239.2	4.0	28.5
	III	7.4	4979.7	.9	296.5	10.6	2484.5	2.5	989.8	3.9	39.4
Bc	I	4.1	1768.5	.3	67.5	25.9	2681.8	3.6	712.9	3.6	42.1
	II	.7	463.9	.(1)	.	63.3	5342.5	12.3	2707.1	1.7	17.8
	III	.9	561.5	.5	164.4	37.2	8346.1	9.9	1470.0	3.6	82.9
Bt	I	2.4	958.1	1.0	311.8	23.4	2140.8	12.0	2457.3	4.3	193.7
	II	5.7	1657.6	.7	73.1	28.0	2780.8	30.8	3245.7	3.0	12.8
	III	6.0	2444.0	.9	223.5	14.8	2320.8	11.1	1779.9	3.1	45.0
Bt_1	I	1.7	218.2	.5	2.6	21.6	1737.5	3.1	645.6	2.9	94.6
	II	.8	534.0	1.3	174.6	17.3	2264.3	19.7	2952.0	1.2	7.5
	III	1.8	1936.5	1.6	420.3	11.4	2748.4	7.6	1194.9	.9	6.8

*In 2 hours of electroshocking and 48 hours of gill netting
**Number of individuals
***Expressed in grams

(1) Species not found at this station

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2.

TABLE 2.2-25 1

TOTAL NUMBER AND WEIGHT OF ALL FISH SPECIES CAPTURED PER UNIT EFFORT*

AT EACH STATION DURING YEARS I, II, III IN THE VICINITY OF WATERFORD 3

STATION	YEAR	YEARLY AVERAGE NUMBER**	YEARLY AVERAGE WEIGHT***
Ac	I	43.7	6,924.4
	II	25.3	8,243.7
	III	50.6	10,585.1
At	I	39.5	5,202.1
	II	35.5	5,014.6
	III	37.4	11,071.2
Bc	I	46.8	8,562.3
	II	95.5	11,981.2
	III	55.6	12,051.5
Bt	I	47.9	9,229.0
	II	74.0	9,731.7
	III	39.3	7,893.9
Bt_1	I	34.0	3,463.2
	II	47.3	10,044.8
	III	26.7	9,198.6

*In 2 hours of electroshocking and 48 hours of gill netting
**Number of individuals
***Expressed in grams

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-26 | 1

FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE;

TESTING THE NULL HYPOTHESIS (H_0) OF

EQUAL CATCH/EFFORT* AT 5 WATERFORD STATIONS

YEAR I
Catch/Effort

	STATION				
	Ac	At	Bc	Bt	Bt_1
Blue Catfish	5.429	5.233	4.089	2.375	1.700
Freshwater Drum	.486	.322	.322	1.042	.500
Gizzard Shad	24.543	15.411	24.944	23.403	21.550
Striped Mullet	2.443	4.100	3.600	12.000	3.075
Threadfin Shad	1.500	7.800	3.600	4.431	2.900

Rank**

	Ac	At	Bc	Bt	Bt_1
Blue Catfish	5	4	3	2	1
Freshwater Drum	3	1.5	1.5	4	5
Gizzard Shad	4	1	5	3	2
Striped Mullet	1	4	3	5	2
Threadfin Shad	1	5	3	4	2
Sum of Ranks	14	15.5	15.5	19	11
Sum of Ranks Squared	196	240.25	240.25	361	121

$X^2_r = 2.68$
Fail to reject H_0 = ie stations were not significantly different with respect to catch/effort

*Per 48 hour gill net set and
1 hour electroshocking effort

**Stations ranked according to catch/effort for species listed (ties were averaged).

Source: Siegel S. Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill Book Company, Inc. 1956.

TABLE 2.2-27 | 1

FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE;

TESTING THE NULL HYPOTHESIS (H_0) OF

EQUAL CATCH/EFFORT* AT 5 WATERFORD STATIONS

YEAR III
Catch/Effort

	STATION				
	Ac	At	Bc	Bt	Bt_1
Blue Catfish	5.015	7.389	.875	6.000	1.773
Freshwater Drum	.432	.889	.458	.917	1.573
Gizzard Shad	20.697	10.622	37.167	14.845	11.355
Striped Mullet	9.030	2.456	9.917	11.083	7.600
Threadfin Shad	3.008	3.900	3.583	3.083	.909

Rank**

Blue Catfish	3	5	1	4	2
Freshwater Drum	1	3	2	4	5
Gizzard Shad	4	1	5	3	2
Striped Mullet	3	1	4	5	2
Threadfin Shad	2	5	4	3	1
Sum of Ranks	13	15	16	19	12
Sum of Ranks Squared	169	225	256	361	144

$X_r^2 = 2.40$

Fail to reject H_0 = Stations were not significantly different with respect to catch/effort.

*Per 48 hour gill net set and
1 hour electroshocking effort

**Stations ranked according to catch/effort for species listed
(ties were averaged)

Source: Siegel S. Nonparametric Statistics for the Behavorial Sciences. McGraw-Hill Book Company, Inc. 1956

TABLE 2.2-28

AVERAGE DENSITIES* BY STATION OF ICHTHYOPLANKTON IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3

1

DATE	STATION Ac	At	Bc	Bt	Btl	Average
74 NOV 13	.000	.122	.000	.000	.000	.024
75 FEB 26	.000	.000	.000	.000	.000	.000
75 APR 24	.000	.000	.000	.000	.010	.002
75 AUG 08	.000	.000	.005	.054	.077	.027
75 OCT 30	.000	.000	.000	.000	.000	.000
75 NOV 20	.000	.000	.000	.000	.000	.000
75 DEC 22	.000	.000	.000	.000	.000	.000
76 JAN 30**	.000	.000	.000	.000	.000	.000
76 FEB 26	.000	.000	.000	.000	.000	.000
76 MAR 25	.000	.010	.009	.023	.004	.009
76 APR 30**	.000	.081	.007	.026	.015	.026
76 MAY 27	.020	.009	.069	.000	.007	.021
76 JUN 08	.127	.176	.030	.139	.058	.106
76 JUN 24	.000	.000	.000	.000	.008	.002
76 JUL 07	.003	.034	.013	.017	.017	.017
76 JUL 29	.000	.000	.000	.011	.000	.002
76 AUG 12	.000	.000	.006	.000	.007	.003
76 SEP 10	.000	.000	.000	.000	.000	.000
76 SEP 27	.000	.000	.000	.000	.000	.000

*Densities expressed in number/m^3
**Samples collected over two sampling days

Source of Data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-29 | 1

AVERAGE ICHTHYOPLANKTON DENSITIES* BY SPECIES
IN SAMPLES COLLECTED IN THE
VICINITY OF WATERFORD 3

Date	Unidentifiable	Centrarchidae	Clupeidae	Cyprinidae	Esocidae	Ictaluridae	Sciaenidae
Nov 13 74	-	-	.019	-	-	-	-
Feb 26 75	-	-	-	-	-	-	-
Apr 24 75	-	-	-	.002	-	-	-
Aug 8 75	-	.015	.005	.004	-	.004	-
Oct 30 75	-	-	-	-	-	-	-
Nov 20 75	-	-	-	-	-	-	-
Dec 22 75	-	-	-	-	-	-	-
Jan 30 76	-	-	-	-	-	-	-
Feb 26 76	-	-	-	-	-	-	-
Mar 25 76	-	-	.002	.008	-	-	-
Apr 30 76	.004	.008	-	.005	.002	.002	.003
May 27 76	.003	.007	-	.012	-	-	-
Jun 8 76	.002	.003	.065	-	-	-	.029
Jun 24 76	-	.002	-	-	-	-	-
Jul 7 76	-	-	.004	-	-	-	.012
Jul 29 76	.003	-	-	-	-	-	-
Aug 12 76	-	-	-	-	-	-	.003
Sep 10 76	-	-	-	-	-	-	-
Sep 27 76	-	-	-	-	-	-	-

* Densities expressed in number/m^3
Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-30 1

DENSITIES* BY DEPTH OF ICHTHYOPLANKTON IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3

	DEPTH		
DATE	BOTTOM	MIDDLE	SURFACE
74 NOV 13	.049	.000	.000
75 FEB 26	.000	.000	.000
75 APR 24	.000	.010	.000
75 AUG 08	.024	.047	.011
75 OCT 30	.000	.000	.000
75 NOV 20	.000	.000	.000
75 DEC 22	.000	.000	.000
76 JAN 30	.000	.000	.000
76 FEB 26	.000	.000	.000
76 MAR 25	.005	.027	.004
76 APR 30	.044	.000	.017
76 MAY 27	.014	.015	.034
76 JUN 08	.119	.054	.106
76 JUN 24	.000	.008	.000
76 JUL 07	.025	.013	.010
76 JUL 29	.007	.000	.000
76 AUG 12	.000	.013	.000
76 SEP 10	.000	.000	.000
76 SEP 27	.000	.000	.000

* Densities expressed in number/m^3

Source of data: Waterford 3 Environmental Surveillance Program, explained in Section 6.1.1.2

TABLE 2.2-31 | 1

FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE;
TESTING THE NULL HYPOTHESIS (H_0) OF EQUALITY OF
ICHTHYOPLANKTON CONCENTRATIONS (NUMBER PER CUBIC METER)
AT 5 WATERFORD STATIONS DURING YEAR III

NUMBER PER CUBIC METER

	STATION				
Date	Ac	At	Bc	Bt	Bt_1
March 25, 1976	.000	.010	.009	.023	.004
April 30, 1976	.000	.081	.007	.026	.015
May 27, 1976	.020	.009	.069	.000	.007
June 8, 1976	.127	.176	.030	.139	.058
June 24, 1976	.000	.000	.000	.000	.008
July 7, 1976	.003	.034	.013	.017	.107
July 29, 1976	.000	.000	.000	.011	.000
August 12, 1976	.000	.000	.006	.000	.007

RANKS*

Date	Ac	At	Bc	Bt	Bt_1
March 25, 1976	1	4	3	5	2
April 30, 176	1	5	2	4	3
May 27, 1976	4	3	5	1	2
June 8, 1976	3	5	1	4	2
June 24, 1976	2.5	2.5	2.5	2.5	5
July 7, 1976	1	5	2	3.5	3.5
July 29, 1976	2.5	2.5	2.5	5	2.5
August 12, 1976	2	2	4	2	5
Sum of Ranks	17	29	22	27	25
Overall Rank	1	5	2	4	3

$X^2_r = 4.40$

Fail to Reject H_0; i.e Stations were not significantly different with respect to ichthyoplankton densities.

*Stations ranked according to ichthyoplankton densities
(ties were averaged)

Source: Siegel S. Nonparametric Statistics for the Behavioral Sciences McGraw-Hill Book Company, Inc. 1956.

TABLE 2.2-32

RANK* FOR FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE TESTING THE NULL HYPOTHESIS (H_0) OF EQUAL ICHTHYOPLANKTON CONCENTRATIONS BY DEPTH COLLECTED IN THE VICINITY OF WATERFORD 3

	DEPTH			
Year/Date	Bottom	Middle	Surface	
November 13, 1974	3	1.5	1.5	
April 24, 1975	1.5	3	1.5	
August 8, 1975	2	3	1	
March 25, 1976	2	3	1	
April 30, 1976	3	1	2	
May 27, 1976	1	2	3	
June 8, 1976	3	1	2	
June 24, 1976	1.5	3	1.5	1
July 7, 1976	3	2	1	
July 29, 1976	3	1.5	1.5	
August 12, 1976	1.5	3	1.5	
Sum of Ranks	24.5	24.0	17.5	
Sum of Ranks Squared	600.25	576.0	306.25	

$X_r^2 = 2.91$

Fail to Reject H_0: i.e., depths were not significantly different with respect to the number of ichthyoplankton per cubic meter.

*Depths were ranked by date, according to the average number of ichthyoplankton per square meter (ties were averaged).

Source: Siegel S. Nonparametric Statistics For the Behavioral Sciences. McGraw-Hill Book Company, Inc. 1956.

TABLE 2.2-33 | 1

COMMERCIAL CATCHES FROM MISSISSIPPI RIVER
BETWEEN BATON ROUGE, LOUISIANA AND THE MOUTH OF RIVER, 1971 - 1975
(IN POUNDS, ROUND OR LIVE WEIGHT AND DOLLAR VALUE)

	1971		1972		1973		1974		1975	
Species	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value
Bowfin	-		-		1,000	80	1,000	60	900	63
Buffalofish	10,700	1,317	28,900	3,749	60,800	8,289	88,400	13,054	138,600	20,992
Carp	10,200	836	10,900	1,064	9,300	8,079	7,300	474	16,200	944
Catfish, F W	227,500	71,372	190,200	56,428	360,000	111,883	818,000	259,504	1,198,400	401,903
Garfish	13,500	1,746	34,000	4,479	53,700	6,385	42,900	4,572	42,800	6,755
Paddlefish	-		-		3,000	295	200	19	200	14
Gaspergou (Freshwater drum)	3,500	392	11,600	1,364	57,600	7,341	46,700	5,986	80,300	11,763
Crawfish	14,100	2,826	16,700	3,725	45,600	11,400	35,000	11,200	54,200	16,260
River Shrimp	900	297	1,900	855	2,700	1,005	3,500	1,400	4,200	2,940
Drum:										
Black	200	18	-		-		-		-	
Red	1,400	291	-		-		-		-	
Sea Trout:										
Spotted	2,300	569	-		-		-		-	
White	100	11	-		-		-		-	
Turtle, Snapper	4,100	885	400	176	-		700	258	200	70

Source: Personal Communication, Dept. of Commerce,
National Oceanic and Atmospheric Admin., 1976

LENGTH FREQUENCIES FOR BLUE CATFISH

FOR YEAR I

MONTH \ LENGTH	0.	30.	60.	90.	120.	150.	180.	210.	240.	270.	300.	330.	360.	390.	450.	480.	510.	540.
73 APR	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
73 JUN	0	0	0	1	0	2	2	5	5	3	0	0	0	0	0	0	0	0
73 JUL	8	41	2	1	6	2	3	2	0	1	0	0	0	0	0	0	0	0
73 AUG	0	16	21	15	5	5	1	2	3	0	1	1	1	0	0	0	0	0
73 SEP	0	17	24	5	1	2	7	4	1	3	0	1	0	2	0	0	0	0
73 OCT	0	6	86	35	3	0	4	2	3	1	1	1	0	0	0	0	0	0
73 NOV	0	1	15	7	0	3	4	6	5	2	1	2	0	0	0	0	0	0
73 DEC	0	0	7	8	2	1	5	18	17	4	5	1	0	1	0	0	0	0
74 JAN	0	0	1	1	0	1	2	11	9	1	0	2	0	0	0	0	0	0
74 FEB	0	0	1	1	0	0	0	6	3	1	0	0	0	0	0	0	0	0
74 MAR	0	1	7	5	0	0	0	2	3	1	0	0	0	0	0	0	0	0
74 APR	0	0	4	5	0	1	0	5	2	2	0	1	2	0	1	1	1	1

FOR YEAR II

MONTH \ LENGTH	30.	60.	90.	120.	150.	180.	210.	240.	270.	300.	330.	450.	480.	540.	570.	630.
74 JUN	0	0	2	2	0	0	0	0	0	0	0	0	0	1	1	0
74 AUG	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1
74 NOV	1	23	5	1	0	0	2	1	2	0	2	0	1	0	0	0
75 FEB	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
75 JUN	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0
75 AUG	3	1	9	3	1	2	1	1	0	1	0	1	0	0	0	0

FOR YEAR III

MONTH \ LENGTH	30.	60.	90.	120.	150.	180.	210.	240.	270.	300.	330.	360.	390.	420.	450.	480.	510.	540.	570.	600.
75 OCT	0	0	0	0	1	0	3	0	2	1	0	1	0	1	0	0	0	0	0	0
75 NOV	302	429	85	11	11	6	0	2	3	0	0	0	1	0	0	0	0	0	0	0
75 DEC	1	4	3	3	5	1	4	5	9	8	4	0	1	1	2	0	0	0	0	0
76 JAN	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
76 FEB	0	0	8	8	9	7	20	7	5	6	3	2	2	1	1	0	0	0	0	0
76 MAR	0	1	0	1	0	1	3	10	13	10	5	3	0	0	0	1	0	0	0	0
76 APR	20	116	17	12	15	5	4	1	3	3	0	2	4	0	0	1	0	0	0	0
76 MAY	0	35	17	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76 JUN	0	5	12	2	2	1	0	1	3	2	2	2	1	0	0	0	0	0	1	0
76 JUL	2	6	2	2	1	2	0	0	0	1	1	1	0	0	0	0	0	0	0	0
76 AUG	1	27	15	6	1	0	3	2	5	1	0	0	0	0	2	0	1	0	0	1
76 SEP	0	4	7	3	4	3	2	1	1	5	0	1	0	1	0	0	0	1	0	0

DATA EXPRESSED IN LENGTH INTERVALS OF 30MM
IE 30 = 30 – 59MM
60 = 60 – 89MM
ETC

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

LENGTH FREQUENCIES OF SELECTED FISH SPECIES COLLECTED IN THE WATERFORD AREA
(APRIL 1973 – SEPTEMBER 1976)
(SHEET 1 OF 5)

Table 2.2-34

1

LENGTH FREQUENCIES FOR FRESHWATER DRUM

FOR YEAR I

MONTH \ LENGTH	0.	15.	30.	45.	60.	75.	90.	105.	135.	150.	165.	180.	195.	210.	225.	240.	255.	270.	300.
73 JUN	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
73 JUL	1	48	78	58	12	1	2	1	1	1	2	2	1	1	0	0	0	0	0
73 AUG	0	0	5	17	16	3	0	0	1	1	0	0	0	0	0	2	2	1	1
73 SEP	0	17	7	5	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0
73 OCT	0	1	6	6	15	24	7	2	0	0	0	2	0	0	0	1	0	0	0
73 NOV	0	1	1	1	2	6	6	2	0	0	0	1	1	0	1	1	0	0	0
73 DEC	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
74 MAR	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
74 APR	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0

FOR YEAR II

MONTH \ LENGTH	15.	45.	75.	105.	120.	135.	150.	165.	180.	195.	210.
74 JUN	2	0	0	1	2	0	1	0	0	3	0
74 AUG	0	0	1	0	0	0	0	0	0	1	1
74 NOV	0	1	0	0	1	1	1	0	1	1	0
75 FEB	0	0	0	0	0	2	1	1	1	0	0
75 JUN	0	0	0	0	0	0	0	0	1	0	0

FOR YEAR III

MONTH \ LENGTH	15.	30.	45.	60.	75.	90.	105.	120.	135.	150.	165.	180.	195.	210.	225.	240.	255.	270.
75 OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
75 NOV	0	9	18	29	29	20	12	2	1	2	0	0	0	0	0	0	0	0
75 DEC	0	0	0	0	0	1	0	1	0	0	2	1	3	0	0	0	0	0
76 FEB	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1
76 MAR	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
76 APR	0	0	1	7	16	15	6	6	6	11	5	5	8	2	1	4	2	0
76 MAY	0	0	0	1	4	3	4	0	2	0	0	1	1	2	1	0	0	0
76 JUN	30	2	0	0	0	1	1	0	0	0	0	0	2	1	0	0	0	0
76 JUL	20	31	12	3	0	1	6	8	1	4	1	2	2	2	0	0	0	0
76 AUG	0	0	0	0	0	0	0	0	0	0	1	1	1	3	0	1	2	0
76 SEP	0	0	0	0	0	0	0	1	1	0	2	2	1	3	1	1	0	0

DATA EXPRESSED IN LENGTH INTERVALS OF 15MM
IE 15 = 15 – 29MM
30 = 30 – 44MM
ETC

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	LENGTH FREQUENCIES OF SELECTED FISH SPECIES COLLECTED IN THE WATERFORD AREA (APRIL 1973 – SEPTEMBER 1976) (SHEET 2 OF 5)	Table 2.2–34

Amendment No. 1, (9/79)

1

LENGTH FREQUENCIES FOR GIZZARD SHAD

FOR YEAR I

MONTH \ LENGTH	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.
73 JUN	0	0	3	2	2	0	0	0	0	1	3	3	0	0	0
73 JUL	139	349	55	5	1	2	1	1	0	0	2	0	2	0	0
73 AUG	10	417	378	37	5	3	1	0	1	2	1	6	5	0	1
73 SEP	0	0	9	121	64	14	7	2	1	9	17	17	7	4	0
73 OCT	0	17	128	23	13	6	4	2	2	3	4	3	0	0	0
73 NOV	0	2	31	48	73	20	9	6	7	38	30	13	6	1	0
73 DEC	0	2	2	3	4	2	4	11	4	18	14	2	5	0	0
74 JAN	0	0	1	2	8	4	2	2	0	13	7	5	6	3	0
74 FEB	0	0	1	2	1	1	1	0	4	6	12	7	2	0	0
74 MAR	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
74 APR	0	0	2	31	77	33	12	10	12	11	2	0	0	0	0

FOR YEAR II

MONTH \ LENGTH	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.
74 JUN	0	3	3	13	45	14	3	2	2	4	2	0	0
74 AUG	0	10	2	2	0	1	0	0	2	2	0	0	0
74 NOV	2	15	72	49	58	44	45	15	26	9	7	3	0
75 FEB	0	1	4	10	18	28	52	53	95	42	15	4	3
75 JUN	1	0	0	1	0	0	1	0	1	1	0	0	0
75 AUG	1	6	0	0	3	1	0	1	1	1	0	0	0

FOR YEAR III

MONTH \ LENGTH	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.	320.	340.
75 OCT	0	0	2	20	37	2	1	4	4	13	15	3	9	22	5	1	0
75 NOV	0	0	4	15	26	7	2	8	2	11	5	3	2	4	1	1	0
75 DEC	0	0	1	6	23	9	7	4	24	48	16	8	4	0	3	0	0
76 JAN	0	0	0	0	1	0	0	0	3	16	19	4	4	7	1	0	0
76 FEB	0	0	9	5	4	2	3	9	35	65	44	35	15	20	8	3	1
76 MAR	0	0	5	6	16	44	13	16	48	80	27	10	7	5	3	1	0
76 APR	0	0	0	4	15	6	4	0	4	3	5	1	1	0	1	0	0
76 MAY	0	0	0	1	1	0	0	1	2	4	1	1	0	0	0	0	0
76 JUN	1	7	1	0	2	3	3	2	1	0	0	0	1	3	1	0	0
76 JUL	0	1	0	0	0	3	1	0	1	1	0	0	0	0	1	0	0
76 AUG	0	0	0	0	0	0	0	3	2	6	2	4	3	0	2	0	0
76 SEP	0	0	0	0	0	0	0	0	2	6	3	6	4	1	2	1	0

DATA EXPRESSED IN LENGTH INTERVALS OF 20MM
IE 20 = 20 – 39MM
40 = 40 – 59MM
ETC

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	LENGTH FREQUENCIES OF SELECTED FISH SPECIES COLLECTED IN THE WATERFORD AREA (APRIL 1973 – SEPTEMBER 1976) (SHEET 3 OF 5)	Table 2.2-34

1

Amendment No. 1, (9/79)

LENGTH FREQUENCIES FOR STRIPED MULLET

FOR YEAR I

MONTH \ LENGTH	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.	320.	340.
73 JUN	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
73 JUL	5	1	1	0	0	1	2	2	0	1	0	0	0	0	0
73 AUG	0	0	4	0	1	1	2	8	4	2	0	0	0	0	0
73 SEP	0	1	5	8	12	6	23	28	15	8	7	3	1	0	0
73 OCT	0	0	0	1	0	0	1	4	4	6	1	1	0	0	0
73 NOV	0	0	0	2	1	2	1	3	7	2	0	0	0	1	1
73 DEC	0	0	0	5	0	0	1	0	0	0	0	0	0	0	0
74 JAN	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0
74 APR	0	0	0	1	1	1	12	18	13	4	0	1	0	0	1

FOR YEAR II

MONTH \ LENGTH	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.	320.	360.	380.
74 JUN	0	0	2	12	14	7	5	6	4	3	4	2	0	0	1
74 AUG	5	1	0	7	14	9	12	15	18	10	5	3	1	1	0
74 NOV	26	47	29	10	7	17	22	13	6	9	3	3	2	0	0
75 FEB	9	51	34	14	9	3	7	1	2	0	1	1	0	0	0
75 JUN	0	0	2	2	1	0	2	0	0	1	0	0	0	0	0
75 AUG	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

FOR YEAR III

MONTH \ LENGTH	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.	320.	340.	360.
75 OCT	1	3	8	2	2	7	7	5	4	5	1	4	3	3	0
75 NOV	0	0	3	0	0	2	3	1	0	0	2	0	0	0	0
75 DEC	0	3	3	1	2	4	4	3	4	1	1	1	1	0	1
76 FEB	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
76 MAR	0	0	4	2	1	1	3	2	0	0	0	0	0	0	0
76 APR	0	1	10	15	12	12	13	6	1	2	1	1	0	1	0
76 MAY	0	1	9	14	4	2	0	1	1	0	0	0	1	0	0
76 JUN	0	0	7	7	5	2	1	2	1	0	0	0	0	0	0
76 JUL	10	6	4	6	13	5	6	6	2	1	1	0	0	0	0
76 AUG	6	24	14	5	3	12	17	18	5	7	2	0	2	0	1
76 SEP	3	21	9	3	1	2	0	0	3	3	1	1	1	0	1

DATA EXPRESSED IN LENGTH INTERVALS OF 20MM
IE 20 = 20 – 39MM
40 = 40 – 59MM
ETC

LENGTH FREQUENCIES FOR THREADFIN SHAD

FOR YEAR I

MONTH \ LENGTH	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.	110.	120.	130.	140.	150.	190.
73 JUN	0	0	0	0	0	2	3	0	1	0	0	0	0	0	0	0
73 JUL	2	102	178	105	41	7	1	2	0	0	0	0	0	0	0	0
73 AUG	0	14	118	153	63	27	7	3	3	1	0	0	0	0	0	0
73 SEP	0	0	0	13	36	11	10	7	1	1	0	0	0	0	0	0
73 OCT	0	1	1	5	18	15	5	5	2	0	0	0	0	0	0	0
73 NOV	0	0	0	5	4	8	5	2	2	0	0	0	0	0	0	0
73 DEC	0	0	0	1	4	5	0	1	1	0	0	0	0	0	0	0
74 JAN	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
74 FEB	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
74 MAR	0	0	0	0	0	0	0	0	0	1	0	1	8	28	11	1
74 APR	0	0	0	0	2	12	9	11	9	4	6	0	1	5	3	0

FOR YEAR II

MONTH \ LENGTH	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.	140.
74 JUN	5	23	41	36	9	2	4	4	1	1	1
74 AUG	0	0	0	2	4	2	0	0	0	0	0
74 NOV	0	0	0	3	26	108	57	21	7	0	0
75 JUN	0	0	10	3	0	0	4	5	2	0	0
75 AUG	0	0	4	0	0	0	0	1	1	0	0

FOR YEAR III

MONTH \ LENGTH	20.	30.	40.	50.	60.	70.	80.	90.	100.	110.	120.	130.	140.
75 OCT	0	0	0	1	0	4	3	1	0	0	0	1	0
75 NOV	0	1	3	1	2	6	3	0	0	0	0	0	0
75 DEC	0	0	0	0	0	1	0	0	0	0	0	0	0
76 FEB	0	0	1	0	0	3	0	1	0	0	0	0	0
76 MAR	0	0	0	0	3	18	1	5	0	1	5	3	0
76 APR	0	0	0	0	2	9	9	4	6	1	4	0	1
76 MAY	1	0	0	0	3	17	7	7	1	0	0	0	0
76 JUN	0	4	1	0	0	0	0	0	0	0	0	0	0
76 JUL	0	0	3	16	8	7	8	1	0	0	0	0	0
76 AUG	0	0	1	0	1	1	8	10	0	0	0	0	0
76 SEP	0	0	0	0	1	0	2	4	4	2	0	0	0

DATA EXPRESSED IN LENGTH INTERVALS OF 10MM
IE 10 = 10 – 19MM
20 = 20 – 29MM
ETC

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

LENGTH FREQUENCIES OF SELECTED FISH SPECIES COLLECTED IN THE WATERFORD AREA
(APRIL 1973 – SEPTEMBER 1976)
(SHEET 5 OF 5)

Table 2.2-34

Amendment No. 1, (9/79)

1

1

TABLE 2.2-35

MONTHLY AVERAGE RIVER FLOWS AT TARBERT LANDING LOUISIANA (RM 306.3)

Year I			Year II			Year III		
Month		Flow (1000 cfs)	Month		Flow (1000 cfs)	Month		Flow (1000 cfs)
April	1973	1305	May	1974	594	October	1975	333
May	1973	1372	June	1974	800	November	1975	346
June	1973	978	July	1974	491	December	1975	396
July	1973	447	August	1974	239	January	1976	555
August	1973	305	September	1974	328	February	1976	454
September	1973	222	October	1974	221	March	1976	658
October	1973	370	November	1974	354	April	1976	511
November	1973	373	December	1974	435	May	1976	429
December	1973	849	January	1975	620	June	1976	341
January	1974	976	February	1975	716	July	1976	352
February	1974	1084	March	1975	862	August	1976	232
March	1974	824	April	1975	1086	September	1976	173
April	1974	799						

TABLE 2.2-36

1

HABITATS, SPAWNING AREAS, MIGRATION ROUTES AND FOODS OF SOME FISH SPECIES PRESENT IN THE VICINITY OF WATERFORD 3*

(Sheet 1 of 3)

Species	Habitat	Spawning Area and Egg Type	Migration Routes	Foods
Bigmouth Buffalo	Widely distributed but most commonly found in larger rivers, lakes, oxbows and sloughs.	Shallow bays; sloughs; wait until water levels rise in the spring. Eggs are adhesive and are deposited in dead vegetation on the bottom.	Move into shallow bays and up tributary streams to spawn.	Bottom feeder; also filter feeder on plankton
Blue Catfish**	Prefer large lakes and deeper portions of major rivers where a noticeable current is present	Construct Nests		Zooplankton (for fish under 125 mm); larger fish feed on insect larvae (benthic), organic, detritus and fish
Bowfish	Usually found in clear, sluggish waters of bayous, borrow pits and backwaters of rivers where aquatic vegetation is present.	Shallow weedy areas; a depression is built in 2-3 feet of water. Eggs are adhesive. Young cling to vegetation at the bottom of the nest for 7-9 days post hatching.		Adults feed on fish, crustaceans; young feed on insects, small shrimp, vegetable matter.
Brown Bullhead	Clear, weedy lakes, muddy pools of intermittent drainageways, slow moving streams with abundant vegetation and sand to mud bottoms.	Build nexts adjacent to stones, logs, or other shelter, on sand or mud bottoms in water up to 2 feet deep. Eggs are adhesive.		Fish up to 75 mm feed on zooplankton and chiromids; adults eat insects, fish, fish eggs, molluscs and plants
Carp	Widely distributed but prefers quiet shallow waters of rivers and impoundments.	Shallow areas - Eggs are adhesive and are scattered at random over plant beds, debris and rubble.	There is frequently a migration to the shallow water spawning areas.	Bottom fauna, chiromids plant material, small molluscs, small crustaceans, organic detritus

* All information and sources can be found in the Life Histories of Important Species, Appendix 2-3.

** Dominant species

TABLE 2.2-36 (Cont'd)

HABITATS, SPAWNING AREAS, MIGRATION ROUTES AND FOODS OF SOME FISH SPECIES PRESENT IN THE VICINITY OF WATERFORD 3*
(Sheet 2 of 3)

Species	Habitat	Spawning Area and Egg type	Migration Routes	Foods
Channel Catfish	Found in streams, rivers, lakes and ponds but prefer moderate to swiftly flowing streams with warm water and bottom of sand, gravel or rubble. During daytime, in streams, adults inhabit pool areas and remain near cover; at night they move into stronger, deeper, riffle areas for feeding.	Under overhanging ledges, hollow logs or in similarly sheltered areas. Also spawn in lakes and ponds: They will not spawn in clear ponds. Eggs deposited in a gelatinous mass.	Migration into rivers during spawning periods.	Omnivorous - feed on aquatic insects or other fish. In the River Bend study *** they were found to feed on detritus, oligochaetes, microcrustacea, crayfish, mayfly larvae, caddisfly larvae and dipteran larvae.
Freshwater Drum**	Lakes and large rivers, especially in the shallow areas of the Red and Mississippi Rivers.	Spawn on mud and sand bottom generally in areas where aquatic vegetation is present. Eggs are buoyant.		Bottom feeding foods include mayflies, amphipods, fish, crayfish, small molluscs and detritus ***.
Gizzard Shad**	Successful in both streams and lakes.	Pond bottoms; shallow water. Eggs are demersal and adhesive.	There may be a spawning migration upstream in the lower Mississippi River.	Young feed on zooplankton and later on bottom organisms. Adults are filter feeders - Strain detritus from the bottom and plankton from the water.
Largemouth Bass	All types of freshwater bodies from small creeks to large lakes but is most common in non-flowing water characterized by abundant aquatic vegetation and soft bottoms.	Sheltered bays among aquatic vegetation in 6 inches to 6 feet of water over bottoms which vary from gravelly sand to marl and soft mud.		Young feed on zooplankton. Adults feed on insects, crawfish, small turtles and frogs. Cannibalism is common.
Longnose Gar	Sluggish pools, backwaters, oxbows; adults usually found in large deep pools. Often inhabit brackish water and sometimes saltwater.	Shallow open sloughs and backwaters. Eggs are adhesive; larvae attach themselves to stones and other objects by means of a sucking disc.	Spawning is often preceded by upstream migrations into smaller streams.	Young feed at the surface on small insects, crustaceans and fish; adults are piscivorous.
Paddlefish	Seem to be generally confined to large rivers and impoundments.	Over sand and pebbles and gravel bars in strong currents; generally spawn in schools.	In the Osage River, an upstream migration follows the warming of the waters to 50°F.	Plankton, fish, insects (mayfly naiads).

** Dominant species
*** Bryan CF, JV Conner, and DJ Demont, "An Ecological Study of the Lower Mississippi River and Alligator Bayou near St. Francisville, Louisiana" In: Environmental Report, River Bend Station Units 1 and 2, Construction Permit Stage, Volume III, Appendix E, Gulf State Utilities Company, 1973

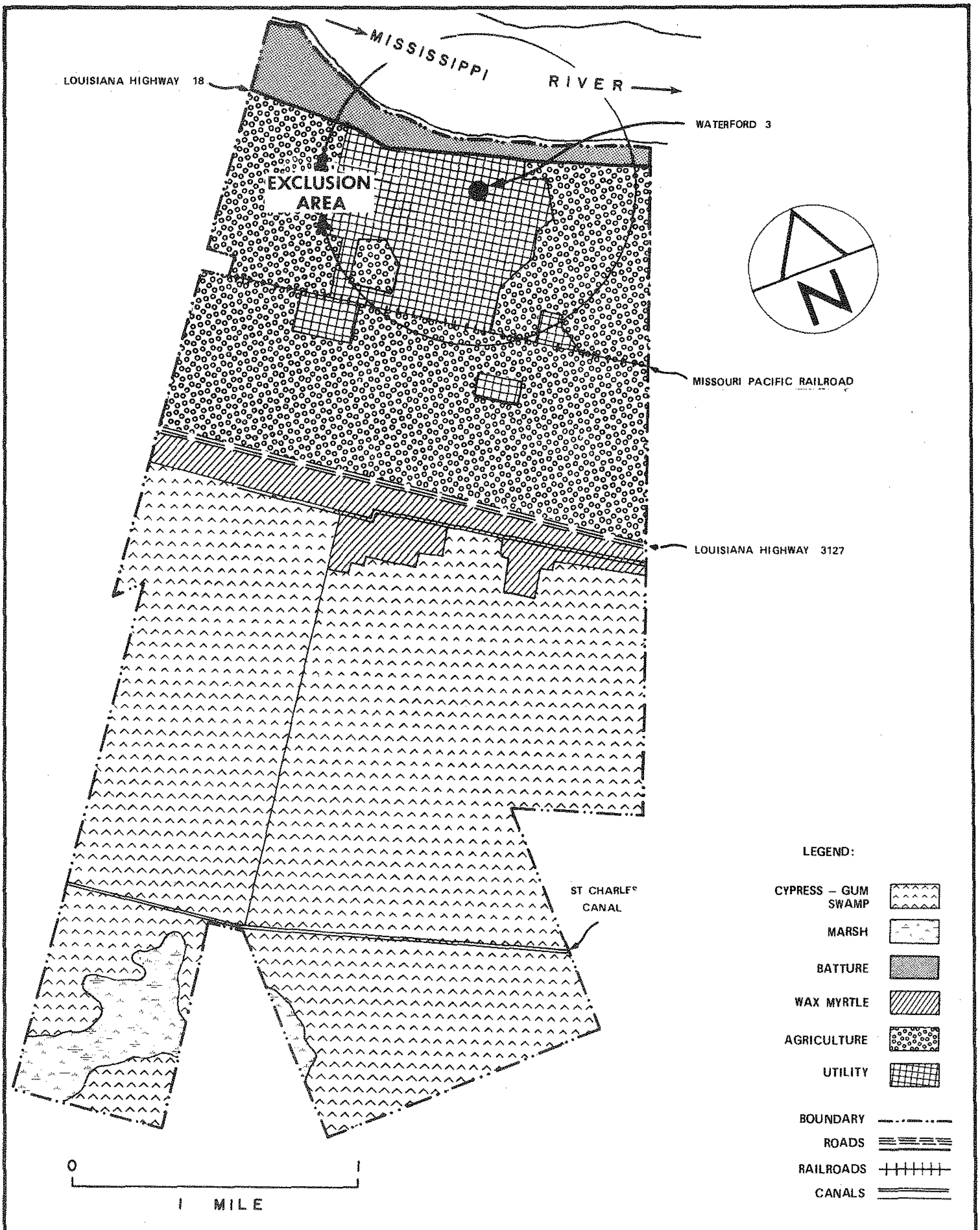
TABLE 2.2-36 (Cont'd)

1

HABITATS, SPAWNING AREAS, MIGRATION ROUTES AND FOODS OF SOME FISH SPECIES PRESENT IN THE VICINITY OF WATERFORD 3*
(Sheet 3 of 3)

Species	Habitat	Spawning Area-and Egg Type	Migration Routes	Foods
Pallid Sturgeon	Largest, muddiest rivers of the Missouri-Mississippi System. Bottom inhabitant, usually living in strong currents over firm sandy bottoms.			
River Carpsucker	Streams and rivers. Preferred habitat is quiet silt-bottomed pools, backwaters, and oxbows or large streams	1-3 feet of water in lakes and reservoirs over a firm sand bottom; in silty shoals; in shallow silty bays; on silt deltas at the mouth of tributaries extending upstream; and over tree roots and vegetation in moderately deep water.		Indiscriminate omnivore; bottom feeder.
Shortnose Gar	Lakes, oxbows, backwaters but prefer the mainstreams of large muddy rivers.	Eggs deposited in small masses held together by a clear gelatinous substance which attaches to weeds.	Doesn't appear to be any particular spawning migration.	Young feed on ostracods, worms and aquatic insects; adults are piscivorous but sometimes feed on crawfish and shrimp.
Shovelnose Sturgeon	Larger rivers of Mississippi Basin and Rio Grande. Lives on the bottom in areas characterized by strong currents.	Rocky bottoms in swift water.	Upstream migrations precede spawning. Enters tributaries for spawning when water is high.	Insects, algae, aquatic vegetation (bottom feeder).
Skipjack Herring	Deep swift waters - usually avoiding high turbidities.		In Louisiana-spring migration when it travels to the headwaters or larger streams and into connecting lakes.	Other fish; invertebrates.
Smallmouth Buffalo	Oxbow lakes, backwater areas of large rivers, swift shallow riffles, creeks.	Areas of aquatic vegetation or innundated terrestrial plants, and sloughs.		Bottom feeder, indiscriminate omnivore.
Striped Mullet**	Marine waters - sometimes come up into waters of the Gulf States and California and up the Mississippi River.	They do not seem to spawn in fresh water.	Schools of mullet are known to come up the Atchafalaya River in the spring as far as Avoyelles Parish.	Miscroscopic organisms including diatoms and formanifera, detritus.
Threadfin Shad**	Prefers large bodies of water and is most abundant where strong current is found - Pelagic	Open water; under brush and floating logs. Spawns in schools. Eggs are adhesive		Plankton, Chaoborus, Tendipedids.

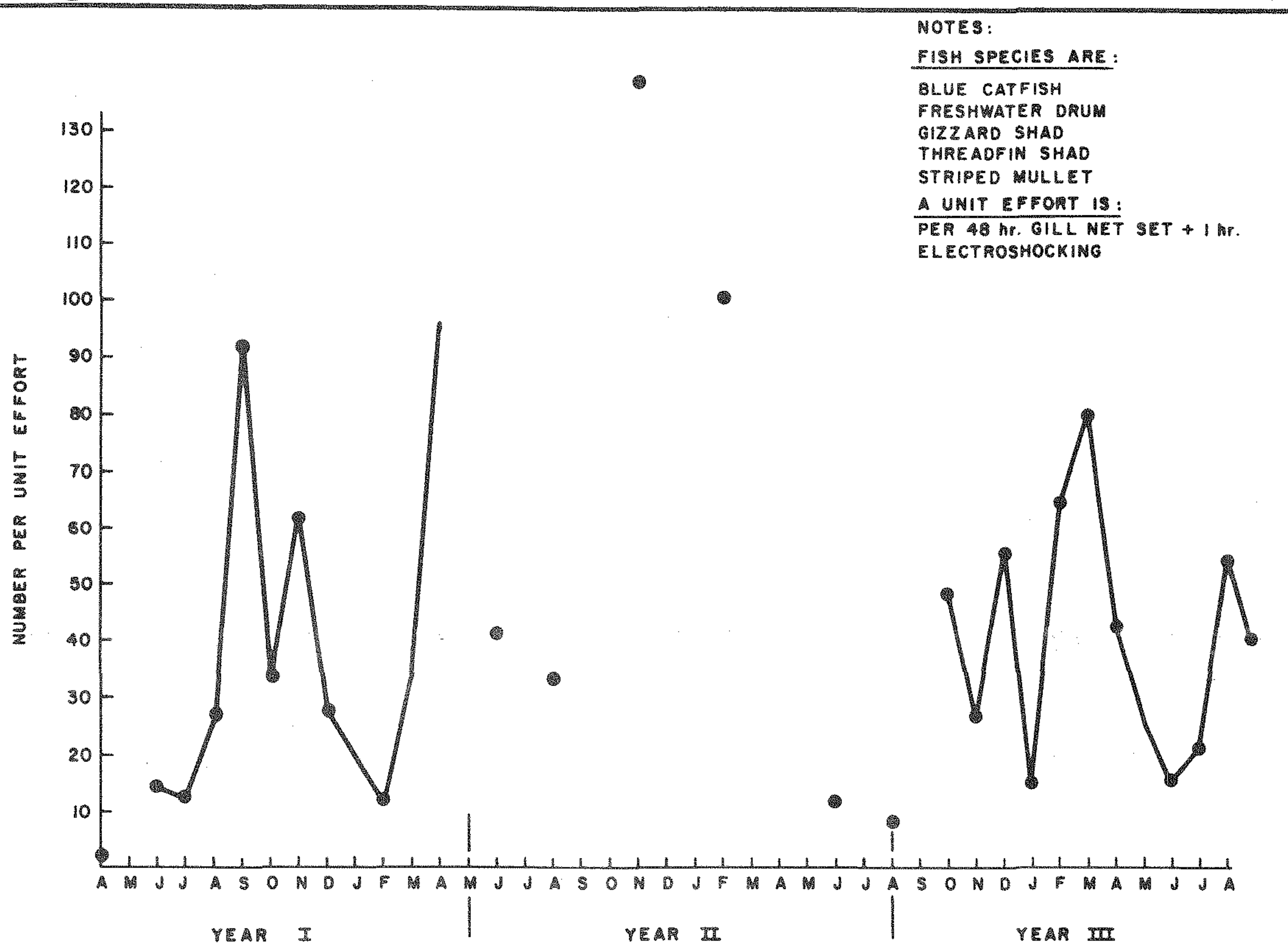
** Dominant Species



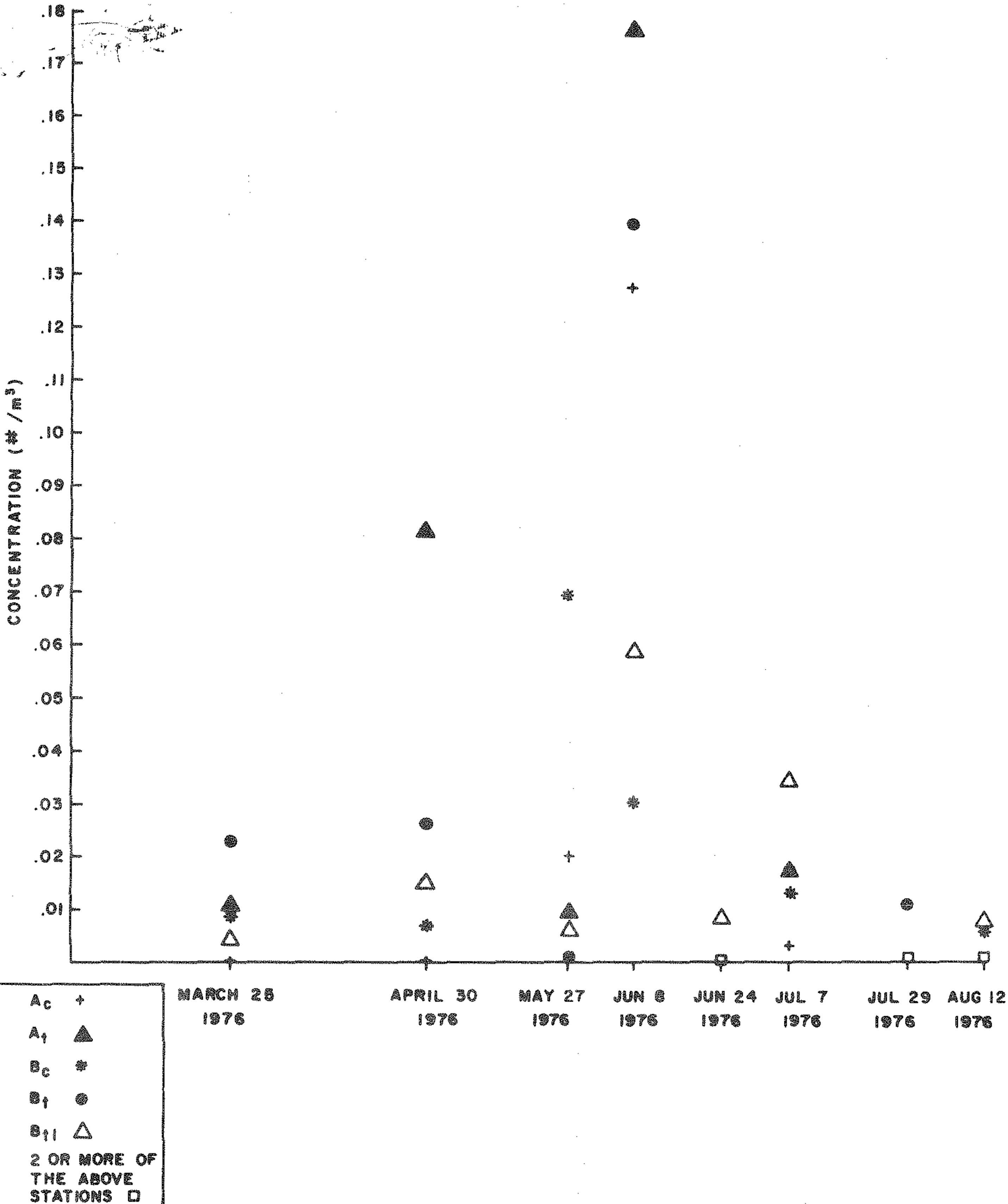
LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

PRINCIPAL PLANT COMMUNITIES

Figure 2.2-1



LOUISIANA POWER & LIGHT Co. Waterford Steam Electric Station	NUMBER OF FISH CAUGHT PER UNIT EFFORT AT WATERFORD STATIONS, APRIL 1973 - SEPTEMBER 1976	FIGURE 2.2-2



LOUISIANA POWER & LIGHT Co. Waterford Steam Electric Station	TOTAL ICHTHYOPLANKTON CONCENTRATION (#/m³) AT WATERFORD STATIONS ON EIGHT DATES IN YEAR III	FIGURE 2.2-3

2.3 METEOROLOGY

Requirements pursuant to Section V.B.1 of Appendix I to 10CFR50, fulfilled previously and transmitted to the NRC on June 4, 1976, have been used in parts of this section. This transmittal is contained in Appendix 3-1.

2.3.1 REGIONAL CLIMATOLOGY AND AIR QUALITY

2.3.1.1 General Climate

The climate of southeastern Louisiana is classified as humid subtropical[1]. It is influenced to a large degree by the many water surfaces provided by lakes and streams and by the proximity of the Gulf of Mexico[2].

During mid-June to mid-September, the prevailing southeast to southwesterly winds carry warm, moist tropical air inland, creating conditions favorable for sporadic, often quite localized, development of thundershowers[2]. Occasionally, the pressure distribution of the atmosphere changes, bringing in a flow of hotter and drier air.

In the summer months[2], the prevailing southeast to southwest winds are usually associated with the area of high pressure that often remains stationary over the Atlantic Ocean off the southeast coast of the United States. This area of high pressure is commonly referred to as the "Bermuda High". On some days, however, the southeast to southwest winds merely reflect a localized sea breeze. The hotter drier conditions, on the other hand, are usually caused by changes in the pressure distribution, often by the formation of a high pressure system over the western Gulf of Mexico.

Cool continental air rarely reaches the site region in summer. If a cold front passage does occur, the cold air behind the front has usually been greatly moderated by solar heating over the plains states to the north or northwest. From late fall until early spring, bursts of cold air do reach southeastern Louisiana, but the cool temperatures which result seldom last more than a few days[2]. Even during these seasons, the weather is still usually dominated by maritime tropical air from the Gulf of Mexico[3]. The interaction between this moist air and the much colder, drier air to the north often generates or intensifies winter storms, which then usually pass to the north of the site[2,3].

The many water surfaces in the site area modify the relative humidity and temperature regime throughout the year by decreasing the range between extremes[2]. These effects are increased during periods of southerly wind flow, imparting the characteristics of a marine climate to the area. Relative humidities of less than 50 percent occur in each month of the year; however, they are less frequent in the summer than during the other seasons[2]. Freezing temperatures are not common and are generally restricted to the period mid-December to mid-March. Some years have no freezing temperatures[2].

Measureable snowfall in the region is rare. Only 4 times in the 100 years of data collected prior to 1975 has the snowfall depth exceeded 2 inches[2]. A fairly definite rainy period exists from mid-December to mid-March, when precipitation falls on about a third of the days. Rainy conditions in this period often persist for several days at a time.

Damaging hail and sleet are not frequently reported in the site area[2,3].

2.3.1.2 Regional Air Quality

The air quality in the site region is acceptable, and the levels of oxides of sulfur and nitrogen, ozone, carbon monoxide, and hydrocarbons generally meet all local ambient air quality standards.

Existing levels of air pollutants will have little effect upon Waterford 3 operations. For sixty 24-hour periods of sampling in nearby Metairie, Louisiana in 1976, no violations of ambient air quality standards for oxides of sulfur or nitrogen occurred[4]. Even if occasional localized violations of some standards do occur, the facility's ability to operate will not be affected. The emergency diesel generators and the auxiliary boiler, the principal sources of fossil fuel pollutants from the plant, will operate only infrequently, and therefore are not likely to contribute to ground level concentrations that exceed standards.

2.3.2 LOCAL METEOROLOGY

Four years of onsite data covering the periods July, 1972 to June, 1975 and February, 1977 to February, 1978 have been collected in support of the licensing activities for Waterford 3. In addition, long-term climatological data [2, 3], collected by the National Weather Service Station at New Orleans International Airport (formely known as Moisant International Airport), about 13 miles east of the site were utilized in the preparation of this report. Climatological records [6] of temperature and precipitation for stations at Audubon Park in downtown New Orleans and the cooperative weather station at Reserve, Louisiana, about 7 miles northwest of the site, were also utilized. All of the offsite data are considered to be generally representative of site conditions because these offsite stations are all within 22 miles of the Waterford site and have similar topographic and regional characteristics. Both the site and the offsite stations are located
in generally flat terrain which is characteristic of the New Orleans area. 1
The maximum difference in mean sea land elevations between the four locations does not exceed 15 feet and there are no land features with elevations higher than 30 feet above sea level between the site and the stations. Additionally, the site and offsite stations are each from four to eight miles from Lake Pontchartrain and within a mile of the Mississippi River, and thus will experience similar meteorological effects of these water bodies. The offsite data used and the respective periods of record are listed in Table 2.3-1.

Although each of these stations will have its own unique microclimatic characteristics, data from each of the stations are representative of the climatological conditions throughout the general area surrounding the Waterford site[7].

2.3.2.1 Cloud Cover, Sunshine and Solar Radiation

The mean annual cloud cover (in tenths of the celestial dome) from sunrise to sunset at New Orleans is 5.4. On the average, the maximum number of cloudy and clear days occurs in January and October, respectively, and totals 16 in both cases. The percentage of possible sunshine likewise ranges from a January minimum of 49 to an October maximum of 70.

The mean daily total solar and sky radiation received on a horizontal surface (in BTU per ft^2 per day) increases from December to mid-June. These values show a decrease in the latter half of June and July because of increased cloudiness associated with thunderstorm activity[8].

Average monthly cloud cover, sunshine, and solar radiation are listed in Table 2.3-2.

2.3.2.2 Temperature

The long-term temperature records of the area show the typical annual cycle. The monthly average temperature varies from a minimum of 54.6°F in January to a maximum of 81.9°F in August at New Orleans International Airport. Temperature records for New Orleans Aududon Park and for Reserve, Louisiana show similar annual cycles, as given in Table 2.3-3.

On the average, there are only about seven days a year in the New Orleans area when the temperature rises to 95°F or higher. The highest temperature of record for the region is 102°F, occurring most recently on June 30, 1954 in Orleans Parish[2]. The longest period in New Orleans with daily maximum temperatures of 90°F or higher was 64 days, from June 21 to August 23, 1917; however, the temperature did not exceed 96°F[2]. The warmest summer was 1951, when the temperature for June, July and August averaged 84.7°F[2].

The average diurnal temperature distribution at New Orleans International Airport is presented in Table 2.3-4. This table points out that extremes in temperature in the site vicinity range from 6°F, recorded in February 1899, to 102°F in June 1954. The mean number of days during the period of 1947 to 1969 when maximum and minimum temperatures exceeded the threshhold values of 0°F, 32°F, and 90°F are listed in Table 2.3-5.

For purposes of comparison, temperature data from the Waterford site for the period July, 1972 to June, 1975 and February, 1977 to February, 1978 were tabulated, and are presented in Table 2.3-6. It can be seen from this table that the onsite temperature data show the same tendencies as the offsite data. Though the diurnal temperature range is several degrees less at the Waterford site, the annual mean temperatures are within 0.7°F.

2.3.2.3 Relative Humidity, Dewpoint and Fog

From December to May, the waters of the Mississippi River are usually colder than the air temperature, and favor formation of river fog, particularly with light southerly winds[2,3]. Nearby lakes also serve to modify the extremes of temperature and to increase the incidence of fog over narrow strips of land along their shores[2]. January is the month with the greatest frequency of fog occurrences.

Monthly and annual mean relative humidity at 12 midnight, 6 a.m., 12 noon and 6 p.m. CST[2], mean dewpoint temperatures[5] and the mean number of days with heavy fog[2] are listed in Table 2.3-7. In about half of the winter hours, the relative humidity is under 80 percent. Humidity values of less than 50 percent are about twice as frequent in winter as in the summer.

Maximum dewpoint temperatures, persisting for 12 hours or more, were estimated from climatological maps[5], and are presented for each month in Table 2.3-7. These temperature values range from 71°F in January and February to higher than 78°F for the months June through September.

2.3.2.4 Wind Characteristics and Local Air Flow Trajectories

2.3.2.4.1 General Wind Regimes

The transport trajectories of airborne effluents potentially released from the plant will be a function of low level wind patterns. These in turn are determined by large scale meteorological conditions, and are modified to some extent by local water bodies and terrain features. The diffusion and deposition of airborne effluents is also a function of wind conditions and, additionally, is dependent upon atmospheric stability.

The seasonal migration of the area of high pressure, generally located in the western portions of the Atlantic Ocean or south-central areas of the United States and commonly referred to as the "Bermuda High", exerts a strong influence on airflow trajectories in the Waterford 3 site area. During the winter, spring and summer months, the typical position of the Bermuda High is about 500 miles east of the Florida or South Carolina coast. This results in a general southerly flow in the Waterford 3 site region. However, during the fall, the Bermuda High migrates westward, taking a position over Tennessee or Kentucky. The clockwise circulation around this high thus results in a general northeast flow in the site region during the fall months.

Although southern Louisiana is south of the usual track of winter storm centers moving across the United States, the site area is occasionally influenced by storms that deviate southward. In such situations, strong southerly wind flows may exist ahead of the storm, with the storm passage generally followed by northerly winds.

2.3.2.4.2 Offsite Wind Data

Surface wind data[9], taken at the New Orleans International Airport during the 10 year period of 1951-1960, were used to define long-term wind conditions for the New Orleans area. The annual wind rose data show that south is the predominant wind direction (9 percent of the total hours), although 8 of the remaining 15 points of the compass have a percentage frequency of 6 to 8 percent. The annual wind rose at the airport is shown in Figure 2.3-1. Monthly wind roses are given in Figures A2.3-1 to A2.3-12, contained in Appendix 2-1. These wind roses strongly suggest a wide variation in wind direction. The wind rose data are given in a tabular form, on an annual basis, in Table 2.3-8. Wind speeds by month are given in Tables A2.3-1 to A2.3-12, and are contained in Appendix 2-1. Calms occur 12 percent of the total hours.

An examination of the wind data from 1951 to 1960 from New Orleans International Airport, given in Table 2.3-8 and Tables A2.3-1 to A2.3-12, indicate that wind speeds have a definite seasonal variation and, to a lesser extent, vary with wind direction. Over this period, minimum average monthly wind speeds of 6.2 mph were recorded in August and maximum average monthly speeds of 10.9 mph were recorded in March, with intermediate speeds recorded in the spring and fall. On an annual basis, winds with a northerly component have the maximum average monthly speeds (9.0 mph). It should be noted that there may be deviations from these average values, depending on specific meteorological conditions.

2.3.2.4.3 Onsite Wind Data

Tabulated annual wind rose data and annual wind roses for the onsite meteorological station, at the 30 foot level, for the four years of onsite observation (July, 1972 through June, 1975 and February, 1977 through February, 1978) are presented in Table 2.3-9 and Figure 2.3-2, respectively. The monthly onsite wind speed and direction values, for the combined four years of data, are given in Tables A2.3-13 to A2.3-24, of Appendix 2-1. This appendix also presents these data as onsite wind roses in Figures A2.3-13 to A2.3-24. As these data indicate, winds at the site show fewer calms and more frequent southeasterly components than do the airport data. These differences are most likely due to the effects of Lake Pontchartrain and the different relative location of the lake with respect to the airport and the Waterford site.

The onsite wind data were used in all of the diffusion analyses performed in conjunction with this report. Since a substantial base of onsite data now exists, it was not felt necessary to compare the onsite data to offsite data to determine the long term representativeness of the onsite data. The onsite data are available on magnetic tape.

2.3.2.5 Atmospheric Stability

Temperature difference between 30 feet and 130 feet, recorded onsite during the periods July, 1972 through June, 1975 and February, 1977 to February, 1978, indicate that stable atmospheric conditions (stability classes E, F, and G) occurred about 56 percent of the time and unstable conditions (Classes A,B, and C) occurred about 19 percent of the time. The remaining observations (about 25 percent) fall into the neutral (Class D) category. The average monthly and annual frequency of the various stability categories (defined in accordance with USNRC Regulatory Guide 1.23) for the same period of record are presented in Table 2.3-10. Persistence of certain stability categories was analyzed for the four years of data gathered. Stable conditions (Classes E, F or G) persisted for a maximum of 47 hours in September, 1974. Extremely stable conditions (Class G) persisted for 15 hours on six different occasions - all during the 1972-1975 data period in the months of October through January.

Tables 2.3-11 through 2.3-17 are the annual average joint frequency tables (wind speed/wind direction/stability class) for the period July, 1972 through June, 1975, combined with the period February, 1977 through February, 1978. The monthly average joint frequency for July, 1972 through June, 1975 are presented in Tables B-13 through B-96, contained in Appendix 3-1. These tables are based upon wind data collected at the 30 foot level of the onsite meteorological tower, and upon data for the temperature difference between the 130 and 30 foot levels. The temperature difference data were converted to stability class summaries using the procedures outlined in USNRC Regulatory Guide 1.23. Data recovery percentages for the onsite program on a monthly and annual basis are summarized in Table 2.3-18.

2.3.2.6 Air Pollution Potential

Relative estimates of the air pollution potential of a specific site can be made from tabulated summaries of meteorological data. Two types of data summaries readily available are tabulations of mixing height and tabulations of stagnating anticyclone occurrences. Knowledge of potentially restricting terrain features is also an important consideration.

2.3.2.6.1 Mixing Height Data

The mixing height of the atmosphere is defined as the height of that surface based layer through which pollutant material released to the atmosphere will be thoroughly mixed. The lower the mixing height, the more unfavorable dispersion conditions become. When low mixing heights are in turn combined with low wind speeds in the mixing layer, air pollution problems can result. Using mixing height and wind speed data for the period 1960-1964, Holzworth [10] examined and generally summarized the relative potential for adverse dispersion conditions for urban areas throughout the contiguous United States. Although the Waterford site is located in a non-urban area, Holzworth's analyses are still felt to be reasonably applicable for the purposes of this study. Holzworth's results indicate that the site area can expect to experience between 10 and 15 days each year of adverse dispersion conditions. This value is somewhat high in comparison to much of the eastern US where 5-10 such days generally occur each year, but is quite low in comparison to areas west of the Rocky Mountains.

Seasonal morning and afternoon mixing heights as obtained by Holzworth [10] are shown in Table 2.3-19. As would be expected, mixing heights are higher in summer than winter; the fall values are slightly higher, on the average, than spring values. Strong, low inversions are a common phenomenon in the area on winter mornings when the colder air over the Mississippi Delta is surrounded by warm, moist air over the Gulf of Mexico.

2.3.2.6.2 Stagnating Anticyclone Data

The occurrence frequency of stagnating anticyclones, i.e., high pressure systems, represents another easily obtainable index of high air pollution potential. Stagnating anticyclones are, in fact, a cause of low mixing heights.

Using pressure gradient and low wind speed criteria, Korshover (11) has determined that approximately 30 stagnation incidents, covering a total of 110 days, occurred in the site area from 1936 through 1965. Such statistics are higher than those for the Northeast and the Midwest, but considerably lower than those for the Southeast - especially the inland Carolinas and northern Georgia. Korshover also has concluded that only 2 stagnation incidents, lasting for 7 days or longer, occurred in the site area during the entire 30 year period examined.

2.3.2.6.3 Local Terrain Features

The terrain in the Waterford site region is very flat and contains numerous lakes, bayous, and streams, in addition to the Mississippi River. Figure 2.3-3 shows topographical features within 5 miles of the project site. Figure 2.3-4 shows that there are few significant terrain features within 50 miles of the site, because of the flat character of the area.

Maximum elevations for distances up to 10 miles from the center of the station are given in Figure 2.3-5, for the 16 cardinal points of the compass. This figure shows that no land features exist with elevations higher than 30 feet above sea level. This is generally the case within a 50 mile radius of the site, except for a few small hills less than 60 feet high, which are about 35 miles to the northwest. Because of the flat nature of the terrain, it is felt that terrain cross-sectional plots are not necessary beyond the 10 mile distance given in these figures.

2.3.2.6.4 Air Pollution Summary

In summary, it may be concluded that limited dispersion days occur with greater frequency in the New Orleans area than in much of the eastern US, but that this frequency is far below that experienced west of the Rocky Mountains. Both the mixing height and anticyclone data support this conclusion regarding air pollution potential in the site area. In addition, dispersion in any direction from the plant will not be restricted by any significant confining terrain features.

2.3.2.7 Precipitation

A fairly definite rainy period occurs from mid-December to mid-March. During this period, measurable precipitation occurs on about one third of the days in conjunction with a weather front which has stalled over the northern Gulf of Mexico. During this period, rain is generally continuous and may last for several days. Snowfall amounts are generally light, with the snow usually melting as it falls. In fact, snowfall amounts in excess of two inches have only been recorded four times in the 100 years of available data prior to 1975 (5.0 inches in January 1881, 8.2 inches in February 1895, 3.0 inches in February 1899 and 2.7 inches in December 1963[12,13]).

Only one glaze storm was reported in the region by the U.S. Weather Bureau for the 28-year period between 1925-1953[14]. Although the Weather Bureau data has only limited information on glaze occurrence in the New Orleans area, communication with the Lead Forecaster at the National Weather Service New Orleans office[15] indicates that since the early 1920's there have
been only three significant glaze occurrences in the site vicinity. The 1
most severe occurred in the early 1920's when approximately 1/4 inch of glaze ice accumulated on vegetation in the area. The accumulated glaze completely melted within less than 24 hours. The other two glaze storms occurred of January 1940 and in the mid to late 1950's. Each of these storms deposited less than 1/4 inch of glaze on vegetation, automobiles, etc., and in both cases the glaze accumulations melted within several hours.

Although April, May, October and November are generally dry, there have been some extremely heavy showers in those months. The greatest 24-hour precipitation total recorded since 1871 was 14.01 inches, which fell April 15-16, 1927, while 13.68 inches fell October 1-2, 1937[2]. The heaviest recorded rate of rainfall in the New Orleans area was one inch in 5 minutes, measured during a thunderstorm on February 5, 1955. Such a rate, however, has never been sustained for a long period[2].

In contrast, one can expect a period of 3 consecutive weeks without measureable rainfall about once in 10 years. The longest period was 53 days, from September 29 to November 20, 1924[2].

Average monthly and annual precipitation values representative of the area have been given in Table 2.3-3. Extreme monthly and daily precipitation data, and the mean number of days per month when precipitation equaled or exceeded 0.01 inch, are listed in Table 2.3-20. Maximum short
period precipitation data for Audubon Park[16] are shown in Table 1
2.3-21. Table 2.3-22 shows monthly frequencies of occurrence of precipitation by time of day at New Orleans International Airport for the period 1951 through 1960.

Annual and seasonal precipitation wind rose data for the US Naval Air
Station at New Orleans, located about 26 miles ESE of the site[17], 1
were obtained from the 17 year period of record (1949-1965). Table 2.3-23 presents the percentage frequency of wind direction during precipitation. The data show that the highest annual frequency (13.6 percent) of precipitation occurs when the wind is calm (equal to or less than 2 mph), and the lowest annual frequency (1.9 percent) of precipitation occurs with wind directions of WSW and WNW.

2.3.3 SEVERE WEATHER

2.3.3.1 Maximum Winds

Thom[18] has computed the return period for extreme winds (fastest mile 1
of wind exclusive of tornado winds) at 30 feet about the ground. Based

on Thom's analysis, a fastest mile of wind value of 100 mph (one mile of air passing in 36 seconds) can be expected to occur in the area on the average once every 100 years. Based on a gustiness factor developed by Huss[19], the highest instantaneous gust expected once in 100 years is 1
130 mph. Extreme wind speeds at New Orleans, for recurrence intervals from 2 to 100 years, are presented in Table 2.3-24. Winds greater than 50 knots occur less frequently than every 2 years. For comparison purposes, maximum observed 1 minute wind speeds and directions at New Orleans International Airport, for the period 1921-1967, are presented in Table 2.3-25.

The distribution of high wind speeds with height is an important factor in building design. Using the once in a hundred year wind (100 mph) and a standard logarithmic wind profile, the distribution of extreme winds with height is as follows:

0-50 feet	50-150 feet	150-400 feet
100 mph	119 mph	138 mph

2.3.3.2 Hurricanes

During the period 1871-1977, 55 tropical storms or hurricanes passed within 1
100 nautical miles of the Waterford site[20,21]. Beginning with 1886, the National Weather Service (formerly the US Weather Bureau) has differentiated between tropical storms (maximum wind less than 74 mph) and hurricanes (maximum wind equal to or greater than 74 mph). Since 1886, 26 hurricanes 1
and 23 tropical storms have passed within 100 nautical miles of the site. Since 1900, the centers of 3 hurricanes have passed over New Orleans[2].

At 9:12 a.m. on September 19, 1947, during the passage of a hurricane, the highest wind recorded at New Orleans International Airport was measured as 98 mph. Afterwards, and shortly before the eye of the hurricane passed over the station, the wind velocity became indistinguishable on the indicator, but the wind was estimated to reach 110 mph, with gusts estimated to 125 mph.

In 1965, Hurricane "Betsy" brought destructive winds to the New Orleans Metropolitan area. On September 9, 1965, at 11:47 p.m. the winds at New Orleans International Airport reached 86 mph from the east, with gusts to 112 mph. In downtown New Orleans, an extreme wind of 125 mph from the east was estimated from measurements taken on top of the Federal Building. Since 1963, five tropical cyclones with winds in excess of 50 mph, (all hurricanes - including Betsy), have passed within 100 nautical miles of the Waterford site. Of these, Betsy was by far the most severe in the New Orleans- 1
Waterford site area. A summary of these five hurricanes is presented in Table 2.3-26.

2.3.3.3 Thunderstorms

Thunderstorms, accompanied by damaging winds and hail, are relatively infrequent in the region. The most damaging thunderstorms are those associated with the passage of a cold front or squall line[2].

Based on 21 years of records (1949-1969) of the US Weather Bureau at New Orleans International Airport, also called the Moisant International Airport during this period, the mean number of days with thunderstorms is:

January	2	May	6	September	7
February	2	June	9	October	2
March	3	July	16	November	1
April	5	August	13	December	2
				Annual	68

The maximum thunderstorm occurrence during the months of July and August is also reflected in the monthly average precipitation.

Hail occurrences are relatively infrequent, and during the period 1955-1967, hail 3/4 inches or more in diameter was reported only 13 times in the 1° latitude - longitude square containing the site[22]. This is 1
rare, especially when compared to over 100 such hail reports from some localities in Oklahoma.

2.3.3.4 Tornadoes

Occasionally, an especially severe thunderstorm or hurricane will generate a tornado. According to Thom[23], the total frequency of tornadoes for the 10-year period 1953-1962, by one-degree latitude-longitude squares for south-eastern Louisiana is:

	89-90W	90-91W
29-30 N	9	0
30-31 N	12	11

The mean annual frequency of tornadoes per one degree square in the site area, therefore, is about one. 1

Thom[23] also gives the probability of a tornado striking a point based on the path width and length of all tornadoes reported in Iowa during 1953-1963. The average path area of the Iowa storms is given by Thom as 2.8209 square miles. Using this information, the tornado frequency presented above and the method suggested by Thom, the annual probability of a tornado striking the site is approximately 6.3×10^{-4} or about once every 1585 years.

An examination of tornado statistics for 1950-1977[24] showed that during this period a total of 112 tornadoes had been reported within 50 nautical miles (58 statute miles) of the Waterford site. The average path length and width of these 112 tornadoes is 3.36 miles and 318 feet, respectively; these values yield an average path area of 0.20 square miles.

Using the above, site specific statistics and Thom's method, the probability of a tornado striking the Waterford site is 7.68×10^{-5} or once in approximately 13,000 years.

The site specific tornado data described above show that the two most severe tornadoes to occur in the site vicinity were classed F4 according to the Fujita Tornado intensity scale[25]. This scale, which was developed by TT Fujita of the University of Chicago, classifies tornado intensity and maximum wind speed based upon the observed extent of damage attributable to the storm. The F4 classification is associated with wind speeds (rotational and translational combined) estimated to be between 207 and 260 mph. 1

Even though the probability of a tornado at the site is small, all structures and equipment necessary to initiate and maintain a safe plant shutdown have been designed to withstand short-term loadings resulting from a tornado funnel with a peripheral tangential velocity of 300 mph, a translational velocity of 60 mph and an external pressure drop of three psi in three seconds.

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TABLE 2.3-1

SUMMARY OF OFFSITE METEOROLOGICAL DATA SOURCES

Station	Data	Period of Record
New Orleans, Louisiana(Moisant) International Airport	Average Temperature and Precipitation	30 yrs. (1931-1960)
	Extreme Temperature and Precipitation	23 yrs. (1947-1969)
	Average Wind Direction and Speed	10 yrs. (1951-1960)
	Extreme Wind Direction and Speed	47 yrs. (1921-1967)
	Average Clear, Partly Cloudy and Cloudy Days	21 yrs. (1949-1969)
	Average Sea-Level Pressure	30 yrs. (1931-1960)
	Wind Persistance, Inversion Winds and Pasquill-Turner Stability	2 yrs. (1959-1960)
New Orleans, Louisiana/ Audubon Station	Average Temperature and Precipitation	30 yrs. (1931-1960)
	Extreme Temperature and Precipitation	81 yrs. (1889-1969)
	Average Cloud Cover (Sunrise-Sunset)	44 yrs. (1916-1959)
	Average Percentage of Possible Sunshine	67 yrs. (1891-1959)
	Average Daily Solar Radiation	13-15 yrs. (Unspecified)
Reserve Louisiana/ Cooperative Observer	Average Temperature and Precipitation	30 yrs. (1931-1960)

TABLE 2.3-2

AVERAGE MONTHLY CLOUD COVER, SUNSHINE, AND SOLAR RADIATION
NEW ORLEANS, LOUISIANA

Month	Mean Number of Days: Clear	Mean Number of Days: Partly Cloudy	Mean Number of Days: Cloudy	Mean Sky Cover (Tenths) Sunrise-Sunset	Pct of Possible Sunshine	Average Daily Solar Radiation $BTU/Ft^2/day$
January	7	8	16	6.0	49	789
February	7	7	14	6.0	50	955
March	9	8	14	5.8	57	1235
April	8	11	11	5.3	63	1519
May	11	11	9	5.1	66	1655
June	10	13	7	5.4	64	1633
July	5	16	10	6.1	58	1537
August	9	14	8	5.8	60	1534
September	11	10	9	5.2	64	1412
October	16	7	8	4.0	70	1316
November	11	9	10	4.7	60	1025
December	8	8	15	5.9	46	730
Annual	112	122	131	5.4	59	1279

TABLE 2.3-3

AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION
FOR SELECTED STATIONS IN THE NEW ORLEANS AREA

New Orleans, La - New Orleans International Airport

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temp (°F)	54.6	57.1	61.4	67.9	74.4	80.1	81.6	81.9	78.3	70.4	60.0	55.4	68.6
Precip (in.)	3.84	3.99	5.34	4.55	4.38	4.43	6.72	5.34	5.03	2.84	3.34	4.10	53.90

New Orleans, La - Audubon Station

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temp (°F)	55.5	57.7	62.1	68.9	75.7	81.1	82.6	82.5	78.9	71.1	61.0	56.6	69.5
Precip (in.)	4.29	4.35	5.91	5.54	4.86	5.59	8.12	6.64	6.41	3.15	3.51	4.59	62.96

Reserve, La - Cooperative Observer

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temp (°F)	53.8	55.9	60.6	67.8	75.1	80.0	82.5	82.3	78.7	70.4	59.8	54.6	68.5
Precip (in.)	4.49	5.16	5.64	4.92	4.90	5.31	7.00	5.74	5.14	2.96	3.77	5.54	60.57

TABLE 2.3-4

TEMPERATURE MEANS AND EXTREMES*
NEW ORLEANS INTERNATIONAL AIRPORT, NEW ORLEANS, LOUISIANA

	Normal			Extremes			
Month	Daily Maximum	Daily Minimum	Mean Monthly	Record Maximum	Year	Record Minimum	Year
January	64.4	44.8	54.6	83	1957	14	1963
February	66.7	47.5	57.1	84	1948	19	1951
March	71.2	51.6	61.4	87	1955	26	1968
April	77.7	58.1	67.9	91	1948	38	1962
May	84.4	64.4	74.4	96	1953	41	1960
June	89.6	70.5	80.1	100	1954	55	1966
July	90.6	72.6	81.6	99	1951	60	1967
August	90.7	73.0	81.9	100	1951	60	1968
September	87.2	69.3	78.3	97	1954	42	1967
October	80.3	60.5	70.4	92	1962	35	1968
November	70.3	49.6	60.0	86	1951	28	1968
December	65.3	45.5	55.4	82	1951	17	1962
Annual	78.2	59.0	68.6	100	June 1954	14	Jan 1963

Note: *Maximum and minimum temperature extremes have been exceeded at other sites in the locality as follows: Highest temperature 102°F in June 1954; lowest temperature 6°F in February 1899.

TABLE 2.3-5

AVERAGE MONTHLY OCCURRENCES OF EXTREME TEMPERATURES

NEW ORLEANS INTERNATIONAL AIRPORT, NEW ORLEANS, LOUISIANA

Month	Maximum Temperature		Minimum Temperature	
	Greater than or equal to 90°F	Less than or equal to 32°F	Greater than or equal to 32°F	Less than or equal to 0°F
January	0	*	5	0
February	0	0	3	0
March	0	0	1	0
April	*	0	0	0
May	4	0	0	0
June	17	0	0	0
July	20	0	0	0
August	19	0	0	0
September	8	0	0	0
October	1	0	0	0
November	0	0	1	0
December	0	*	3	0
Annual	68	*	12	0

Note: *Less than one half

TABLE 2.3-6

MEAN MONTHLY AND ANNUAL DAILY MAXIMUM, MINIMUM, AND AVERAGE TEMPERATURES
ONSITE DATA, WATERFORD 3,
(JULY 1972 - JUNE 1975 AND FEBRUARY 1977 - FEBRUARY 1978)

Month	Mean Temperature (° F)	Mean Maximum Temperature (° F)	Mean Minimum Temperature (° F)
January	53.6	62.4	48.2
February	54.5	62.2	46.9
March	63.5	68.8	53.8
April	67.4	70.9	64.1
May	74.5	81.3	68.2
June	78.5	85.0	72.3
July	79.8	87.8	73.6
August	79.1	86.3	73.6
September	77.7	85.4	73.7
October	70.8	75.9	61.7
November	60.5	67.5	53.6
December	55.0	62.3	45.8
Annual	67.9	74.6	61.3

TABLE 2.3-7

MEAN RELATIVE HUMIDITY AND NUMBER OF DAYS WITH HEAVY FOG
NEW ORLEANS INTERNATIONAL AIRPORT, NEW ORLEANS, LOUISIANA

Month	Relative Humidity (%) 12 Mid-night (CST)	6 A M (CST)	12 Noon (CST)	6 PM (CST)	Dewpoint (°F) Mean	Max	Heavy Fog Mean Days
January	84	86	67	73	46	71	7
February	83	85	64	69	48	71	5
March	82	84	60	64	52	72+	4
April	85	88	60	66	59	75	2
May	86	89	60	65	66	77+	1
June	87	90	62	68	72	78+	*
July	89	91	66	73	73	78+	*
August	89	91	66	73	73	78+	*
September	87	89	65	74	70	78+	*
October	84	87	58	72	60	77	2
November	83	86	59	73	52	75	4
December	83	86	66	75	47	72+	6
Annual	85	88	63	70	60		32

*Less than 1/2 day on the average

+Higher than value given but next contour not drawn on map.

TABLE 2.3-8

NEW ORLEANS, LA.

NEW ORLEANS INTERNATIONAL AIRPORT

PERCENTAGE FREQUENCIES

OF WIND DIRECTION AND SPEED

(1951-1960)

DIRECTION	HOURLY OBSERVATIONS OF WIND SPEED (In Miles Per Hour)										
	0-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	46+	Total	Av Speed
N	+	1	2	2	1	+	+	+		6	12.4
WNE	+	1	2	2	1	+	+			6	12.0
NE	+	2	3	2	+	+	+	+		8	10.5
ENE	+	2	3	2	+	+	+	+	+	8	10.2
E	+	2	2	1	+	+	+			6	8.9
ESE	+	2	1	1	+	+				4	8.0
SE	+	2	2	1	+	+				5	8.4
SSE	+	3	3	2	+	+	+	+		8	9.8
S	+	3	3	2	+	+	+			9	9.9
SSW	+	2	3	1	+	+	+			7	9.8
SW	+	2	1	1	+	+				4	8.4
WSW	+	1	1	+	+	+	+			2	8.6
W	+	1	1	+	+	+	+			3	8.6
WNW	+	1	1	1	+	+	+	+		3	8.9
NW	+	1	1	1	+	+		+		4	11.4
NNW	+	1	2	2	1	+	+	+		6	12.8
CALM	12									12	
TOTAL	16	27	32	19	5	1	+	+	+	100	9.0

+ Indicates frequency greater than 0 but less than 0.5

TABLE 2.3-9

PERCENT FREQUENCY DISTRIBUTION OF HOURLY WIND OBSERVATIONS*
FOR WATERFORD 3 SITE
(JULY 1972 - JUNE 1975 AND FEBRUARY 1977 - FEBRUARY 1978)

SPEED (MPH)

	CALM	0.8-3	3.1-7	7.1-12	12.1-18	18.1-24	24.1-32	GREATER THAN 32	TOTAL
N	0.000	0.007	0.017	0.015	0.005	0.000	0.000	0.000	0.045
NNE	0.000	0.008	0.028	0.022	0.004	0.000	0.000	0.000	0.064
NE	0.000	0.010	0.042	0.032	0.007	0.000	0.000	0.000	0.090
ENE	0.000	0.010	0.032	0.022	0.006	0.000	0.000	0.000	0.070
E	0.000	0.006	0.015	0.015	0.003	0.000	0.000	0.000	0.038
ESE	0.000	0.010	0.034	0.026	0.008	0.000	0.000	0.000	0.079
SE	0.000	0.014	0.035	0.028	0.012	0.002	0.000	0.000	0.091
SSE	0.000	0.017	0.037	0.025	0.012	0.002	0.000	0.000	0.094
S	0.000	0.015	0.028	0.016	0.001	0.000	0.000	0.000	0.069
SSW	0.000	0.015	0.023	0.013	0.006	0.001	0.000	0.000	0.057
SW	0.000	0.013	0.018	0.012	0.004	0.000	0.000	0.000	0.047
WSW	0.000	0.014	0.017	0.007	0.003	0.000	0.000	0.000	0.041
W	0.000	0.010	0.014	0.008	0.003	0.000	0.000	0.000	0.036
WNW	0.000	0.010	0.014	0.009	0.004	0.000	0.000	0.000	0.038
NW	0.000	0.010	0.023	0.012	0.006	0.000	0.000	0.000	0.052
NNW	0.000	0.009	0.026	0.024	0.008	0.001	0.000	0.000	0.067
CALM	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023
TOTAL	0.023	0.179	0.404	0.287	0.097	0.009	0.001	0.000	1.000

* Number of observations - 32743

TABLE 2.3-10

PERCENT FREQUENCY OF ONSITE STABILITY CLASSES
JULY 1972 - JUNE 1975 AND FEBRUARY 1977 - FEBRUARY 1978

Month	STABILITY CLASS A	B	C	D	E	F	G	Number of Observations
January	6.66	2.85	4.35	37.64	29.92	11.45	7.13	2734
February	9.63	2.59	3.60	26.92	35.24	14.04	7.97	2585
March	11.42	2.43	3.17	32.62	36.51	9.18	4.67	2679
April	21.41	2.63	3.00	22.50	28.91	10.03	11.53	2733
May	18.16	2.10	2.24	20.25	33.13	16.31	7.81	2765
June	16.77	2.84	2.73	22.93	24.59	18.36	11.80	2713
July	15.75	2.67	1.84	22.10	22.21	20.96	14.47	2882
August	13.84	2.60	2.64	21.16	26.78	18.64	14.34	2580
September	13.34	3.52	3.40	20.60	29.66	16.51	12.96	2616
October	17.98	2.15	1.25	18.62	26.22	14.92	18.85	2647
November	10.62	1.76	1.68	26.33	38.19	12.19	9.23	2731
December	10.92	3.14	3.31	29.49	33.05	11.77	8.32	2838
Annual	13.89	2.61	2.76	25.13	30.34	14.53	10.74	32503

TABLE 2.3-11

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS A
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 4515)
PERCENTAGE FREQUENCY DISTRIBUTION

		WIND SPEED (MPH)							
WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
CALM	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
N	0.00	0.42	1.55	0.86	0.31	0.07	0.00	0.00	3.21
NNE	0.00	0.42	4.96	4.92	0.53	0.00	0.00	0.00	10.83
NE	0.00	0.31	9.01	7.73	1.00	0.02	0.00	0.00	18.07
ENE	0.00	0.20	3.92	3.63	0.40	0.04	0.00	0.00	8.19
E	0.00	0.04	0.71	1.11	0.22	0.00	0.00	0.00	2.08
ESE	0.00	0.18	1.62	3.37	1.22	0.04	0.00	0.00	6.42
SE	0.00	0.24	1.28	3.10	1.77	0.27	0.02	0.00	6.69
SSE	0.00	0.24	2.48	3.46	1.68	0.29	0.00	0.00	8.15
S	0.00	0.31	1.31	1.59	0.89	0.13	0.00	0.00	4.23
SSW	0.00	0.16	1.22	1.73	1.13	0.11	0.00	0.00	4.34
SW	0.00	0.16	1.15	2.02	0.71	0.02	0.00	0.00	4.05
WSW	0.00	0.11	1.00	1.35	0.51	0.09	0.00	0.00	3.06
W	0.00	0.13	0.84	1.57	0.73	0.00	0.00	0.00	3.28
WNW	0.00	0.11	1.22	1.44	0.62	0.04	0.00	0.00	3.43
NW	0.00	0.22	3.03	2.21	0.47	0.00	0.00	0.00	5.94
NNW	0.00	0.35	3.61	3.01	0.86	0.13	0.00	0.00	7.97
TOTAL	0.04	3.61	38.91	43.10	13.05	1.26	0.02	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 13.89 PERCENT OF THE TOTAL 32503

TABLE 2.3-12

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS B
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 847)
PERCENTAGE FREQUENCY DISTRIBUTION

		WIND SPEED (MPH)							
WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
CALM	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
N	0.00	0.47	2.13	0.71	0.71	0.00	0.00	0.00	4.01
NNE	0.00	0.59	3.19	2.36	0.83	0.47	0.00	0.00	7.44
NE	0.00	0.59	6.02	3.78	1.53	0.00	0.00	0.00	11.92
ENE	0.00	0.24	2.83	3.90	1.65	0.12	0.00	0.00	8.74
E	0.00	0.12	0.83	1.77	1.42	0.00	0.00	0.00	4.13
ESE	0.00	0.00	1.53	2.60	1.53	0.00	0.00	0.00	5.67
SE	0.00	0.35	0.94	2.24	1.89	0.24	0.00	0.00	5.67
SSE	0.00	0.12	2.01	4.72	2.24	0.59	0.00	0.00	9.68
S	0.00	0.00	1.18	2.83	1.42	0.12	0.00	0.00	5.55
SSW	0.00	0.35	1.06	2.60	1.77	0.24	0.00	0.00	6.02
SW	0.00	0.00	2.36	2.95	1.77	0.00	0.00	0.00	7.08
WSW	0.00	0.00	1.30	1.06	0.71	0.24	0.00	0.00	3.31
W	0.00	0.24	1.53	1.42	1.30	0.00	0.00	0.00	4.49
WNW	0.00	0.47	1.30	1.65	0.59	0.00	0.00	0.00	4.01
NW	0.00	0.12	2.83	1.77	0.59	0.12	0.00	0.00	5.43
NNW	0.00	0.24	2.60	2.60	1.30	0.00	0.00	0.00	6.73
TOTAL	0.12	3.90	33.65	38.96	21.25	2.13	0.00	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 2.61 PERCENT OF THE TOTAL 32503

TABLE 2.3-13

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS C
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 898)
PERCENTAGE FREQUENCY DISTRIBUTION

WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
	WIND SPEED (MPH)								
CALM	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
N	0.00	0.56	1.89	1.00	1.56	0.11	0.00	0.00	5.12
NNE	0.00	0.67	1.89	1.67	0.67	0.33	0.00	0.00	5.23
NE	0.00	0.11	4.57	4.12	1.22	0.11	0.00	0.00	10.13
ENE	0.00	0.78	3.12	3.56	1.22	0.11	0.00	0.00	8.80
E	0.00	0.11	0.67	0.67	0.33	0.00	0.00	0.00	1.78
ESE	0.00	0.11	1.00	3.45	1.67	0.00	0.00	0.00	6.24
SE	0.00	0.33	1.22	3.34	2.23	0.22	0.00	0.00	7.35
SSE	0.00	0.11	2.23	3.01	2.56	0.89	0.00	0.00	8.80
S	0.00	0.11	1.78	2.12	0.89	0.45	0.00	0.00	5.35
SSW	0.00	0.22	1.67	2.56	1.34	0.11	0.00	0.00	5.90
SW	0.00	0.00	2.00	2.45	1.22	0.00	0.00	0.00	5.68
WSW	0.00	0.45	2.45	1.78	1.34	0.00	0.00	0.00	6.01
W	0.00	0.45	0.56	1.56	1.67	0.00	0.00	0.00	4.23
WNW	0.00	0.11	0.78	1.22	1.22	0.00	0.00	0.00	3.34
NW	0.00	0.33	2.34	2.34	0.78	0.00	0.00	0.00	5.79
NNW	0.00	0.67	3.01	4.68	1.78	0.00	0.00	0.00	10.13
TOTAL	0.11	5.12	31.18	39.53	21.71	2.34	0.00	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 2.76 PERCENT OF THE TOTAL 32503

TABLE 2.3-14

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS D
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 8167)
PERCENTAGE FREQUENCY DISTRIBUTION

		WIND SPEED (MPH)							
WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
CALM	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28
N	0.00	0.53	1.70	2.34	0.94	0.06	0.00	0.00	5.57
NNE	0.00	0.73	2.39	3.23	0.82	0.05	0.00	0.00	7.22
NE	0.00	0.62	3.60	3.75	1.11	0.02	0.00	0.00	9.11
ENE	0.00	0.59	2.36	2.55	1.16	0.04	0.00	0.00	6.70
E	0.00	0.23	0.99	1.76	0.54	0.06	0.00	0.00	3.59
ESE	0.00	0.45	2.14	4.08	1.38	0.10	0.00	0.00	8.15
SE	0.00	0.51	2.41	3.86	2.23	0.34	0.01	0.00	9.37
SSE	0.00	0.34	2.27	3.64	2.33	0.50	0.06	0.00	9.13
S	0.00	0.36	1.95	2.69	1.54	0.23	0.01	0.00	6.78
SSW	0.00	0.31	1.71	2.11	1.05	0.12	0.01	0.00	5.31
SW	0.00	0.24	1.78	1.79	0.64	0.02	0.00	0.00	4.47
WSW	0.00	0.28	1.44	1.04	0.36	0.06	0.00	0.00	3.18
W	0.00	0.22	1.15	1.13	0.48	0.00	0.02	0.00	3.00
WNW	0.00	0.45	1.22	1.41	0.80	0.02	0.01	0.00	3.92
NW	0.00	0.54	2.29	1.56	1.46	0.09	0.00	0.00	5.93
NNW	0.00	0.48	2.61	3.44	1.62	0.13	0.00	0.00	8.28
TOTAL	0.28	6.89	32.02	40.36	18.45	1.86	0.13	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 25.13 PERCENT OF THE TOTAL 32503

TABLE 2.3-15

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS E
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 9862)
PERCENTAGE FREQUENCY DISTRIBUTION

		WIND SPEED (MPH)							
WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
CALM	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
N	0.00	0.63	2.11	2.39	0.43	0.01	0.00	0.00	5.57
NNE	0.00	0.69	2.86	2.06	0.31	0.02	0.00	0.00	5.94
NE	0.00	0.85	3.65	3.05	0.58	0.00	0.00	0.00	8.13
ENE	0.00	0.65	3.71	2.65	0.48	0.00	0.00	0.00	7.48
E	0.00	0.42	2.35	2.20	0.23	0.00	0.00	0.00	5.20
ESE	0.00	0.89	5.35	2.97	0.52	0.01	0.00	0.00	9.74
SE	0.00	0.84	5.26	3.76	1.02	0.12	0.01	0.00	11.02
SSE	0.00	1.17	4.39	2.99	0.76	0.08	0.06	0.00	9.45
S	0.00	0.88	3.33	1.91	0.59	0.12	0.02	0.00	6.84
SSW	0.00	1.01	2.55	1.27	0.17	0.07	0.02	0.00	5.09
SW	0.00	0.66	1.79	0.74	0.11	0.03	0.00	0.00	3.34
WSW	0.00	0.76	1.62	0.43	0.09	0.02	0.00	0.00	2.92
W	0.00	0.51	1.44	0.62	0.10	0.01	0.00	0.00	2.68
WNW	0.00	0.63	1.97	0.77	0.20	0.00	0.00	0.00	3.57
NW	0.00	0.89	2.26	1.26	0.41	0.01	0.00	0.00	4.83
NNW	0.00	0.73	3.04	2.89	0.49	0.03	0.00	0.00	7.18
TOTAL	1.01	12.21	47.69	31.95	6.49	0.54	0.11	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 30.34 PERCENT OF THE TOTAL 32503

TABLE 2.3-16

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS F
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 4724)
PERCENTAGE FREQUENCY DISTRIBUTION

WIND DIRECTION	CALM	0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
		WIND SPEED (MPH)							
CALM	4.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.04
N	0.00	1.31	1.84	0.30	0.00	0.00	0.00	0.00	3.45
NNE	0.00	1.40	3.07	0.17	0.00	0.00	0.00	0.00	4.64
NE	0.00	1.80	3.58	0.64	0.06	0.00	0.00	0.00	6.08
ENE	0.00	2.35	4.19	0.49	0.06	0.00	0.00	0.00	7.09
E	0.00	1.44	2.10	0.61	0.00	0.00	0.00	0.00	4.15
ESE	0.00	2.39	5.40	0.19	0.06	0.02	0.00	0.00	8.07
SE	0.00	3.11	5.27	0.30	0.13	0.00	0.02	0.00	8.83
SSE	0.00	3.15	6.18	0.25	0.06	0.00	0.02	0.00	9.67
S	0.00	3.56	5.02	0.17	0.04	0.00	0.00	0.00	8.78
SSW	0.00	3.13	4.04	0.13	0.02	0.00	0.00	0.00	7.32
SW	0.00	2.56	2.46	0.42	0.02	0.00	0.00	0.00	5.46
WSW	0.00	2.82	2.96	0.11	0.04	0.00	0.00	0.00	5.93
W	0.00	1.84	2.46	0.11	0.00	0.00	0.00	0.00	4.40
WNW	0.00	1.65	1.46	0.06	0.04	0.00	0.00	0.00	3.22
NW	0.00	1.69	2.52	0.25	0.02	0.00	0.00	0.00	4.49
NNW	0.00	1.67	2.20	0.49	0.02	0.00	0.00	0.00	4.38
TOTAL	4.04	35.88	54.74	4.68	0.59	0.02	0.04	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 14.53 PERCENT OF THE TOTAL 32503

TABLE 2.3-17

WIND DISTRIBUTION BY PASQUILL STABILITY CLASS G
WATERFORD 3 - ANNUAL
(NUMBER OF OBSERVATIONS = 3490)
PERCENTAGE FREQUENCY DISTRIBUTION

WIND DIRECTION	CALM	WIND SPEED (MPH) 0.8 3.0	3.1 7.0	7.1 12.0	12.1 18.0	18.1 24.0	24.1 32.0	ABOVE 32.0	TOTAL
CALM	12.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.38
N	0.00	1.17	0.89	0.00	0.00	0.00	0.00	0.00	2.06
NNE	0.00	1.52	0.86	0.03	0.00	0.00	0.00	0.00	2.41
NE	0.00	2.26	1.20	0.00	0.00	0.00	0.00	0.00	3.47
ENE	0.00	2.49	1.38	0.00	0.00	0.00	0.00	0.00	3.87
E	0.00	1.32	0.40	0.14	0.00	0.00	0.00	0.00	1.86
ESE	0.00	2.12	1.29	0.37	0.11	0.00	0.00	0.00	3.90
SE	0.00	4.50	2.92	0.17	0.00	0.00	0.03	0.00	7.62
SSE	0.00	7.19	4.24	0.14	0.00	0.00	0.00	0.00	11.58
S	0.00	5.70	3.09	0.03	0.00	0.00	0.00	0.00	8.83
SSW	0.00	5.47	2.35	0.00	0.00	0.00	0.00	0.00	7.82
SW	0.00	5.79	1.78	0.00	0.00	0.00	0.00	0.00	7.56
WSW	0.00	6.45	1.40	0.03	0.00	0.00	0.00	0.00	7.88
W	0.00	4.96	1.26	0.00	0.00	0.00	0.00	0.00	6.22
WNW	0.00	4.38	0.83	0.03	0.00	0.00	0.00	0.00	5.24
NW	0.00	3.01	1.03	0.00	0.03	0.00	0.00	0.00	4.07
NNW	0.00	2.49	0.69	0.06	0.00	0.00	0.00	0.00	3.24
TOTAL	12.38	60.83	25.62	1.00	0.14	0.00	0.03	0.00	

THIS STABILITY CLASS ACCOUNTS FOR 10.74 PERCENT OF THE TOTAL 32503

TABLE 2.3-18

AVERAGE MONTHLY DATA RECOVERY
WATERFORD 3 ONSITE METEOROLOGICAL
MONITORING PROGRAM
JULY 1972 - JUNE 1975 AND FEBRUARY 1977 - FEBRUARY 1978

Month	Number of Valid Observations	Number of Possible Observations	Data Recovery (Percent)
January	2,734	2,976	91.2
February	2,585	2,688	96.2
March	2,679	2,976	90.0
April	2,733	2,880	94.9
May	2,765	2,976	92.9
June	2,713	2,880	94.2
July	2,882	2,976	96.8
August	2,580	2,976	86.7
September	2,616	2,880	90.8
October	2,647	2,976	88.9
November	2,731	2,880	94.8
December	2,838	2,976	95.4
TOTAL PERIOD	32,503	35,040	92.8

TABLE 2.3-19

SEASONAL AND ANNUAL AVERAGE
MORNING AND AFTERNOON MIXING HEIGHTS
WATERFORD 3 AREA

	Mixing Height Above Ground (Meters)	
	Morning	Afternoon
Winter	500	800
Spring	600	1,000
Summer	900	1,300
Fall	700	1,200
Annual Average	700	1,100

Source: Holzworth, George C, "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States." Division of Meteorology, Office of Air Programs, Environmental Protection Agency, Research Triangle Park, North Carolina. January, 1972.

TABLE 2.3-20

EXTREME MONTHLY AND DAILY PRECIPITATION (INCHES) AND
MEAN NUMBER OF DAYS WITH RAIN
NEW ORLEANS INTERNATIONAL AIRPORT, NEW ORLEANS, LOUISIANA

Month	Maximum Monthly	Year	Minimum Monthly	Year	Maximum 24 Hour Amounts	Year	Mean Number of Days with Precipitation 0.01 or more
January	12.62	1966	0.54	1968	4.77	1955	10
February	10.56	1959	1.02	1962	5.60	1961	10
March	19.09	1948	0.24	1955	7.87	1948	9
April	8.78	1949	0.33	1965	4.35	1953	7
May	14.33	1959	0.99	1949	9.86	1959	8
June	8.87	1962	1.12	1952	4.19	1953	10
July	11.46	1954	3.45	1951	4.30	1966	15
August	11.77	1955	2.00	1952	3.06	1969	13
September	13.53	1948	0.24	1953	5.46	1957	9
October	6.45	1959	0.00	1952	2.58	1960	6
November	14.58	1947	0.21	1949	6.38	1953	6
December	10.77	1947	1.46	1958	3.94	1952	10

TABLE 2.3-21

MAXIMUM SHORT PERIOD PRECIPITATION (INCHES)

AUDUBON PARK STATION, NEW ORLEANS, LOUSIANA

	Minutes				Hours					
Time Period	5	10	15	30	1	2	3	6	12	24
Amount	1.00	1.48	1.90	3.18	4.71	5.87	6.54	8.62	12.76	14.01
Date	2/5	4/25	4/25	4/25	4/25	4/25	4/15	9/6	4/15	4/15
Year	1955	1953	1953	1953	1953	1953	1953	1929	1927	1927

TABLE 2.3-22

NUMBER OF PRECIPITATION OCCURRENCES BY
HOUR OF DAY FOR NEW ORLEANS INTERNATIONAL AIRPORT 1951-1960
(Sheet 1 of 2)

Hour of Day Ending at:	Month												
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual Average
0100	30	43	33	21	17	8	8	7	23	22	36	38	29
0200	33	43	27	21	18	7	9	6	24	21	32	42	28
0300	39	42	27	25	18	13	10	9	23	21	38	44	31
0400	39	44	28	26	18	16	14	9	19	23	38	37	31
0500	33	45	38	25	15	16	13	10	20	24	33	46	32
0600	31	29	42	22	16	11	10	12	26	27	26	50	31
0700	34	38	39	30	20	16	16	20	28	24	23	45	33
0800	31	39	38	25	22	16	25	19	25	16	25	42	32
0900	33	42	35	26	20	16	27	23	26	16	27	41	33
1000	31	39	34	23	23	25	37	32	34	18	26	43	37
1100	37	37	34	24	24	34	48	48	31	27	28	36	41
1200	26	40	39	29	32	49	58	67	46	28	34	30	48
1300	32	42	35	32	35	55	68	68	53	32	29	35	52
1400	36	36	32	35	32	57	77	67	52	30	30	38	52
1500	36	40	41	34	42	52	78	68	56	35	29	37	55
1600	33	52	37	33	39	40	76	63	50	36	23	31	51
1700	32	43	38	34	38	35	62	50	44	27	28	34	47
1800	30	47	36	29	38	31	59	45	42	25	26	39	45
1900	34	48	43	29	36	26	45	33	36	23	21	40	41
2000	24	46	41	28	32	20	36	27	28	21	20	41	37

TABLE 2.3-2[illegible]

NUMBER OF PRECIPITATION OCCURRENCES BY
HOUR OF DAY FOR NEW ORLEANS INTERNATIONAL AIRPORT 1951-1960
(Sheet 2 of 2)

Hour of Day Ending at:	Month												
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual Average
2100	30	47	31	19	26	18	26	25	24	18	21	41	33
2200	33	43	32	18	19	13	21	13	17	21	28	40	30
2300	33	44	33	19	21	9	21	10	19	22	34	42	31
2400	34	46	31	22	18	9	13	8	18	19	34	39	29
No. of days	128	136	134	108	116	137	194	167	140	89	122	137	160

TABLE 2.3-23

ANNUAL AND SEASONAL PERCENTAGE FREQUENCY OF SURFACE WIND DIRECTION DURING PRECIPITATION NAVAL AIR STATION - NEW ORLEANS, LOUISIANA

	Winter	Spring	Summer	Fall	Annual
N	11.8	7.1	2.4	7.3	6.8
NNE	10.6	5.2	3.0	12.0	8.7
NE	12.2	5.8	5.5	11.3	8.5
ENE	8.6	7.1	4.9	10.7	7.0
E	9.4	11.0	6.1	8.0	8.7
ESE	4.9	6.5	5.5	10.0	7.0
SE	3.7	5.8	7.3	4.0	5.3
SSE	2.0	9.1	4.9	3.3	3.6
S	4.9	10.4	8.5	4.0	7.0
SSW	4.1	5.2	7.3	1.3	5.3
SW	2.0	3.2	7.3	2.0	3.6
WSW	0.8	1.3	4.3	2.0	1.9
W	2.0	3.2	3.0	1.3	3.7
WNW	1.6	2.6	2.4	2.0	1.9
NW	4.5	5.8	3.7	2.0	3.7
NNW	8.2	3.9	1.8	4.0	3.7
CALM	8.6	7.8	21.9	14.7	13.6

TABLE 2.3-24

RECURRENCE INTERVAL AND WIND SPEED
AT NEW ORLEANS, LOUISIANA

Recurrence Interval (yrs)	Wind Speed (MPH)
2	49
10	67
25	70
50	90
100	100

TABLE 2.3-25

MAXIMUM OBSERVED ONE MINUTE WIND SPEED AND DIRECTION
NEW ORLEANS INTERNATIONAL AIRPORT 1921-1967

Month	Direction	Speed (MPH)
January	NE	41
February	E	44
March	NW	43
April	SE	35
May	SE	43
June	NE	40
July	NW	37
August	SE	41
September	SE	98
October	SE	31
November	NW	28
December	SW	31

TABLE 2.3-26

STORMS IN EXCESS OF 50 MPH SINCE 1963

Storm	Date	Maximum Recorded Wind Speed (mph) In Louisiana	Maximum Recorded Wind Speed (mph) at New Orleans	
Hilda	10/3-10/4/64	135	40/G-54*	
Betsy	9/9/65	136/G-145	125	
Camille	8/17/69	87/G-109	42/G-59	
Edith	9/16/71	69/G-96	32/G-51	1
Carmen	9/8/74	85	33	

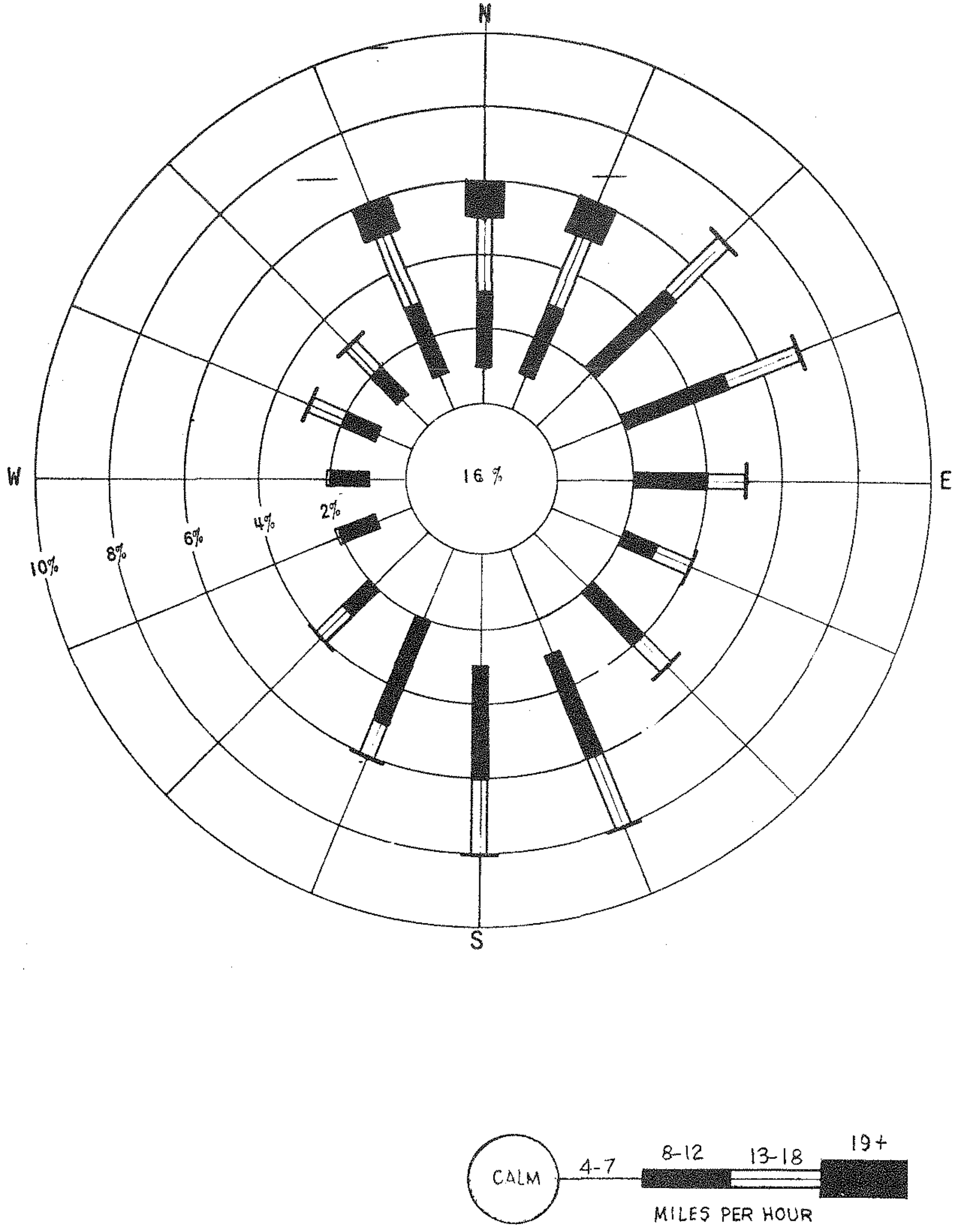
REFERENCE

1) North Atlanta Tropical Cyclones (1964, 1965, 1969, 1971 and 1974 issues),

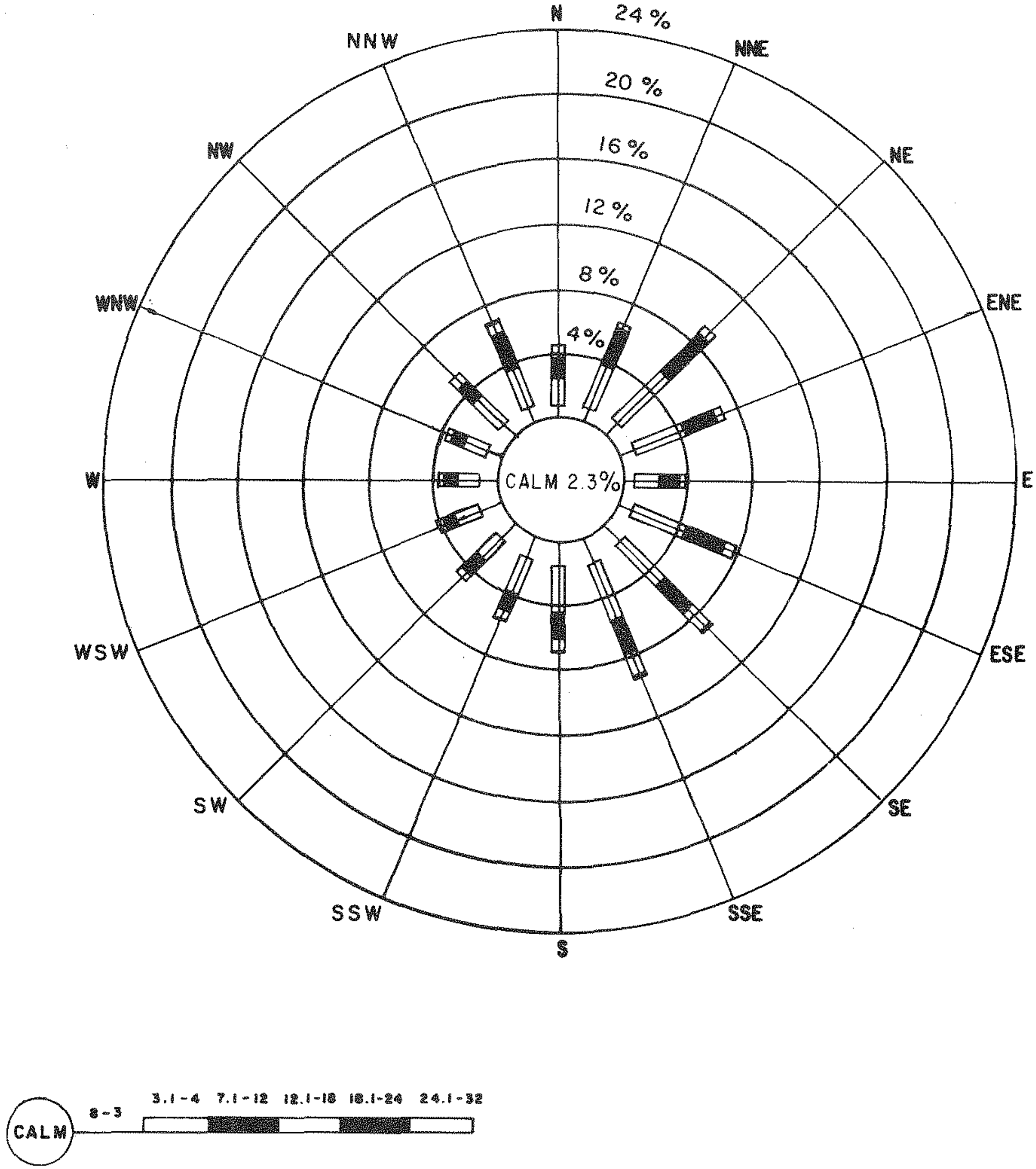
U.S. Department of Commerce, NOAA, Environmental Data Service Washington, DC.

NOTES

*40/G - 54 means: 40 mph sustained winds, gusts to 54 mph.

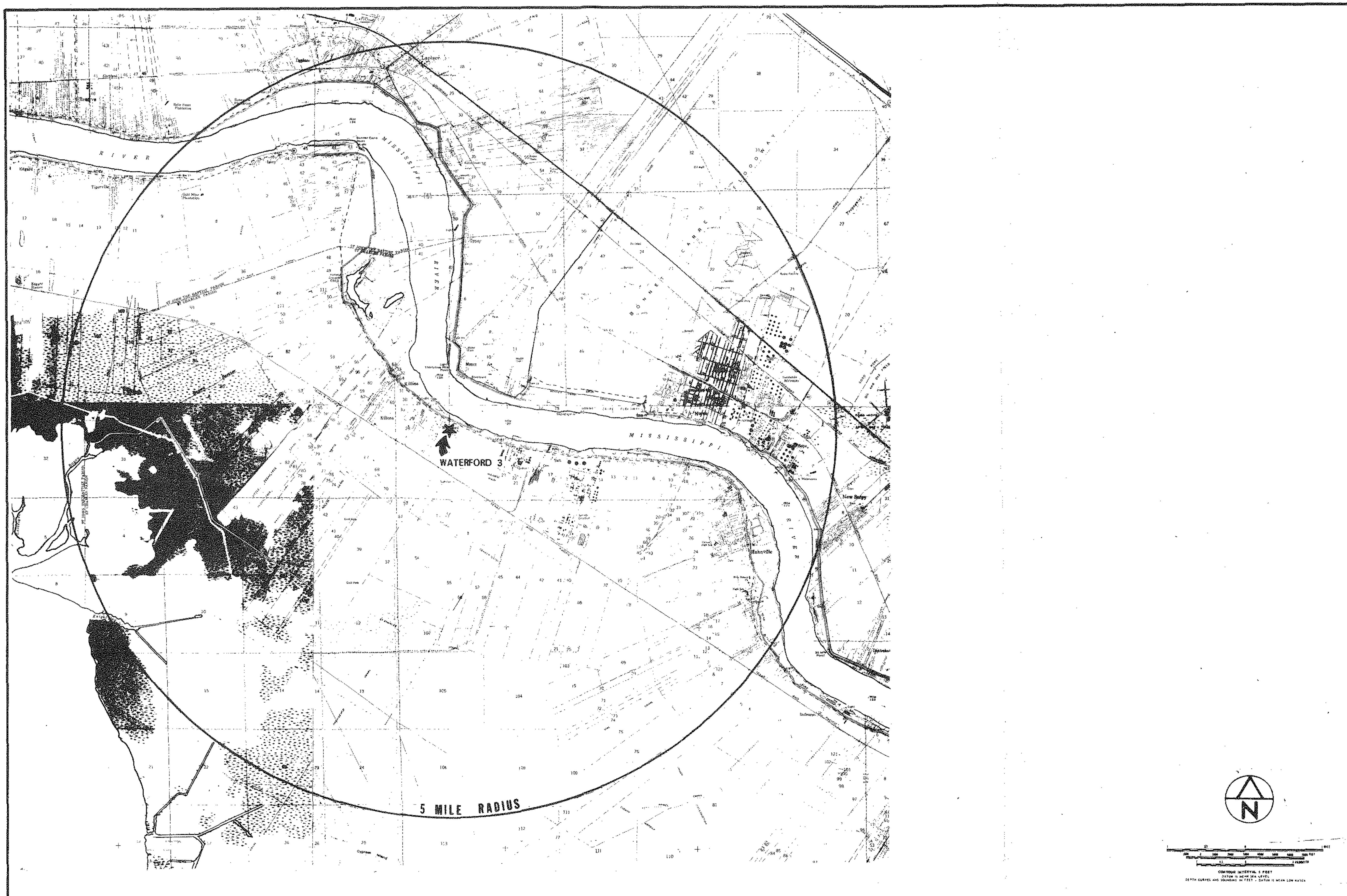


LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	ANNUAL WIND ROSE NEW ORLEANS INTERNATIONAL AIRPORT NEW ORLEANS, LOUISIANA	Figure 2.3-1



32751 OBSERVATIONS

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	WATERFORD 3 ONSITE WIND ROSE — ANNUAL 1972-75, 1977-78	FIGURE 2.3-2

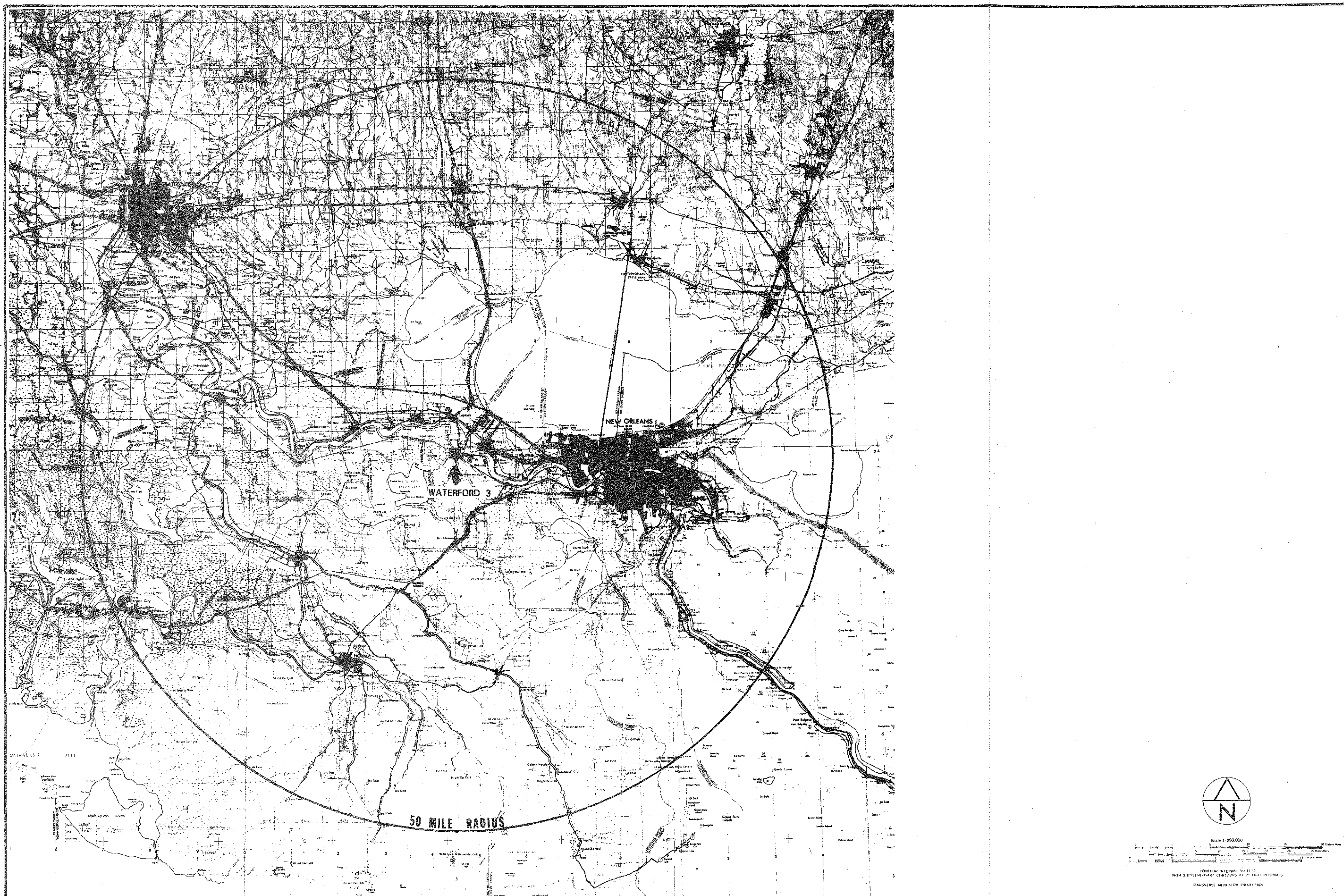


LOUISIANA
POWER & LIGHT CO.
Waterford Steam
Electric Station

TOPOGRAPHIC FEATURES WITHIN 5 MILES OF SITE

Figure

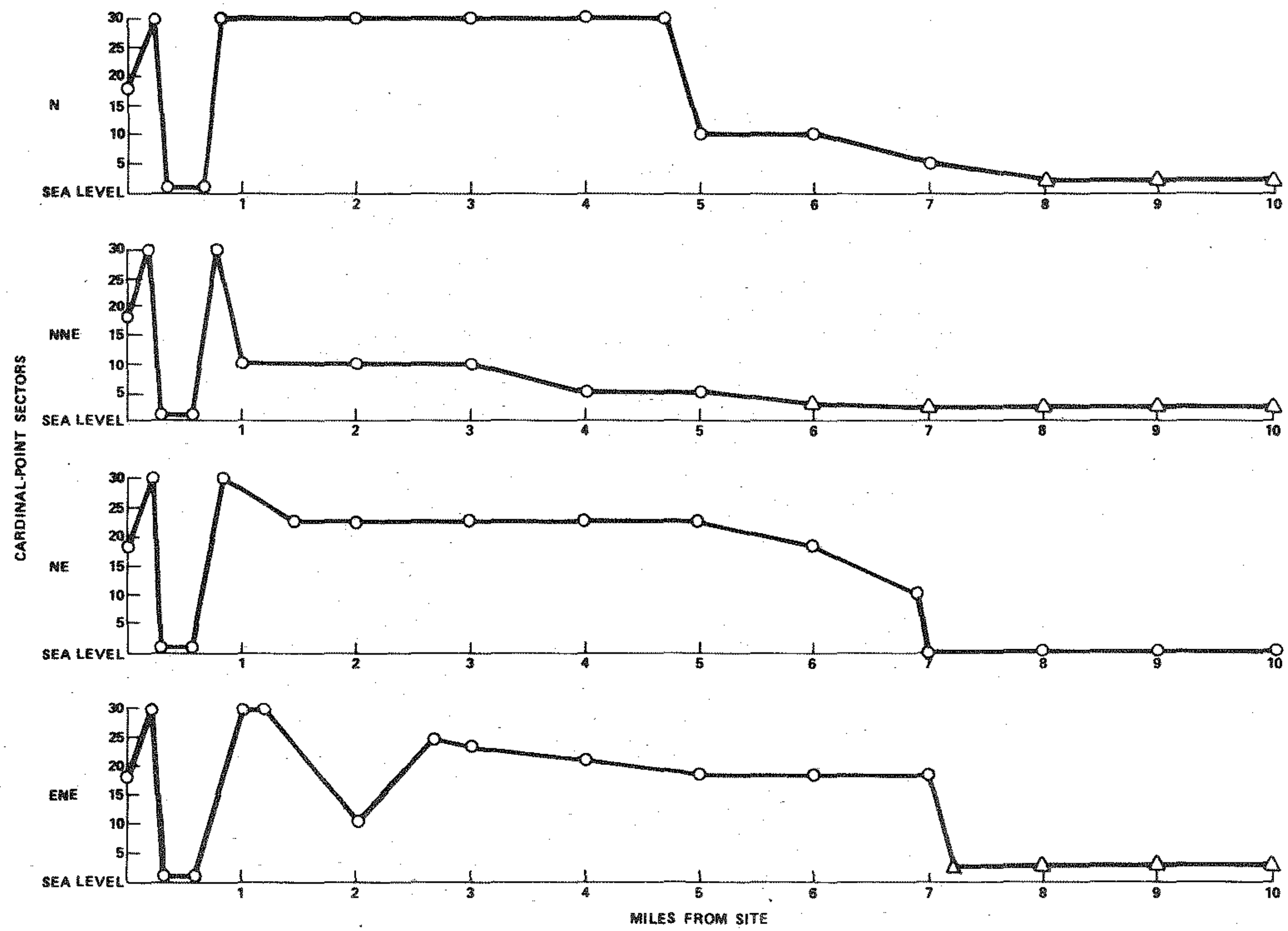
2.3-3



LOUISIANA
POWER & LIGHT CO.
Waterford Steam
Electric Station

TOPOGRAPHIC FEATURES WITHIN
50 MILES OF SITE

Figure
2.3-4

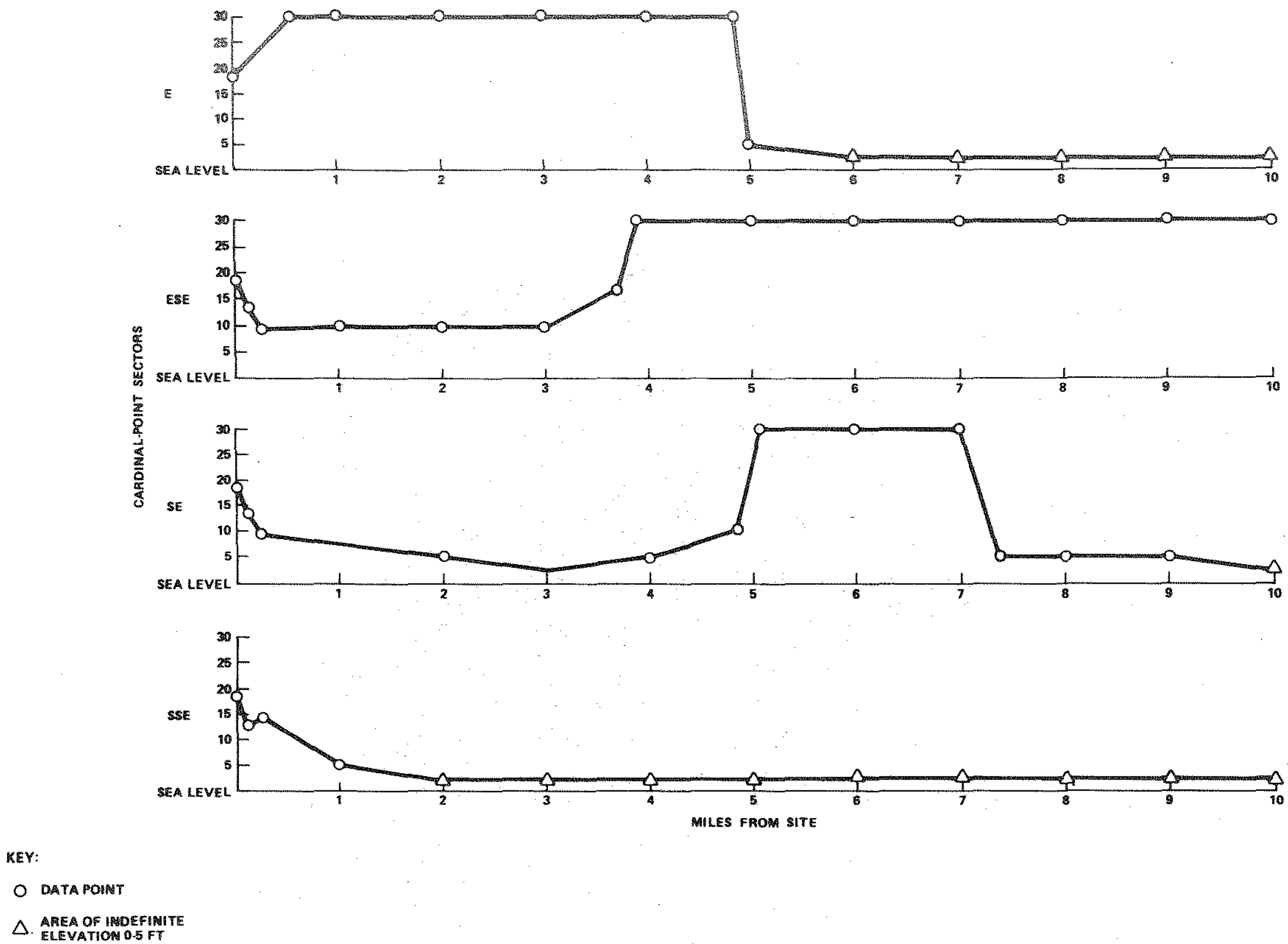


KEY:

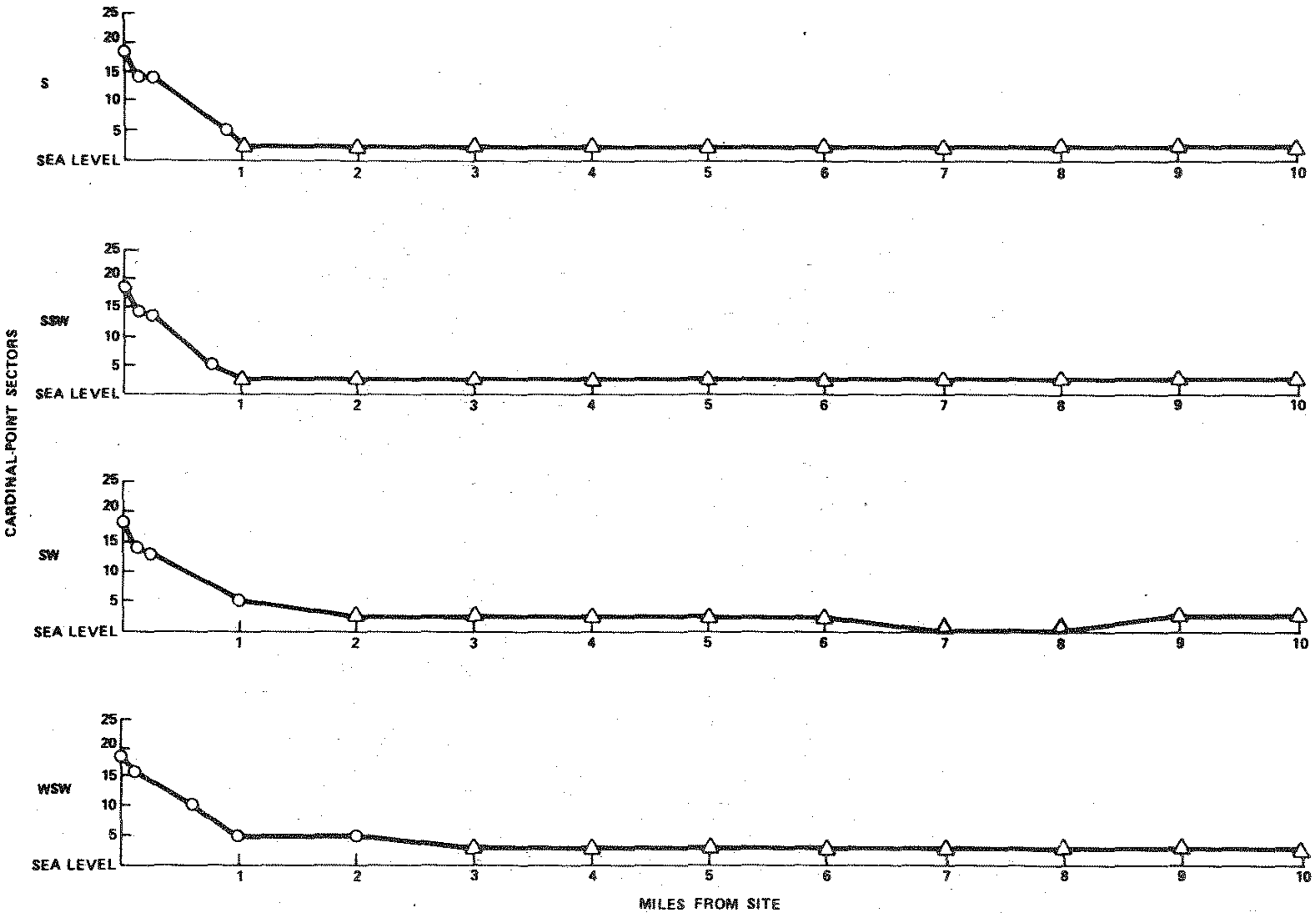
○ DATA POINT

△ AREA OF INDEFINITE ELEVATION 0-5 FT

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MAXIMUM TOPOGRAPHIC ELEVATION VS DISTANCE FROM CENTERLINE OF PLANT SHEET 1 OF 4	Figure 2.3-5 (Sheet 1)



LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MAXIMUM TOPOGRAPHIC ELEVATION VS DISTANCE FROM CENTERLINE OF PLANT SHEET 2 OF 4	Figure 2.3-5 (Sheet 2)

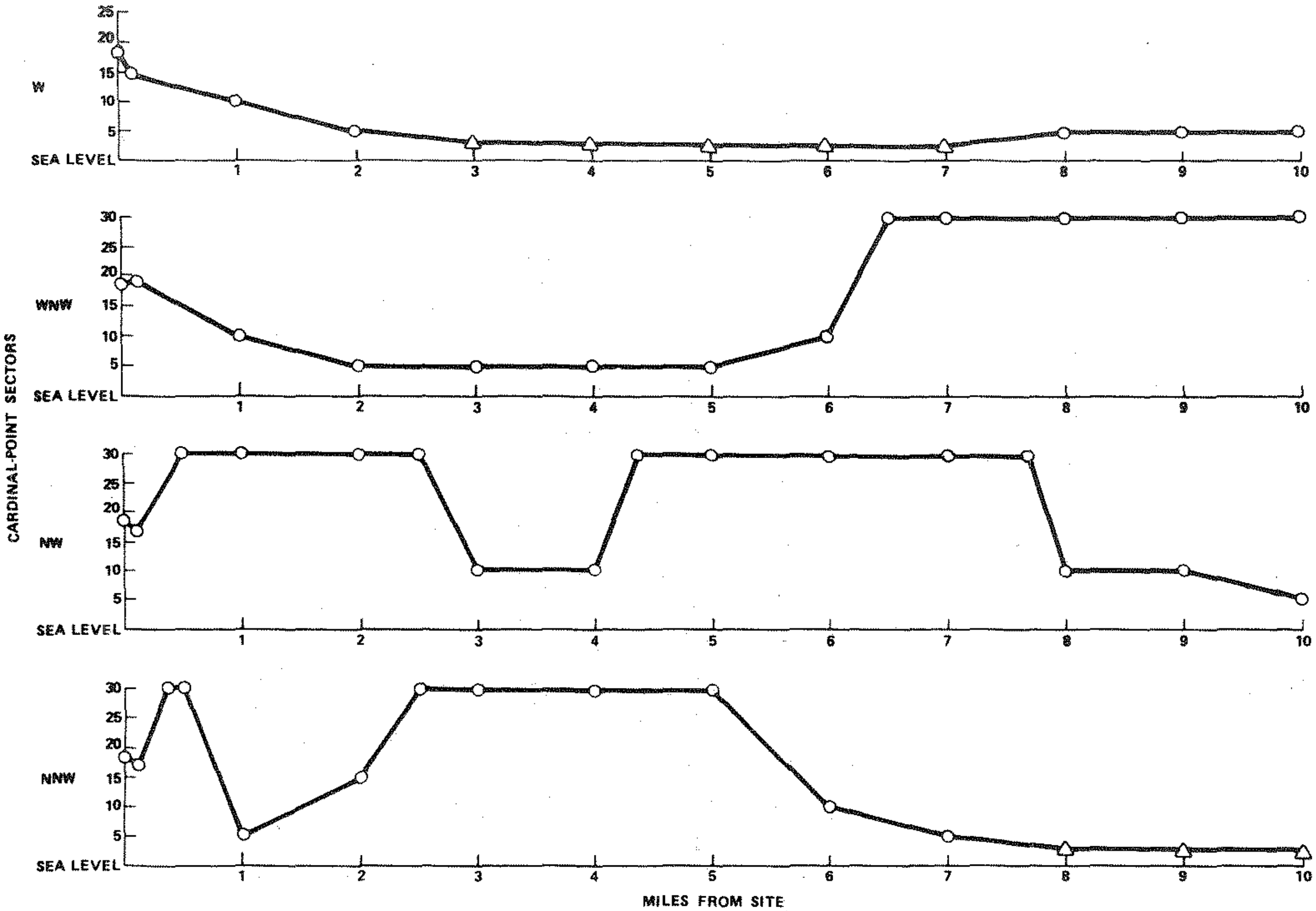


KEY:

○ DATA POINT

△ AREA OF INDEFINITE ELEVATION 0-5 FT

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MAXIMUM TOPOGRAPHIC ELEVATION VS DISTANCE FROM CENTERLINE OF PLANT SHEET 3 OF 4	Figure 2.3-5 (Sheet 3)



KEY:

○ DATA POINT

△ AREA OF INDEFINITE ELEVATION 0-5 FT

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MAXIMUM TOPOGRAPHIC ELEVATION VS DISTANCE FROM CENTERLINE OF PLANT SHEET 4 OF 4	Figure 2.3-5 (Sheet 4)

2.4 HYDROLOGY

2.4.1 INTRODUCTION

Waterford 3 is located on the west bank of the Mississippi River at River Mile 129, or 129 miles up the river from Head of Passes, Louisiana. The site is located within the Mississippi Delta Plain; a vast complex of wetlands, lakes, and bayous, as shown in Figure 2.4-1.

The primary hydrologic feature with which Waterford 3 interacts is the Mississippi River. The plant uses the river as a source of all its water needs, except potable water, as described in Section 3.3. Waterford 3 will also use the Mississippi for waste heat dissipation and disposal of liquid waste after treatment, as described in Sections 3.4, 3.6 and 3.7, respectively.

This section discusses the surface water hydrology of the Mississippi River in the vicinity of Waterford 3, the region's groundwater hydrology, and aspects of water quality.

2.4.2 REGIONAL SURFACE WATER HYDROLOGY

The Mississippi River and its tributaries drain a total of 1,246,000 square miles, and are bounded on the west by the Rocky Mountains, and on the east by the Appalachian Mountains[1]. The location of Waterford 3 within the Mississippi River Basin is shown in Figure 2.4-2.

Of the regional surface water hydrologic characteristics, the flow regime of the Mississippi River is considered the principal concern to the description and evaluation of the Waterford 3 project. The primary items discussed are flooding, flood control, and flow volumes.

2.4.2.1 Flooding

The lower alluvial valley of the Mississippi River is a relatively flat plain which has experienced frequent severe floods. After the disastrous flood of 1927, the Flood Control Act of May 1928 was passed for flood control in the Mississippi River Alluvial Valley. This Act has been modified 23 times, the latest being by the Water Resources Development Act of 1974[2,3]. The existing comprehensive flood control and navigation plan for the Mississippi River consists of a levee system along the main stem of the river and its tributaries in the alluvial plain, reservoirs on the tributary streams, a floodway to receive excess flow from the Mississippi, and channel improvements such as revetments, dikes, and dredging to increase channel capacity. Other flood control programs consist of control structures, cutoffs, pumping plants, flood walls, and flood gates.

2.4.2.1.1 Flood History

The major floods on the lower Mississippi River generally result from large floods on the Ohio River, augmented by contributions from other major tributaries of the lower Mississippi. The flood season on the Mississippi River is usually from the middle of December through July.

The first recorded flood of the Mississippi was described by Garciliaso de la Bega, as occurring in 1543. Fragmentary records indicate that floods also occurred in 1782, 1785, 1796, 1809, 1815, 1823, 1844, 1849, 1858, 1862, 1867, and 1882. Major floods of recent years occurred in 1903, 1912, 1913, 1916, 1922, 1927, 1937, 1945, 1952, 1973, and 1975. For more than 200 years of record, the Mississippi has flooded, on an average, every seven years [1].

Table 2.4-1 shows the maximum confined discharges at key stations on the Mississippi River for major Mississippi River floods below St. Louis. As can be seen in this table, the largest recorded flood elevation occurred in 1927, in the lower Mississippi Valley, below the mouth of the Arkansas River. It was this flood which served as a basis for Project Design Flood adopted by the Corps of Engineers for flood control and river improvement works. The Project Design Flood is 3,030,000 cfs at the latitude of Old River.

The most recent floods occurred in 1973 and 1975 on the Mississippi River [2, 3]. Stage hydrographs showing the 1973 flood, as well as other floods, at Red River Landing are shown in Figure 2.4-3. During the 1973 flood, numerous flood-control and multipurpose reservoirs were in operation to reduce water levels. Immediately downstream from the Waterford 3 site, the Bonnet Carre Spillway was opened during this flood, for the first time since 1950, to further lower the river stage at New Orleans by diverting a peak flow of 195,000 cfs from the river through Lake Pontchartrain to the Gulf of Mexico. Since it was built in 1931-1932, the Bonnet Carre Spillway has been used only five times: in 1937, 1945, 1950, 1973, and 1975 [4].

Flood frequencies at Tarbert Landing (River Mile 306.3) and Baton Rouge (River Mile 228.4), as determined by a Log-Pearson Type III distribution, are presented in Figure 2.4-4.

2.4.2.1.2 Flood Control

The Mississippi River and Tributaries Flood Control project (MR&T Project) has served to protect the lower Mississippi Valley against a design flood of 3,030,000 cfs at Red River Landing by use of levees, floodways, channel improvements, and major tributary flood-control improvements. A schematic diagram of the lower Mississippi River Basin, showing the major flood control structures, is given in Figure 2.4-5. This figure also indicates the MR&T project Design Flood, and the distribution of flows in the lower Mississippi Valley.

The levee line on the west bank of the Mississippi River begins just south of Cape Girardeau, Missouri; and, except for gaps where tributaries join the Mississippi, extends through the Waterford 3 site, almost to Venice, Louisiana, near the Gulf of Mexico. The Bonnet Carre Spillway, Old River Control Structures, Morganza Floodway, and Atchafalaya Basin Floodway, are major flood-control works in the lower Mississippi Valley.

The Bonnet Carre is the closest floodway to Waterford 3, and is located on the east bank of the Mississippi, 3/4 miles downstream from the Waterford 3 site. The floodway and spillway structures were constructed to divert approximately 250,000 cfs of flood waters from the Mississippi River to Lake Pontchartrain, to prevent overtopping of the levees at and below

New Orleans, and to insure the safety of New Orleans and the downstream delta area during major floods. The spillway and floodway are operated to prohibit the river stage on the Carrollton Gage from exceeding 20 ft, a stage about 5 ft below levee grade.

2.4.2.2 Flow Volume

Flow records have been maintained on the lower Mississippi at Red River Landing (1900-1963) and Tarbert Landing (1964-1976). There are no major tributaries below these points, and these flows are characteristic of the lower reach of the river and the Waterford 3 site, except for flood flows.

Yearly maximum, minimum, and mean flows of the Mississippi River are given on Table 2.4-2. For the 77 years of record, the mean annual discharge was 494,000 cfs. The average annual maximum flow was 1,043,000 cfs, and the average annual minimum flow was 155,000 cfs. Although flood season is from mid-December to July, on the average, flows are generally above the mean from February to June, and below the mean for the remainder of the year[5], as shown in Figure 2.4-6.

2.4.2.2.1 Low Flows

A frequency analysis from a hydrologic investigation conducted by the Louisiana Department of Public Works, in concert with the USGS, reports that the 95 percent exceedance flow (that flow which will be equalled or exeeded 95 percent of the time) is 131,000 cfs[6]. Recently, however, the 95 percent exceedance flow for the lower Mississippi River has been updated to 140,000 cfs by the USGS[7] for a hypothetical gaging station located midway between Red River Landing and Tarbert Landing. Figure 2.4-7 presents daily flow frequencies computed for this station.

The Old River Control Structure, (which was completed in 1963) as well as additional construction of storage reservoirs on tributaries are designed 1
to sustain a minimum flow of 100,000 cfs during low flow periods, i.e., it is doubtful that daily flows in this section of the river will ever be less than 100,000 cfs[8].

The Mississippi River has a typical low flow condition of about 200,000 cfs. This typical low flow is estimated to have a recurrence interval of approximately 0.7 years as a monthly average river flow. Based on the period of record - 1936 to 1975, the seasonal average flows are 580,000, 650,000, 1
280,000 and 240,000 cfs for winter, spring, summer and fall, respectively.

2.4.3 SITE AREA SURFACE WATER HYDROLOGY

This section deals with the physical aspects of the hydrology of the Mississippi in the Waterford 3 area, and describes the area's drainage, flooding potential, river current, bathymetry, dispersion and diffusion characteristics.

2.4.3.1 Drainage Patterns of the Waterford 3 Area

Surface and subsurface drainage in the region flows southwestward into the Lac des Allemands - Lake Salvador drainage system. This drainage area is bounded on the north and east by the levee of the Mississippi River. Bayou La Fourche and an abandoned distributary form a low divide to the west, where the drainage system is bounded by the Atchafalaya Basin. To the south, drainage is through Little Lake and Barataria Bay into the Gulf of Mexico. The waterways and lake that make up this drainage system are used for navigation, but are not a source of drinking water.

Natural surface drainage at the Waterford 3 site is away from the Mississippi River and toward the southwest. The surface topographic characteristics of the Waterford 3 site, and the immediately surrounding area, are shown in Figure 2.4-8.

2.4.3.2 Flooding Potential

During the site safety studies, three possible types of flooding were analyzed in detail for the Waterford 3 site. The flooding potential at the site can be described from the conclusions reached by these studies, which are discussed in detail in Section 2.4 of the Final Safety Analysis Report (FSAR). The design basis flood information is summarized primarily from the FSAR, which should be consulted for the methodologies and computational techniques. The three types are:

a) Precipitation in excess of the capacity of the plant site drainage system.

b) Levee failure.

c) Probable maximum hurricane surge.

The maximum effective water surface elevation at the site (26.5 feet MSL) was found to result from hurricane surge and wind-induced waves. In consideration of the flooding potential, Waterford 3 has been equipped with flood proofing to an elevation of 30 feet MSL.

2.4.3.3 Bathymetry

The Waterford 3 site is located on the outside (eroding) bank of a bend in the Mississippi River, formed by 35 Mile Point. The lowest elevation of the bottom, in this reach of the Mississippi, is in excess of -129 MSL. Bathymetry for the Mississippi River in the vicinity of the Waterford 3 site is presented in Figure 2.4-9.

2.4.3.4 River Currents

2.4.3.4.1 Calculation of River Current at the Waterford 3 Site

Long-term information on current velocity at the Waterford 3 site is not presently available. However, long-term stage and discharge information is available from the records of the Corps of Engineers, New Orleans District; and from these data, cross-sectional averaged velocities, in feet per second (fps), can be determined for the river at the Waterford site.

The flow rate was established at the Carrollton Station by taking the Tarbert Landing and Red River Landing flow data, and assuming that arrival time at Carrollton was at a later time. Thus, the flow rate was established at Carrollton by time.

The calculated Carrollton data and the measured stage were then used to construct a rating curve at Carrollton. From this information, a rating curve was then back-calculated at the Waterford 3 site, using cross-section data and the Manning's Coefficient provided by the Corps of Engineers, New Orleans District.

After construction of the rating curve at the site area, seasonal flow data over a 39-year period from Red River Landing was examined, and the mean monthly flows were calculated for the Waterford site. Using this flow data in conjunction with the site rating curve, the stage at the site was determined. For each stage, cross-sectional areas calculated from bathymetry were determined for the site area. Velocity data for the site area were calculated from the expression:

$$\overline{V} = \frac{Q}{CA}$$

Where: $\overline{V}$ = mean velocity in fps

Q = flow in cfs

CA = cross-sectional area in ft^2

2.4.3.4.2 River Current at the Waterford 3 Site

Table 2.4-3 summarizes the calculations described above. The 39-year average current velocity calculated at the Waterford 3 site is 2.3 fps. The minimum is 1.1 fps. While this is an approximation, it falls within the range previously recorded. As noted, these values are cross-sectionally averaged velocities. The actual velocity distribution is controlled by the channel geometry, described further in Section 5.1, and can be expected to vary greatly along the cross-section.

During similar studies made between December 1970 and October 1973(9), a backwater eddy current was also observed near the Waterford 1 and 2 discharge structure, and is estimated to occur when the mean river flow is less than approximately 600,000 cfs. This eddy current was investigated with both dye studies and drogue tracks.

In a hydrothermal study conducted for Louisiana Power & Light Company(10), a program utilizing drogues and current meters was undertaken to establish the current velocity in the Mississippi near the Waterford site. Current speed and direction measurements were taken at several sampling stations, which are shown in Figure 2.4-10. Table 2.4-4 gives the current velocity profiles developed from measurements taken on September 16 and 17, 1976, when the Mississippi was at a stage of 2.19 feet, as measured at the Carrollton Gage. This stage indicates that the river was in a low flow condition, i.e., this flow has the probability of being exceeded approximately 90% of the time.

2.4.3.4.3 "Time of Travel" Studies

Everett[8] presented the results of dye dispersion studies that are performed at Baton Rouge (RM 219) when the river discharge was 364,000 cfs. Everett developed time of travel curves for the leading edge, peak concentration, and trailing edge of dye plumes. The results for the peak concentration are shown in Figure 2.4-11. This figure indicates that the travel time from Baton Rouge to the Waterford site, a distance of 90 river miles, is approximately 77 hours. 1

2.4.4 GROUNDWATER HYDROLOGY

2.4.4.1 Regional and Site Area Aquifers

The major aquifers in the region are unconsolidated sands that dip southward, and in general, these sand deposits are separated and confined by relatively impermeable clays and silts. Major water-bearing zones can be correlated in a northwest-southeast direction along the Mississippi River between Baton Rouge and New Orleans.

The connate water within the aquifers, which is the water in an aquifer at the time of deposition, is generally brackish or salty in southeastern Louisiana. Fresh water is found only near areas of recharge where the salty connate water has been displaced.

Because of the southerly dip of the aquifers in the region, deep aquifers approach the land surface further to the north than shallow aquifers. Since the topography of the region rises from south to north, the recharge areas for the deeper aquifers are at a higher elevation than those for the shallower aquifers. This circumstance is considered to induce, under natural conditions, a general piezometric gradient which falls from north to south and concurrently causes an increase in piezometric head with depth at a given location.

The principal aquifer systems which exist within the Waterford 3 region are (in order of increasing depth):

1) The Shallow aquifers

2) The Gramercy aquifer

3) The Norco aquifer

4) The Gonzales-New Orleans aquifer

The aquifer systems are named for areas in which they are used intensively. The aquifers of the Waterford 3 site area are correlative with the regional aquifers. The geological materials underlying the site area have been divided into five zones, as shown in Figure 2.4-12, which gives a brief description of each zone and its permeability. From piezometric levels recorded during dewatering for the Waterford 3 foundation construction, described in Section 6.1.2, it is evident that clay strata isolate the plant from the groundwater system by a minimum of 300 feet of impermeable clay interbedded with dense sand lenses. This is also shown in Figure 2.4-12.

clay interbedded with dense sand lenses. This is also shown in Figure 2.4-12.

Water table gradients in all of the zones are away from the Mississippi River at all stages of flow. Gradients range from 0.009 (feet vertical: feet horizontal) in the Zone 1 material to 0.008 in the Zone 3 sand.

2.4.4.1.1 The Shallow Aquifers

Shallow isolated sands, isolation point bar deposits, and abandoned distributary deposits are collectively described as shallow aquifers. Isolated sand deposits below depths of about 150 feet have small yields of poor quality water and are not recognized as important aquifers. Point bar deposits consist chiefly of well-sorted fine sands and silts, with a maximum thickness of about 130 feet, typically overlain by about 20 to 30 feet of natural levee material. Typical wells in point bar deposits have yields of only a few gallons per minute.

Use of the shallow aquifers is generally limited by the water yield and water quality, which is characteristically hard with a high iron concentration. The shallow aquifers have been used, however, for domestic supplies and as livestock water.

In the Waterford 3 site area, the shallow sands which are extensive enough to provide large quantities of water are point bar deposits and abandoned channel deposits of the Mississippi River. The point bar deposits in the site area are shown in Figure 2.4-13. The point bar deposits are not important aquifers because the water is very hard and high in iron content.

The permeability of shallow aquifers in the site area is estimated to be low (about 100 gal/day/ft^2) based on the texture of the deposits[11]. The low permeability, poor quality of water, and limited extent of the shallow aquifers restrict their utility in the site area.

2.4.4.1.2 The Gramercy Aquifer

The Gramercy aquifer is a medium to very fine grained sand in the New Orleans area. Its grain size increases to the west toward Norco and decreases to the south, toward the Gulf of Mexico. It is continuous in the Gramercy area, but is discontinuous in both the New Orleans and Norco areas. The aquifer generally increases in thickness in a north to south direction around both Norco and New Orleans.

Recharge to the Gramercy aquifer is derived from the river via hydraulic connection to the overlying shallow sands. Recharge may also be obtained from vertical leakage. The Gramercy aquifer is pumped extensively in the Gramercy area, but little use has been made of it in the New Orleans or Norco area[11,12]. This limited development has been the result of poor water quality.

In the site area, the Gramercy aquifer is irregular in thickness and discontinuous. The extent and configuration of the top of the aquifer are shown in Figure 2.4-14. The aquifer dips and thickens to the south of the

Waterford 3 area. The top of the aquifer occurs at about -200 ft MSL beneath the southern portion of the site property and is about 100 feet thick. The aquifer is split, thin, or absent immediately north of the site boundary.

Piezometric gradients slope to a depression near Hahnville, where the Gramercy aquifer is apparently in contact with the underlying Norco aquifer. The depression, shown in Figure 2.4-15, is not attributed to pumpage from the Gramercy aquifer[11,12], but rather to vertical movement of water from the Gramercy aquifer into the Norco aquifer in an area of convergence. This vertical leakage has been induced by heavy pumpage from the Norco aquifer.

In the vicinity of Hahnville, the Gramercy aquifer is in contact with a point bar deposit. This connection permits flushing of the Gramercy aquifer which contains salty water in much of the surrounding area. Fresh water (chloride content 250 mg/l or less) is also encountered in this aquifer in the southwest portion of the site area, as indicated in Figure 2.4-14. The quality of the water in the Gramercy aquifer varies more than in the Norco and the Gonzales-New Orleans aquifers in the site area.

Well yields from the Gramercy aquifer in the site area range from several hundred to more than 1,000 gpm. A transmissivity on the order of 150,000 gpd/ft is indicated for the aquifer in the vicinity of Destrehan[11].

2.4.4.1.3 The Norco Aquifer

The Norco aquifer is used extensively in Norco, and to a lesser degree, in New Orleans. It is a medium to fine grained sand in the New Orleans area and medium to coarse grained in Norco. The thickness of the Norco aquifer is highly variable. South of New Orleans the formation thickens; however, the water bearing sands grade into thin stringers[13].

Throughout the site area, the Norco aquifer is continuous, and varies from 25 to 300 feet in thickness. The top of the aquifer occurs at about -325 ft MSL beneath the Waterford 3 site and is about 125 feet thick. The configuration of the top of the Norco aquifer in the site area is shown in Figure 2.4-16. The regional thickening and dip of the aquifer is to the south.

The Norco and Gramercy aquifers are probably in contact in the areas shown in Figure 2.4-16. The Norco aquifer is hydraulically connected to, and recharged by, the Gramercy aquifer in the site area, but the two aquifers generally are separated by clay beds interbedded with sand in the New Orleans area. The interaction with the overlying Gramercy aquifer has a pronounced effect on the Norco aquifer, both under natural and man-made conditions. The large southwest loop in the fresh-salt water interface, shown in Figure 2.4-16, is most likely related to the presence of the large area of convergence of the aquifers southwest of the site.

Water levels in the Norco aquifer reflect heavy industrial pumpage around Norco. Most of the groundwater used in the Norco area is obtained from the

Norco aquifer, however, usage has decreased from a high of 17.5 mgd in 1950 to about 9.5 mgd in 1965. Usage has generally remained below 11 mgd through 1976[11,14].

The hydrostatic pressures in the Gramercy and Norco aquifers have been reversed by the pumping in the Norco area. Water levels are now higher in the Gramercy (Figure 2.4-15) aquifer than those in the Norco aquifer, given in Figure 2.4-17, and therefore groundwater presently moves from the Gramercy aquifer, through the area of convergence, into the Norco aquifer. Water levels in the Norco aquifer, given in Figure 2.4-17, are as low as -50 ft MSL in the vicinity of Norco and -15 ft MSL in the New Orleans area.

The body of freshwater in the aquifer east of Luling, shown in Figure 2.4-16, is probably related to upward movement of water from the Gonzales-New Orleans aquifer through a permeable zone in the confining bed overlying the Gonzales-New Orleans aquifer.

The transmissivity of the Norco aquifer in the site area is about 200,000 to 225,000 gpd/ft and the permeability is about 1,600 to 1,800 gpd/ft^2. Most wells in the Norco aquifer yield from 1,000 to 1,500 gpm and most specific capacities range from 45 to 75 gpm/ft[11].

2.4.4.1.4 The Gonzales-New Orleans Aquifer

The Gonzales-New Orleans aquifer is a fine grained quartz sand of uniform texture [11, 13], present over a large part of the lower Mississippi from Baton Rouge to New Orleans, and northeast from New Orleans to Ft Pike[15]. It is the primary aquifer in New Orleans and the Geismar-Gonzales area. It is correlative with a zone of shallow, coarse-grained aquifers underlying Lake Pontchartrain [16]. The Gonzales-New Orleans aquifer is recharged primarily north of Lake Pontchartrain where it outcrops.

The Gonzales-New Orleans aquifer varies in thickness from an average of 175 feet in the New Orleans area[12] to 225 feet in the vicinity of Norco[11]. In the Waterford 3 site area, it ranges in thickness from less than 175 to more than 325 feet in thickness, and is continuous. The top of the Gonzales-New Orleans aquifer occurs at about -600 ft MSL at the site, as shown in Figure 2.4-18, which illustrates the configuration of the top of this aquifer.

The piezometric gradient of the Gonzales-New Orleans aquifer slopes toward the center of heavy industrial pumping in New Orleans, as shown in Figure 2.4-19, which gives the configuration of the potentiometric surface of this aquifer in the site area. Other minor drawdown cones in the Norco and Laplace vicinity act as minor perturbations on this surface.

Pumpage from the Gonzales-New Orleans aquifer in the Waterford 3 area is about 6 mgd[11] for irrigation and industrial purposes. Large scale future developments in the aquifer are not considered likely in the Waterford 3 area because of the advantages of a higher transmissivity in the overlying Norco aquifer.

In the site area, the transmissivity of the Gonzales-New Orleans aquifer is lower than that of the Norco aquifer, averaging about 148,000 gpd/ft. The permeability is on the order of 680 gpd/ft and most yields of wells are between 1,000 and 1,500 gpm.

2.4.5 WATER QUALITY

Water quality information for the Waterford 3 site has been obtained from available literature sources, and from site specific studies. Most of the available information concerns with the surface water quality of the Mississippi River.

2.4.5.1 Regional Water Quality

2.4.5.1.1 Surface Water

Everett [8] has analyzed 14 years of lower Mississippi River quality data from St Francisville, Louisiana and most of the information presented in this section has been derived from his work. St. Francisville is located downstream of the major tributaries to the Mississippi and the Old River Control Structure. Because it is above the effluent sources of Baton Rouge, water quality at this station can be considered to represent the "unaffected" condition for the lower Mississippi River. In general, daily variations of water quality are small; however, seasonal fluctuations do occur in the chemistry, sediment concentrations, and temperature of the river water. |1

a) Chemical Quality

Variations in the chemical and physical qualities of the lower Mississippi River at St Francisville are presented in Table 2.4-5. St Francisville is located approximately 139 river miles upstream of Waterford 3.

Downstream of St Francisville, ionic concentrations increase as the river receives effluents from municipal and industrial sources, as shown in Figure 2.4-20.

Everett found downstream increases in chloride, sulfate, sodium, and calcium concentrations, with the greatest increase in the chloride concentrations. It was estimated that, as of 1969, approximately 7500 cfs of industrial effluent was discharged into this section of the Mississippi. Each day, this discharge added approximately 20,000 tons of dissolved solids to the river. During high flows, this increase was barely discernible because of dilution effects. Under low flow conditions, however, this effluent caused significant increases in the total dissolved solids.

Everett also estimated that about 200 tons per day of organic material was discharged to the river from sewage plants, chemical and petrochemical plants, oil refineries, and pulp and paper mills. Generally, the effect on the dissolved oxygen content of the water was a downstream decrease of less than

1 mg/1. During the 1969 water year, the oxygen content was greater than 70 percent of saturation for 80 percent of the time. On two occasions of brief duration, the oxygen content dropped below 65 percent of saturation.

Coliform bacteria content of the water showed the effects of sewage discharge. At the Carrollton Street intake (RM 104.7), coliform counts exceeded 5000 colonies/100 ml 13 percent of time. At Algiers (RM 95.8), the counts exceeded 5000 colonies/100 ml 34 percent of the time. Maximum reported counts are in excess of 500,000 colonies/100 ml.

Since the bed of the lower Mississippi River is below sea level, salt water from the Gulf of Mexico intrudes as a wedge under the freshwater discharge. The extent of the saline front upstream of the river mouth, as well as the depth of the top of the wedge, is highly dependent on river flow volume and duration. The saline front generally does not extend above New Orleans. However, in two instances of relatively long duration of low flow (less than 100,000 cfs), the front was found to extend up to River Mile 115 and beyond[8]. 1

For observations made since 1929, the maximum salt water intrusion occured in October 1939, when the wedge was detected at River Mile 120. Flow during the period was slightly less than 100,000 cfs for several days. The wedge also passed the Kenner Hump (RM 115) during October 1940. During 1953-54 and 1956, the wedge encroached to the Kenner Hump, but did not go beyond it as flow slightly exceeded 100,000 cfs. Future intrusions of the wedge should be limited by flow control on the river.

b) Thermal Quality

Temperatures in the Mississippi River below St Francisville vary both seasonally and spatially. Seasonal variations range between a minimum recorded temperature of $1^{\circ}C$, to a maximum of $31^{\circ}C$, as shown in Figure 2.4-21. Spatial distribution is strongly influenced by thermal discharges from industrial sources. Approximately 95 percent of the water withdrawn from the lower Mississippi River 1
is used for cooling[8]. During high and intermediate flows, the return of this heated water causes only local variations in temperature, but is indiscernible with respect to the overall temperature of the river. During low flow, thermal discharges have been found to raise the ambient water temperatures between St Francisville and Luling Ferry[8].

c) Sediment 1

Sediment is transported by the Mississippi River as either a bed load or a suspended load. The amount of material in suspension is generally a function of river discharge, turbulence, particle size, and temperature. Whether flow is increasing or decreasing also appears to influence suspended sediment concentrations. Usually, on the Mississippi, peak sediment concentrations slightly precede peak flow. During high flows, the sediment concentration generally increases downstream. The converse is true for low flows[17]. Figure 2.4-22 gives the duration curve for suspended sediment condition at Red River Landing, Louisiana.

Sediment size varies with depth, river mile, and discharge. In general, the percentage of coarser particles increases with increasing depth and river discharge, as shown in Figure 2.4-23. At a given discharge and depth, particle size decreases downstream. The latter relationship is shown clearly in the size distribution of the bottom sediment in the Mississippi, which is given in Figure 2.4-24. Values for the Mississippi River sediment near the Waterford 3 site should fall between the two plots shown in this figure.

2.4.5.1.2 Groundwater

Groundwater in the Mississippi Delta is highly variable in quality. A given aquifer may yield good quality water or high saline water. The distribution of the fresh water zones are a function of the depositional environment of the aquifers and recharge patterns.

The connate water was saline for all of the regional aquifers except the point bar deposits. Flushing of the saline water has occurred from recharge either from the north of Lake Pontchartrain, from the Mississippi River through the point bar deposits, or from interconnections of the aquifers[11]. The extent of the flushing can be seen for each of the major aquifers on Figures 2.4-14 through 2.4-19.

Each aquifer has water with a characteristic quality, if it is not mixed with water from other aquifers. Water from the shallow (point bar) aquifers is generally hard, and has a high iron content. Chloride content is naturally low; but in some areas where the shallow aquifers are connected with saline aquifers of a higher head, higher chloride concentrations are noted[11].

The Grammercy aquifer water quality is strongly affected by recharge flow from other aquifers. Where it is not affected, the water is a mixed calcium and magnesium bicarbonate, sodium chloride type, and is very hard[11]. Down-dip sodium chloride concentrations increase more rapidly than other ions.

The Norco aquifer water quality also shows the effects of interaquifer recharge. The water ranges from a sodium bicarbonate to a sodium chloride type[11]. Hardness typically ranges from 40 to 60 mg/l. Iron is generally less than 0.5 mg/l. Minimum and maximum recorded pH are 7.1 and 9.0, but most values range between 7.5 to 8.0. Where the water is fresh, the total dissolved solids are characteristically between 750 and 1000 mg/l[11].

The Gonzales-New Orleans aquifer is generally quite uniform in its water quality characteristics. Where variations do occur, they are of a gradual nature. Mineralization increases to the south of the recharge area. In general, the water is of a mixed sodium bicarbonate chloride type, and is soft [11].

Hardness of the fresh water ranges from 10 to 40 mg/l. Iron is generally less than 0.3 mg/l, and the pH range is between 7.4 and 8.4. In the New Orleans area, the water is yellow-colored, which is possibly the result of the presence of organic material [11].

Analyses of waters from a number of wells in the Waterford 3 region are presented in Table 2.4-6.

2.4.5.2 Waterford 3 Area Water Quality

Surface water quality data have been obtained for the Waterford 3 site from two sources. Since 1973, water samples have been taken at five locations as part of the Environmental Surveillance Program, described in Section 6.1.1. Since 1976, river water temperature has been monitored near the Waterford 3 site and the Little Gypsy Steam Electric Station.

Site area groundwater quality is not considered to vary greatly from the regional trends, described above. Because of the isolation of Waterford 3 from the groundwater system, explained earlier, detailed groundwater quality at the site is not presented.

2.4.5.2.1 Surface Water

Water samples were collected and analyzed during the Environmental Surveillance Program. Analysis of the data, presented in Tables 2.4-7 to 2.4-9, shows significant seasonal variation of values for most of the parameters sampled. No statistically significant differences were noted between the stations, which are described in Section 6.1.1.

2.4.5.2.2 Sediment Concentrations

Recent work by the US Geological Survey at Luling Ferry has yielded some preliminary information on the relationship of discharge and sediment concentrations in the vicinity of the Waterford 3 site [18]. The results of these studies, given in Table 2.4-10, are comparable to total suspended solids values derived during the Environmental Surveillance Program, as given in Table 2.4-9. The largest percentage of material was found to be silt-sized or smaller, under all conditions of flow.

2.4.5.2.3 Temperature

There are currently two principal thermal discharges which alter the ambient river temperature regime in the vicinity of Waterford 3. These are the Little Gypsy Steam Electric Station, and Waterford 1 and 2. The two facilities are owned and operated by LP&L.

Little Gypsy has a combined generating capacity of 1250 MW, and discharge is approximately 7.5×10^9 Btu/hr (1448 cfs at 23^oF above ambient); Waterford 1 and 2, with a combined generating capacity of 822 MW, discharges approximately 4.1×10^9 Btu/hr (960 cfs at 19^oF above ambient). Section

5.1 contains a discussion of the combined effects of these discharges under various river conditions.

Continuous water temperature monitoring is being conducted at three depths at two water quality monitoring stations located near each bank of the Mississippi near Waterford 3. This monitoring program is described in Section 6.1.1. The monthly maximum, minimum, and range of variation of river water temperatures are given in Table 2.4-11 for mean sea level (MSL), in Table 2.4-12 for -10 ft MSL, and Table 2.4-13 for -20 ft MSL.

Additional river temperatures, from a longer period of sampling, are available from measurements taken near Westwego, Louisiana, approximately 25 miles downstream of Waterford 3. Table 2.4-14 gives the monthly maximum, minimum, and average river temperatures for 1951 through 1978. 1

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TABLE 2.4-1

FLOOD-CREST ELEVATIONS NEAR THE WATERFORD SITE

Location	Miles Above Head of Passes, La.	Date	Flood Peak (cfs)	Elevation in Feet, MSL	Date	Flood Peak (cfs)	Elevation in Feet, MSL
		1973					
Tarbert Landing, Miss.	306.3	May 13,14,15, May 16	- 1,498,000	59.30 59.20	Feb 19, 1937	1,977,000	54.61[a]
Red River Landing, La.	302.4	May 13	-	58.22	May 14-17, 1927	1,779,000[b]	60.94
Morganza, La.	275.4	May 13	-	53.20	-	-	-
Bayou Sara, La.	265.4	May 14, 15	-	50.66	May 15, 1927	-	55.46
Baton Rouge, La.	228.4	May 10	-	41.58	May 15, 1927	-	47.28
Donaldsonville, La.	175.4	Apr. 9	-	31.11	May 15, 1927	-	36.01
College Point, La.	157.4	Apr. 8	-	27.82	May 15, 1927	-	32.32
Reserve, La.	138.7	Apr. 8	-	24.50	Jun 11, 1929	-	26.00
Bonnet Carre A (at Montz) La.	129.2	Apr. 8	-	22.70	-	-	-
Bonnet Carre (Tower on left Bank) La.	128.0	Apr. 8	-	22.57	Jun 10, 1929	-	23.79
Bonnet Carre B (at Norco) La.	126.4	May 16	-	21.10	-	-	-
New Orleans (Carrollton) La.	102.8	Apr. 7 Apr. 15	- 1,257,000	18.47 -	Apr. 25, 1922	-	21.27

(a) Red River Landing stage.

(b) If discharge had been confined between levees.

TABLE 2.4-2

(Sheet 1 of 2)

STREAMFLOW IN THE MISSISSIPPI RIVER*
1900-1976

Daily Discharge** (in 1000 cfs) 1

Year	Maximum	Minimum	Mean
1900	796	157	434
1901	822	104	377
1902	861	198	461
1903	1206	116	639
1904	1018	119	465
1905	918	165	576
1906	1116	253	592
1907	1275	198	676
1908	1218	138	667
1909	1163	157	581
1910	853	130	473
1911	1007	174	459
1912	1499	198	646
1913	1272	167	584
1914	903	137	409
1915	934	298	653
1916	1327	157	641
1917	1218	110	510
1918	727	110	400
1919	960	154	602
1920	1223	181	657
1921	992	156	527
1922	1437	133	566
1923	1126	226	590
1924	928	154	549
1925	656	104	368
1926	813	143	477
1927	1779	173	867
1928	1035	236	601
1929	1301	163	643
1930	911	125	419
1931	672	119	283
1932	1244	158	516
1933	1076	130	522
1934	720	130	292
1935	1087	112	574
1936	973	92	346
1937	1467	128	514
1938	1062	131	511

*1900-1963 Discharge at Red River Landing, Louisiana and 1964-1976 Discharge at Tarbert Landing, Mississippi
**Army Corps of Engineers Data 1

TABLE 2.4-2
(Sheet 2 of 2)
STREAMFLOW IN THE MISSISSIPPI RIVER
1900-1976

Daily Discharge** in 1000 cfs 1

Year	Maximum	Minimum	Mean
1939	1124	75	445
1940	872	93	313
1941	749	146	376
1942	973	242	499
1943	1280	133	520
1944	1282	125	475
1945	1520	179	683
1946	1085	145	509
1947	898	114	426
1948	959	126	448
1949	1208	176	555
1950	1458	194	696
1951	986	221	625
1952	1011	107	466
1953	852	100	373
1954	583	121	262
1955	1022	120	363
1956	894	99	332
1957	994	180	548
1958	984	157	482
1959	765	130	382
1960	826	148	409
1961	1107	183	514
1962	1081	151	475
1963	881	123	268
1964	1015	119	366
1965	936	168	417
1966	1154	155	372
1967	803	180	384
1968	857	160	434
1969	1064	186	460
1970	980	178	451
1971	1036	174	338
1972	938	218	480
1973	1498	204	721
1974	1174	187	586
1975	1216	230	563
1976	721	158	364*** 1

*1900-1963 Discharge at Red River Landing, Louisiana and
1964-1976 Discharge at Tarbert Landing, Mississippi

**Army Corps of Engineers Data
*** Preliminary-Subject to revision 1

TABLE 2.4-3

AVERAGE MONTHLY CROSS SECTIONAL VELOCITY AT THE WATERFORD 3 SITE

Month	Flow*		Stage (ft)		Cross Sectional Area**		Velocity	
	Average	Minimum	Average	Minimum	Average	Minimum	Average	Minimum
January	455	116	7.6	0.2	18.4	16.2	2.5	0.7
February	577	118	10.25	1.6	18.9	16.7	3.1	1.1
March	700	296	12.9	4.3	19.5	17.6	3.6	1.7
April	773	302	14.6	4.3	19.7	17.6	3.9	1.7
May	590	303	10.6	4.3	19.0	17.6	3.1	1.7
June	474	247	8.2	3.3	18.5	17.2	2.6	1.4
July	384	198	6.3	2.2	18.0	16.8	2.1	1.2
August	243	154	3.1	1.1	17.2	16.5	1.4	0.9
September	194	133	1.9	0.6	16.8	16.4	1.2	0.8
October	212	93	2.4	0.1	16.9	16.2	1.3	0.6
November	225	95	2.7	0.1	17.0	16.2	1.3	0.6
December	294	105	4.3	0.2	17.6	16.2	1.7	0.7
Average							2.3	1.1

*Flow (Q) in 1,000 cfs
**Cross sectional area (CA) in 10,000 sq. ft.

TABLE 2.4-4
(Sheet 1 of 2)

CURRENT VELOCITY PROFILES, STATIONS 1 THROUGH 7
16 September 1976

Station*	1		2		3		4		5		6A		7	
Depth (Feet)	S	D	S	D	S	D	S	D	S	D	S	D	S	D
Surface	0.7	140	1.2	175	1.0	185	0.2	020	0.2	335	0.4	110	0.3	185
10	0.5	115	1.2	145	1.0	165	0.1	0.5	0.2	345	0.3	065	0.3	125
15	0.5	130												
17											0.3	325		
20			1.0	165	1.0	175	0.2	015	0.2	340			0.3	150
30			1.0	155	1.0	175							0.3	165
40			0.9	140	0.8	165							0.2	300
50					0.8	170							0.3	210

CURRENT VELOCITY PROFILES, STATIONS 8 THROUGH 14
16 September 1976

Station*	8		9		10		11A		12		13		14	
Depth (Feet)	S	D	S	D	S	D	S	D	S	D	S	D	S	D
Surface	1.2	175	1.3	195	0.3	325	0.2	035	0.8	195	0.6	320	0.2	070
10	1.0	170	1.0	180	0.15	335	0.2	275	0.5	205	0.05	325	0.3	140
20	1.0	165	0.9	165	0.15	290	0.1	275	0.4	225	0.05	145-245**	0.2	070
25												050-275**		
30	1.0	165	0.9	170	0.1	345	0.3	115	0.4	065			0.2	125-155**
35					0.15	275								
40	0.8	180	0.9	165			0.3	165	0.3	115			0.5	140-155**
50	0.8	205	0.9	170			0.3	165	0.4	135			0.5	140

* Station location shown on Figure 2.4-10
** Direction variable between limits shown

S = Speed (kts)
D = Direction (°True)

TABLE 2.4-4
(Sheet 2 of 2)

CURRENT VELOCITY PROFILES, STATIONS 15 THROUGH 21
16 September 1976

Station*	15		16		17		18		19		20		21	
Depth (Feet)	S	D	S	D	S	D	S	D	S	D	S	D	S	D
Surface	0.6	160	0.55	115	0.6	110	1.0	115	1.0	125	1.0	140	0.2	095
10	0.6	170	0.45	115	0.5	115	0.9	115	0.8	125	0.8	140	0.2	095
20	0.6	140	0.35	125	0.5	115	0.8	115	0.8	125	0.8	135	0.2	095
30	0.5	195	0.35	155	0.5	125	0.8	115	0.8	120	0.8	140	0.2	105
37			0.2	135										
40	0.5	195			0.3	110	0.8	115	0.8	120	0.8	120	0.2	085
50	0.6	165			0.4	110	0.7	115	0.9	110			0.3	120

CURRENT VELOCITY PROFILES, STATIONS 22 THROUGH 28
17 September 1976

Station*	22		23		24		25		26		27		28	
Depth (Feet)	S	D	S	D	S	D	S	D	S	D	S	D	S	D
Surface	0.6	090	1.0	105	0.7	085	0.6	100	1.1	075	1.0	080	0.8	100
10	0.7	110	0.7	105	0.6	085	0.6	105	1.1	105	0.9	085	0.8	090
20	0.7	115	0.8	115	0.7	095	0.6	105	1.0	085	0.9	080	0.8	090
30	0.6	105	0.8	105	0.7	095	0.7	105	1.0	095	0.9	090	0.8	095
40	0.6	100	0.9	100	0.7	095	0.8	065	1.0	075	1.0	095	0.7	095
50	0.6	110	0.8	110	0.6	095	0.9	080	1.0	075	1.0	065		

S = Speed (kts)
D = Direction (°True)

* Station location shown on Figure 2.4-10

Source: Geo-Marine, Inc. "First Operational Hydrothermal Study, Waterford S.E.S, Sept - Oct, 1976." Conducted for Louisiana Power & Light Co. Jan. 1977.

TABLE 2.4-5

PROBABILITIES OF CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE MISSISSIPPI RIVER NEAR ST. FRANCISVILLE, LA, 1954-68

(Chemical constituents, in milligrams per liter; discharge in thousands of cubic feet per second)

Characteristics	Range in Concentration	Percent of time values were equal to or less than those shown										
		95	90	80	70	60	50	40	30	20	10	5
Silica	2.6-15	----	---	---	---	---	---	---	---	---	---	----
Calcium	25-61	50	48	46	44	42	40	38	36	34	32	31
Sodium	7.1-50	33	29	26	23	21	19	17	15	13	11	10
Magnesium	2.7-24	15	14	13	12	11	10	9.5	9.0	7.8	6.8	6.2
Bicarbonate	69-174	164	156	146	133	131	125	118	111	103	93	86
Sulfate	28-89	73	67	61	56	52	48	45	42	39	35	33
Chloride	11-44	35	31	28	26	23	21	20	18	16	14	13
Fluoride	.1-1.0	----	----	----	----	----	----	----	----	----	----	----
Nitrate	.2-7.9	----	----	----	----	----	----	----	----	----	----	----
Hardness	85-257	185	176	165	156	149	142	136	129	122	112	105
Dissolved solids	152-342	300	283	264	250	240	230	220	210	200	185	174
Specific conductance (1)	194-645	535	490	450	425	400	380	360	335	310	280	260
Color (2)	5-100	50	---	---	15	---	10	----	---	---	---	---
Temperature (°C)	1-31	28	27	25	23	21	19	14	11	9	7	5
Discharge	-------	1,000	900	710	570	450	360	290	240	195	150	130

(1) Micromhos at 25°C

(2) Units of the platinum-cobalt scale

Source: Everett, Duane, "Hydrologic and Quality Characteristics of the Lower Mississippi River," Technical Report No. 5, Louisiana Dept. of Public Works. 1971.

TABLE 2.4-6
(Sheet 1 of 2)

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS

Well No.	Aquifer	Depth (feet)	Date of Collection	Temperature (°C)	Silicia (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Specific Conductance (micromhos at 25°C)	pH
					Milligrams per liter									
Jefferson Parish														
Jf-24A	Gonzales-New Orleans	708	5-30-50	25	36	0.30	3.2	1.4	132	7.6	275	1.4	606	7.8
29	Gonzales-New Orleans	760	9-25-57	25	28	.20	2.7	.8	160	1.9	284	.0	716	7.8
75	Point bar	96	7-7-60	21	36	13	93	48	14	5	530	.8	802	6.8
St Charles Parish														
SC-20	Norco	484	1-14-55	22	38	0.64	46	25	920	9.6	341	1.6	4,630	7.7
24	Norco	420	2- 2-61	22	25	.20	13	3.8	474	3.1	372	.0	2,170	7.3
32	Point bar	117	9-29-67	--	--	----	156	36	25	1.2	738	.2	1,070	7.0
35	Gramercy	270	9-12-67	--	--	----	139	42	124	5.8	815	.0	1,420	7.5
			4-15-37	--	--	3.3	464		---	---	913	---	---	---
45	Norco	402	3-11-49	23	--	----	16	12	374		402	.0	1,920	8.8
50	Norco	404	3-11-49	--	52	----	15	14	392		378	.0	1,980	8.9
57	Norco	380	9-14-48	--	40	.00	8.6	5.0	308		500	2.5	1,420	7.7
58	Norco	364	9-14-48	--	33	1.9	30	20	472		372	1.6	2,570	7.6
61	Gramercy	298	9-15-48	--	34	.10	40	19	259		616	1.6	1,470	7.8
62	Gramercy	273	9-15-48	--	32	.10	59	13	498		532	7.8	2,890	7.6
63	Norco	475	9-15-48	--	34	.10	90	50	733		334	1.0	4,390	7.4
66	Gonzales-New Orleans	670	12-27-48	--	28	.42	3.2	1.7	147	6.8	239	1.3	2,470	7.4
73	Gramercy	262	8-14-67	21	--	----	56	34	275	9.4	374	.0	1,780	8.4
87	Norco	400	4-13-60	23	26	.35	16	3.2	340	4.1	577	.6	1,560	7.6
115	Gramercy	315	9-11-67	--	--	----	26	22	410	5.0	722	.0	2,020	8.0
143	Gramercy	315	7-19-61	22	--	----	----	----	---	---	---	---	1,030	---
			9-10-45	--	--	3.5	38.4	----	---	---	---	---	---	7.9
160	Gramercy	287	9-11-67	--	--	----	12	6.1	184	2.9	423	5.4	877	7.3
161	Gramercy	283	4-26-68	--	28	.02	41	25	300	13	828	6.0	1,580	7.9
St John the Baptist Parish														
SJB-17	Norco	310	4- 4-57	21	32	0.38	9.3	4.8	290	4.2	475	0.0	1,340	7.7
30	Norco	328	4- 2-57	21	30	.19	10	5.3	285	3.6	522	.0	1,260	7.8

Source: Hosman, R.L., "Groundwater Resources of the Norco Area, Louisiana." Geological Survey, Water Resources Bulletin Number 18. 1972.

TABLE 2.4-6
(Sheet 2 of 2)

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS

Well No.	Aquifer	Depth (feet)	Date of Collection	Temperature (^oC)	Silicia (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Specific Conductance (micromhos at 25^oC)	pH
					Milligrams per liter									
					St John the Baptist Parish									
31	Norco	375	4- 2-57	21	33	1.8	53	23	253	5.6	506	.0	1,520	7.5
96	Gonzales-New Orleans	609	2-22-61	22	27	.49	5.0	.6	281	.8	384	1.4	1,250	7.7

TABLE 2.4-7
(Sheet 1 of 2)

INORGANIC WATER QUALITY PARAMETERS OF THE MISSISSIPPI RIVER NEAR WATERFORD 3
(ppm)

STA-TION	DATE	Alka-linity	Calcium Hardness	Magnesium Hardness	Chloride	Iron	Ammo-nia(N)	Ni-trate(N)	Ni-trite(N)	Orthophos-phate	Total Phosphate	Sodium	Sulfate
AC	73/04/26	95.	89.00	53.00	18.50	.28	.62	3.88	.012	.19	.44	.0*	31.0
AT	73/04/26	93.	92.00	46.00	20.20	.40	.52	3.88	.011	.42	.63	.0	32.0
	74/04/25	82.	98.00	42.00	21.30	.27	.32	3.15	.006	.25	.54	11.5	33.0
BC	73/04/26	97.	94.00	39.00	19.20	.35	.40	3.95	.014	.41	1.38	.0	28.0
	73/06/07	100.	84.00	58.00	17.70	.48	.50	2.15	.012	.18	.27	.0	29.0
	73/07/11	120.	92.00	77.60	20.50	.33	.28	3.45	.005	.29	.94	.0	31.0
	73/08/21	120.	110.00	55.00	22.00	.35	.02	1.25	.004	.53	.59	.0	37.0
	73/09/27	135.	114.00	62.00	39.00	.30	.05	1.50	.002	.41	.59	.0	46.0
	73/10/26	112.	98.00	50.00	46.00	.48	.12	1.50	.002	.74	.81	.0	41.0
	73/11/30	123.	138.00	37.00									
	73/12/28	90.	84.00	28.00	22.00	.15	.47	3.72	.010	.48	.56	3.0	11.0
	74/01/22	72.	72.00	28.00	19.88	.17	.82	3.13	.015	.21	.24	11.5	17.0
	74/02/14	80.	86.00	22.00	21.30	.20	.32	2.85	.008	.27	.39	11.5	33.0
	74/03/26	96.	104.00	36.00	28.40	.05	.20	2.30	.004	.20	.21	18.4	31.0
	74/04/25	71.	100.00	38.00	28.40	.27	.25	2.85	.008	.30	.37	11.5	33.0
	75/11/05	83.	89.00	34.20	23.00	.05	.72	6.30	.003	.22	.41	11.5	46.0
	75/11/20	105.	96.80	47.40	26.27	.05	.07	9.05	.004	.33	.49	11.5	54.0
	75/12/21	97.	86.00	45.00	24.14	.11	2.15	3.72	.006	.51	.65	23.0	44.0
	76/01/29	94.	91.00	38.20	26.60	.07	.05	3.72	.018	.27	.39	34.5	35.0
	76/02/26	95.	92.00	41.00									
	76/03/25	80.	83.00	33.60	23.10	.01	.33	4.17	.015	.30	.45	23.0	29.5
	76/04/29	106.	103.00	43.80	30.80	.03	.08	3.58	.005	.35	.36	23.0	44.0
	76/05/26	110.	104.00	54.20	32.20	.03	.40	3.88	.006	.28	.29	23.0	44.0
	76/06/25	112.	100.00	63.00	35.00	.07	.10	4.00	.004	1.50	1.61	23.0	44.0
	76/07/29	103.	96.20	44.60	3.50	.04	.13	3.58	.001	.12	.17	23.0	44.0
	76/09/09	121.	102.40	55.00	32.90	.06	.05	3.58	.006	.20	.23	34.5	51.0
	76/09/30	127.	104.40	57.00	32.90	.10	.05	3.30	.003	.23	.24	46.0	54.0
BT	73/04/26	95.	92.00	43.00	20.20	.39	.73	3.80	.015	.42	.69	.0	34.0
	73/06/07	105.	88.00	48.00									
	73/07/11	115.	98.00	83.00	19.70	.17	.28	3.28	.003	.33	.77	.0	30.0
	73/08/21	125.	113.00	53.00	22.70	.30	.02	1.10	.003	.51	.58	.0	41.0
	73/09/27	145.	112.00	60.00	33.00	.25	.02	1.35	.002	.73	.79	.0	48.0
	73/10/26	106.	94.00	52.00	50.00	.23	.02	1.50	.006	.51	.54	.0	41.0
	73/11/30	112.	110.00	52.00	34.00	.48	.42	3.72	.011	.31	.35	3.5	46.0
	73/12/28	91.	86.00	32.00	21.00	.07	.25	3.38	.010	.54	.54	2.3	20.5
	74/01/22	72.	72.00	28.00	19.88	.30	.43	2.30	.011	.27	.30	11.5	17.0
	74/02/14	80.	84.00	36.00	19.88	.20	.35	2.30	.008	.25	.34	11.5	33.0
	74/03/26	94.	112.00	24.00	28.40	.05	.12	2.02	.005	.20	.21	16.1	29.0
	75/11/05	86.	87.60	35.00									
	75/11/20	110.	95.20	47.60	25.56	.05	.09	4.03	.004	.28	.33	23.0	55.0
	75/12/21	90.	87.40	42.20	24.14	.17	.55	4.00	.006	1.09	1.46	34.5	44.0

* .0 = Sample not analyzed for this parameter

TABLE 2.4-7
(Sheet 2 of 2)

INORGANIC WATER QUALITY PARAMETERS OF THE MISSISSIPPI RIVER NEAR WATERFORD 3
(ppm)

STA-TION	DATE	Alka-linity	Calcium Hardness	Magnesium Hardness	Chloride	Iron	Ammo-nia(N)	Ni-trate (N)	Ni-trate (N)	Orthophos-phate	Total phosphate	Sodium	Sulfate
	76/01/29	90.	94.00	33.40	28.70	.08	.05	3.72	.019	.23	.32	23.0	35.0
	76/02/26	97.	98.00	33.20	26.60	.10	.35	3.72	.027	1.35	3.00	35.5	52.0
	76/03/25	73	81.80	35.20	23.80	.01	.42	4.65	.015	.30	.51	17.3	31.3
	76/04/29	107.	105.60	44.20	32.20	.03	.05	3.15	.004	.37	.38	23.0	43.0
	76/05/26	114.	103.60	52.40	31.50	.02	.32	3.72	.006	.41	.42	23.0	46.0
	76/06/25	113.	99.40	57.60	37.10	.08	.05	4.30	.005	1.35	1.42	20.7	42.0
	76/07/29	104.	98.00	46.20	3.50	.05	.10	3.58	.001	.12	.12	23.0	45.0
	76/09/09	119.	104.20	58.00	34.30	.06	.05	3.30	.007	.24	.33	23.0	52.0
	76/09/30	127.	106.00	56.60	31.50	.11	.05	3.00	.009	.22	.24	34.5	54.0
BT1	73/04/26	102.	94.00	44.00	20.20	.28	.43	3.95	.016	.37	.68	.0*	34.0

* .0 = Sample not analyzed for this parameter.

TABLE 2.4-8
(Sheet 1 of 2)

HEAVY METAL CONCENTRATIONS IN THE MISSISSIPPI RIVER NEAR WATERFORD 3
(ppm)

STATION	DATE	LEAD	MERCURY	ZINC	ARSENIC	CADMIUM	HEXAVALENT CHROMIUM
BT	73/04/27	1.0	<.3	33.0	<20.0	<3.0	<30.0
	73/06/11	22.0	<.3	28.0	<20.0	4.0	<30.0
	73/08/22	16.0	<.3	19.0	<20.0	20.0	<10.0
	73/09/28	14.0	<.3	8.0	<20.0	2.0	<10.0
	73/10/25	17.0	<.3	30.0	<20.0	2.0	<10.0
	73/12/03	29.0	<.5	7.0	<20.0	14.0	<10.0
	73/12/27	14.0	<.3	129.0	<20.0	6.0	<10.0
	74/03/27	14.0	2.3	6.0	<20.0	2.0	<10.0
	74/04/25	.5	2.3	12.0	<20.0	.2	<10.0
	74/08/22		0.4	33.0	21.0	2.0	20.0
	75/02/27	<5.0	<.3	14.0	<20.0	6.0	<10.0
	75/04/23	<5.0	<.3	11.0	<20.0	4.0	<10.0
	75/08/07	<5.0	<.3	13.0	<20.0	<1.0	<10.0
	75/11/18	12.0	<.3	12.0	<20.0	<1.0	<10.0
	75/12/21	15.0	<.3	36.0	<20.0	<1.0	<10.0
	76/01/28	13.0	<.3	42.0	<20.0	<1.0	<10.0
	76/02/24	7.0	<.3	26.0	<20.0	<1.0	<10.0
	76/03/26	7.0	<.3	53.0	<20.0	<1.0	<10.0
	76/04/27	10.0	<.3	26.0	<20.0	<1.0	<10.0
	76/05/25	6.0	<.3	6.0	<20.0	<1.0	<10.0
	76/06/22	14.0	<.3	12.0	<20.0	<1.0	<10.0
	76/07/27	8.0	<.3	18.0	<20.0	<1.0	<10.0
	76/09/08	17.0	<.3	34.0	<20.0	<1.0	<10.0
	76/09/27	10.0	<.3	10.0	<20.0	<1.0	<10.0
BC	73/04/27	3.0	<.3	99.0	<20.0	<3.0	<30.0
	73/06/11	22.0	<.3	25.0	<20.0	4.0	<30.0
	73/08/22	29.0	<.7	48.0	<20.0	17.0	<10.0
	73/09/28	16.0	<.3	22.0	<20.0	1.0	<10.0
	73/10/25	14.0	<.3	27.0	<20.0	2.0	<10.0
	73/12/03	27.0	<.5	7.0	<20.0	7.0	<10.0
	73/12/27	16.0	<.3	72.0	<20.0	4.0	<10.0
	74/03/27	13.0	1.8	9.0	<20.0	1.0	<10.0
	74/04/15	37.0	2.9	14.0	<20.0	.5	<10.0
	74/08/22		<.3	157.0	<20.0	1.0	13.0
	75/02/27	5.0	<.3	8.0	<20.0	6.0	<10.0
	75/04/23	5.0	<.3	5.0	<20.0	7.0	<10.0
	75/08/07	5.0	<.3	15.0	<20.0	<1.0	<10.0
	75/11/18	5.0	<.3	12.0	<20.0	<1.0	<10.0
	75/12/21	16.0	<.3	37.0	<20.0	<1.0	<10.0
	76/01/28	13.0	<.3	55.0	<20.0	<1.0	<10.0
	76/02/24	7.0	<.3	16.0	<20.0	<1.0	<10.0
	76/03/26	11.0	<.3	31.0	<20.0	<1.0	<10.0
	76/04/27	5.0	<.3	37.0	<20.0	<1.0	<10.0

TABLE 2.4-8
(Sheet 2 of 2)

HEAVY METAL CONCENTRATIONS IN THE MISSISSIPPI RIVER NEAR WATERFORD 3
(ppm)

STATION	DATE	LEAD	MERCURY	ZINC	ARSENIC	CADMIUM	HEXAVALENT CHROMIUM
	76/05/25	6.0	<.3	10.0	<20.0	<1.0	<10.0
	76/06/22	8.0	<.3	16.0	<20.0	<1.0	<10.0
	76/07/27	7.0	<.3	3.0	<20.0	<1.0	<10.0
	76/09/08	13.0	<.3	11.0	<20.0	<1.0	<10.0
	76/09/27	10.0	<.3	18.0	<20.0	<1.0	<10.0

TABLE 2.4-9
(Sheet 1 of 2)

OTHER WATER QUALITY PARAMETERS OF THE MISSISSIPPI RIVER NEAR WATERFORD 3

STATION	DATE	COD[a]	TOTAL BACTERIA[b]	FECAL COLIFORM[b]	PRIMARY PRODUCTIVITY[c]	ATP[d]	CHLD[a]	TURBIDITY[e]	TOTAL DISSOLVED SOLIDS[a]	TOTAL SUSPENDED SOLIDS[a]	TOTAL VOLATILE SOLIDS[a]	BOD[a]
AC	73/04/26	44.88	210,000	18700*	8.804	.020	.009	240.	254.8	204.5	331.0	1.05
AT	73/04/26	20.40	204,000	19000*	7.432	.030	.010	270.	248.7	263.8	390.0	.45
	74/04/25	28.80	470,000	9000	16.530	.032	.004	240.	223.5	147.6	.0**	.50
BC	73/04/26	20.40	163,000	17000*	8.284	.020	.017	240.	253.4	225.6	364.5	.25
	73/06/07	6.18	300,000	16500*	10.030	.028	.019	200.	279.3	135.0	.0	.30
	73/07/11	116.00	500,000	35400*	27.130	.026	.014	240.	308.5	172.7	.0	.60
	73/08/21	20.00	41,000	10000*	18.480	.020	.018	110.	292.5	26.1	.0	.05
	73/09/27	42.00	180,000	18000*	61.690	.025	.040	85.	349.0	44.2	.0	.10
	73/10/26	40.00	348,000	150000*	7.040	.025	.013	380.	364.7	210.2	.0	.85
	73/11/30	13.52	109,000	11000	12.050	.116	.007	200.	389.1	166.1	.0	.72
	73/12/28	24.00	260,000	20000	12.620	.112	.003	300.	283.3	270.9	.0	.60
	74/01/22	35.20	460,000	16100	6.050	.098	.004	210.	241.5	122.2	.0	1.80
	74/02/14	44.00	175,000	2600	8.160	.019	.011	220.	364.5	89.3	.0	.53
	74/03/26	8.00	800,000	42500	8.230	.016	.003	270.	335.1	164.5	.0	.48
	74/04/25	16.20	150,000	27000	9.730	.032	.008	240.	231.2	117.0	.0	2.10
	75/11/05	25.76	700,000	918	43.450	.018	.012	340.	280.6	85.8	106.3	.55
	75/11/20	3.28	160,900	1100	33.280	.046	.015	150.	290.5	57.5	107.6	1.00
	75/12/21	26.40	221,000	542	21.200	.020	.005	480.	243.7	165.6	94.3	.92
	76/01/29	30.80	240,000	1609	32.780	.005	.034	63.	208.1	229.7	155.4	3.25
	76/02/26	20.00	49,000,000	542	20.160	.006	.018	79.	284.1	145.5	145.6	2.60
	76/03/25	7.20	700,000	1720	32.340	.006	.026	410.	189.3	345.6	227.1	1.10
	76/04/29	3.76	1,090,000	1090	45.820	.003	.009	155.	277.5	59.4	100.4	.05
	76/05/26	10.80	221,000	1100	37.600	.002	.009	500.	322.8	63.6	125.0	1.25
	76/06/25	7.76	280,000	542	62.100	.002	.027	180.	334.4	64.0	155.2	.20
	76/07/29	7.12	278,000	348	105.60	.004	.041	195.	313.7	34.8	194.4	1.35
	76/09/09	3.76	460,000	348	192.35	.030	.030	170.	369.6	44.0	211.3	.50
	76/09/30	3.56	70,000	348	46.620	.016	.023	133.	320.5	6.4	168.0	.40
BT	73/04/26	24.48	109,000	17600*	6.544	.030	.017	250.	258.6	222.7	352.4	.55
	73/06/07	4.12	390,000	12900*	22.860	.030	.020	200.	287.5	90.6	.0	.30
	73/07/11	104.00	310,000	47500*	34.580	.030	.010	240.	297.7	194.6	.0	.65
	73/08/21	48.00	98,500	15900*	24.120	.023	.020	220.	294.5	76.0	.0	.25
	73/09/27	54.00	170,000	16090*	131.35	.011	.036	85.	347.2	39.9	.0	.43
	73/10/26	54.00	161,000	180000*	22.110	.019	.002	380.	354.6	132.1	.0	.35
	73/11/30	11.83	120,000	10000	11.060	.068	.007	170.	392.0	101.1	.0	.72
	73/12/28	41.33	542,000	28000	5.950	.084	.004	350.	268.2	310.1	.0	.88
	74/01/22	26.40	221,000	16100	9.680	.194	.001	220.	241.2	129.6	.0	1.55
	74/02/14	46.20	130,000	5400	6.360	.017	.005	250.	309.5	129.1	.0	.88
	74/03/26	16.00	720,000	26300	7.300	.014	.004	250.	316.1	194.4	.0	1.20
	75/11/05	3.68	630,000	542	57.870	.038	.013	250.	281.0	78.8	101.5	.55
	75/11/20	9.84	240,000	460	35.440	.142	.014	180.	201.2	147.1	96.2	.95
	75/12/21	17.60	278,000	175	9.920	.023	.003	625.	255.1	178.5	95.4	.75

TABLE 2.4-9
(Sheet 2 of 2)

OTHER WATER QUALITY PARAMETERS OF THE MISSISSIPPI RIVER NEAR WATERFORD 3

STATION	DATE	COD (a)	TOTAL BACTERIA (b)	FECAL COLIFORM (b)	PRIMARY PRODUCTIVITY (c)	ATP (d)	CHLD (a)	TURBIDITY (e)	TOTAL DISSOLVED SOLIDS (a)	TOTAL SUSPENDED SOLIDS (a)	TOTAL VOLATILE SOLIDS (a)	BOD (a)
	76/01/29	26.40	278,000	918	33.880	.004	.035	49.	236.1	144.5	144.9	3.24
	76/02/26	60.00	348,000	918	25.860	.007	.024	85.	306.6	132.0	124.9	2.10
	76/03/25	14.40	790,000	1720	17.000	.008	.015	420.	188.6	228.6	87.0	1.20
	76/04/29	11.28	172,000	3480	49.730	.004	.007	175.	285.7	59.8	155.1	.60
	76/05/26	21.60	210,000	278	30.940	.003	.012	400.	335.9	14.2	171.3	1.02
	76/06/25	7.76	240,000	348	53.500	.002	.008	180.	337.2	52.2	156.7	.24
	76/07/29	42.72	221,000	278	118.900	.001	.032	245.	295.3	27.5	175.5	1.28
	76/09/09	18.80	348,000	918	84.810	.307	.016	160.	388.4	58.5	218.4	1.18
	76/09/30	10.68	109,000	43	61.060	.050	.023	143.	373.9	44.2	268.5	.15
BT1	73/04/26	16.32	140,000*	11400*	6.968	.030	.014	250.	259.8	226.1	367.5	.80

(a) Values in ppm.
(b) Values in most probable counts per 100 ml.
(c) Values in (mg C/m^3/hr).
(d) Values in micrograms/l.
(e) Values in Jackson Turbity Units.

* Coliform bacteria
** .0 = Sample not analyzed for this parameter.

TABLE 2.4-10

SEDIMENT CONCENTRATIONS IN THE MISSISSIPPI RIVER AT LULING FERRY, LA.

Discharge at Red River Landing cfs x 1,000	Date	Total Suspended sediment (mg/l)	Silt (mg/l)	Sand (mg/l)
602	April 7, 1976	386	290	96
304	June 19, 1976	135	122	13
221	Aug. 18, 1976	58	49	9
174 (2/10)	Feb. 9, 1977	68	61	7
420 (5/5)	May 4, 1977	250	232	18

Source: Personal Communication, US Geological Survey, Baton Rouge, La. 1944.

Preliminary Data, Subject to Revision.

TABLE 2.4-11

MISSISSIPPI RIVER WATER TEMPERATURE DATA SUMMARY
FROM THE CONTINUOUS WATER QUALITY MONITORING STATIONS
FOR THE PERIOD JULY 1976 TO JUNE 1978 | 1
(Temperatures at zero mean sea level in degrees F)

	LOCATION					
	LITTLE GYPSY			WATERFORD (WEST BANK)		
MONTH	MAX	MIN	RANGE	MAX	MIN	RANGE
76 JUL	86.61	83.77	2.83	87.28	87.15	.13
76 AUG	86.61	83.84	2.77	87.03	86.16	.88
76 SEP	80.85	78.74	2.12	86.29	80.25	6.04
76 OCT	78.52	61.02	17.50	80.04	73.35	6.69
76 NOV	60.40	48.82	11.58	58.72	48.46	10.25
76 DEC	48.77	46.64	2.13	50.21	42.98	7.23
77 JAN	40.35	34.84	5.51	43.08	39.45	3.62
77 FEB	48.11	35.52	12.59	48.36	42.49	5.87
77 MAR	57.83	46.94	10.89	56.95	47.02	9.94
77 APR	64.16	58.10	6.06	67.34	57.52	9.82
77 MAY	78.26	74.23	4.03	78.99	67.74	11.25
77 JUN	85.02	78.27	6.76	84.76	79.01	5.75
77 JUL	86.22	84.50	1.72	*	*	*
77 NOV	59.57	54.79	4.78	*	*	*
77 DEC	50.15	39.87	10.28	*	*	*
78 JAN	39.83	35.56	4.27	36.46	34.47	1.99
78 FEB	41.24	35.47	5.76	41.43	33.67	7.76
78 MAR	46.51	41.77	4.74	46.31	41.24	5.08
78 APR	*	*	*	64.61	46.73	17.88
78 MAY	*	*	*	72.07	61.50	10.57
78 JUN	*	*	*	84.15	72.67	11.48

1

* Months when the continuous water quality monitoring station was not operating correctly.

TABLE 2.4-12
(SHEET 1 of 2)
MISSISSIPPI RIVER
WATER TEMPERATURE DATA SUMMARY
FROM THE CONTINUOUS WATER QUALITY MONITORING STATIONS
FOR THE PERIOD JULY 1976 TO AUGUST 1978 1
(Temperatures at minus 10 ft. mean sea level in degrees F)

	LOCATION						
	LITTLE GYPSY			WATERFORD (WEST BANK)			
MONTH	MAX	MIN	RANGE	MAX	MIN	RANGE	
76 JUL	87.27	84.49	2.78	87.62	87.55	.07	
76 AUG	87.28	84.59	2.69	87.61	84.57	3.04	
76 SEP	81.80	79.75	2.05	84.70	79.34	5.36	
76 OCT	79.56	61.41	18.15	79.18	72.71	6.47	
76 NOV	60.83	50.07	10.76	59.32	49.41	9.91	
76 DEC	50.06	48.09	1.97	49.65	43.12	6.52	
77 JAN	74.82	73.87	.95	43.08	39.47	3.61	
77 FEB	74.99	47.95	27.04	48.12	42.08	6.04	
77 MAR	77.92	48.22	29.70	56.58	46.89	9.69	
77 APR	79.73	66.74	12.99	80.07	57.17	22.90	
77 MAY	*	*	*	82.60	77.80	4.80	
77 JUN	81.67	49.41	32.26	80.58	79.79	.79	
77 JUL	81.77	80.46	1.31				
77 NOV	81.91	79.82	2.09				
77 DEC	81.15	41.54	39.61				
78 JAN	41.46	36.37	5.09	36.03	34.09	1.94	
78 FEB	41.10	34.78	6.32	39.77	33.25	6.52	1
78 MAR	45.92	41.54	4.38	46.75	40.10	6.64	
78 APR				63.95	47.18	16.77	
78 MAY				71.70	60.85	10.85	

*Months when the continuous water quality monitoring station was not operating correctly.

TABLE 2.4-12 (Cont'd)
(SHEET 2 OF 2)

	LOCATION					
	LITTLE GYPSY			WATERFORD (WEST BANK)		
MONTH	MAX	MIN	RANGE	MAX	MIN	RANGE
78 JUN	*	*	*	84.45	72.30	12.15
78 JUL	64.39	64.39	.00	89.69	84.90	4.79
78 AUG	88.40	81.10	7.30	85.35	85.11	.24

1

*Months when the continuous water quality monitoring station was not operating correctly.

TABLE 2.4-13

MISSISSIPPI RIVER
WATER TEMPERATURE DATA SUMMARY
FROM THE CONTINUOUS WATER QUALITY MONITORING STATIONS
FOR THE PERIOD JULY 1976 TO AUGUST 1978 1
(Temperatures at minus 20 ft. mean sea level in degrees F)

	LOCATION					
	LITTLE GYPSY			WATERFORD (WEST BANK)		
MONTH	MAX	MIN	RANGE	MAX	MIN	RANGE
76 JUL	89.59	86.91	2.69	86.64	86.61	.04
76 AUG	89.56	86.70	2.86	86.75	84.47	2.28
76 SEP	81.87	79.03	2.84	84.61	79.29	5.32
76 OCT	78.77	58.96	19.80	79.11	72.80	6.31
76 NOV	59.57	49.77	9.80	59.81	49.91	9.89
76 DEC	50.15	47.61	2.54	50.10	43.54	6.56
77 JAN	41.92	36.21	5.72	43.43	39.97	3.45
77 FEB	62.73	37.08	25.65	48.72	42.58	6.14
77 MAR	56.57	43.14	13.42	56.49	47.50	8.99
77 APR	62.31	56.85	5.47	67.33	57.08	10.25
77 MAY	77.05	73.35	3.71	78.21	67.70	10.51
77 JUN	85.03	77.14	7.88	83.56	78.24	5.32
77 JUL	86.29	84.59	1.70	*	*	*
77 NOV	79.60	77.96	1.64	*	*	*
77 DEC	78.89	42.18	36.71	*	*	*
78 JAN	42.22	37.31	4.92	35.57	33.66	1.91
78 FEB	48.92	35.78	13.14	39.21	32.83	6.38
78 MAR	54.32	40.89	13.43	47.01	39.74	7.27
78 APR	*	*	*	64.57	47.58	16.99
78 MAY	*	*	*	70.17	60.97	9.19
78 JUN	*	*	*	85.24	70.76	14.48

1

* Months when the continuous water quality monitoring station was not operating correctly.

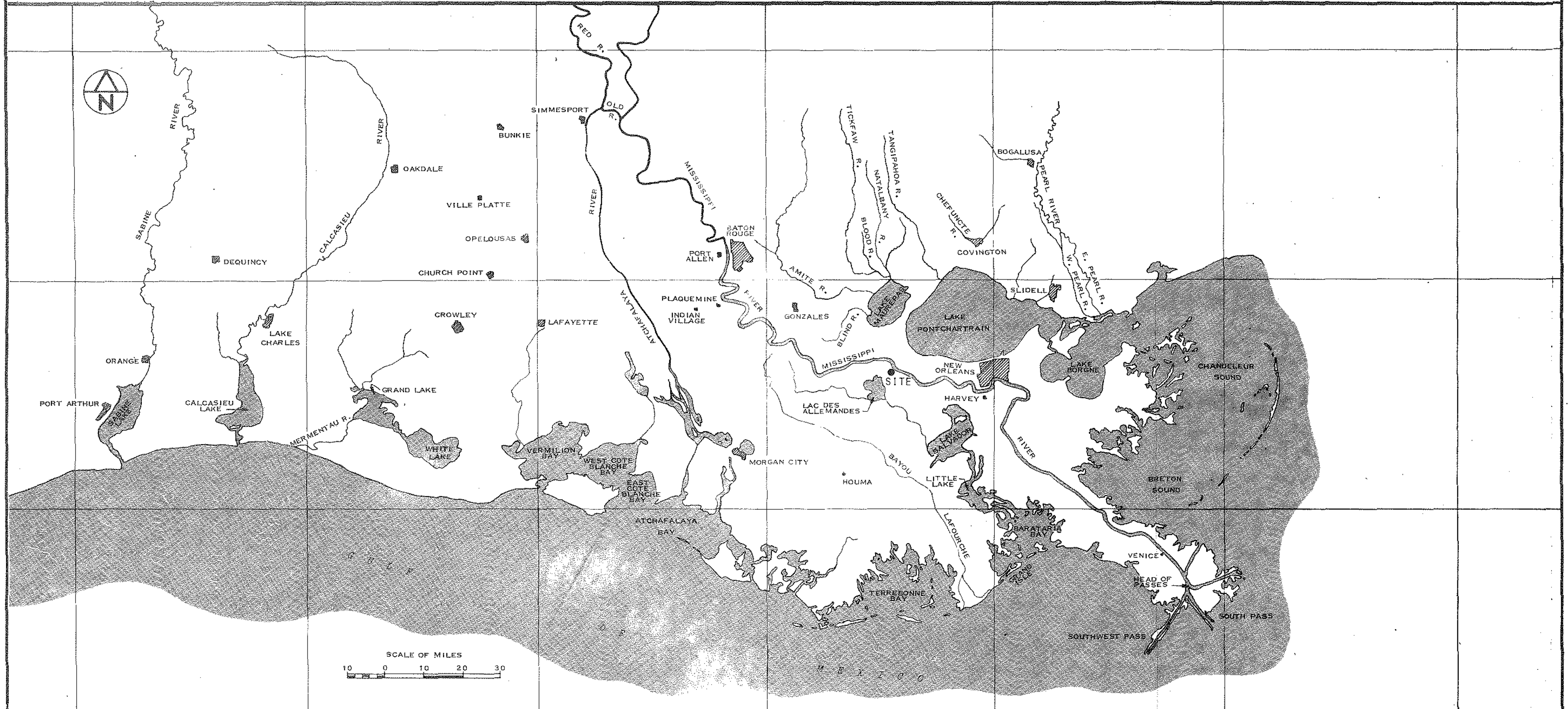
TABLE 2.4-14

MONTHLY WATER TEMPERATURE DATA FROM THE MISSISSIPPI RIVER NEAR WESTWEGO, LOUISIANA*
(1951-1978)

Month	Temperature (°F)		
	Maximum	Minimum	Mean
January	50	39	45
February	50	40	45
March	56	45	51
April	64	51	59
May	78	64	70
June	83	74	79
July	87	81	84
August	90	80	85
September	87	76	83
October	79	67	74
November	71	54	62
December	57	44	51

* Measurements taken at Ninemile Point Generating Station, 25.6 miles downstream from Waterford 3.

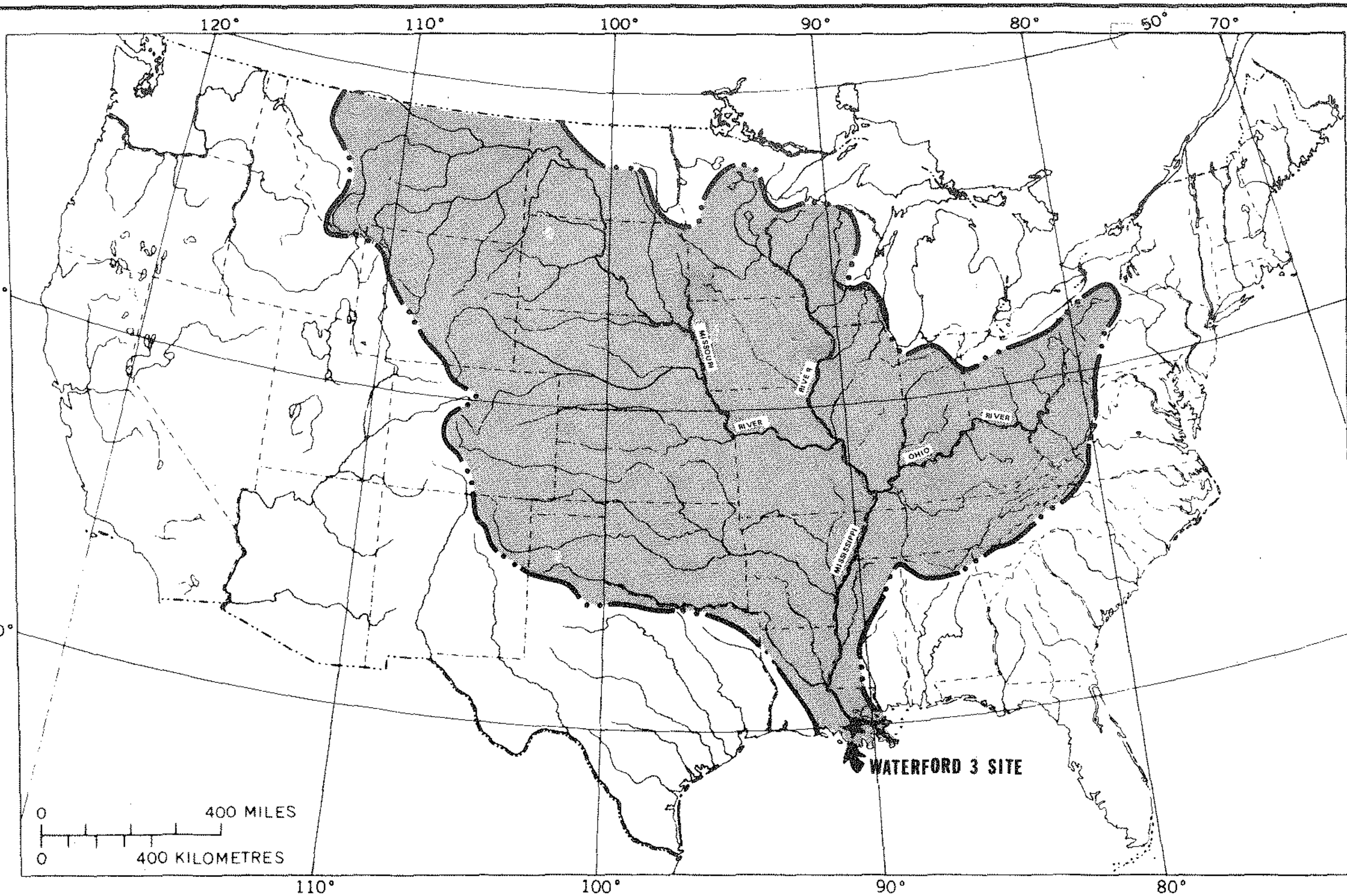
1



LOUISIANA
POWER & LIGHT CO.
Waterford Steam
Electric Station

REGIONAL HYDROLOGY

Figure 2.4-1

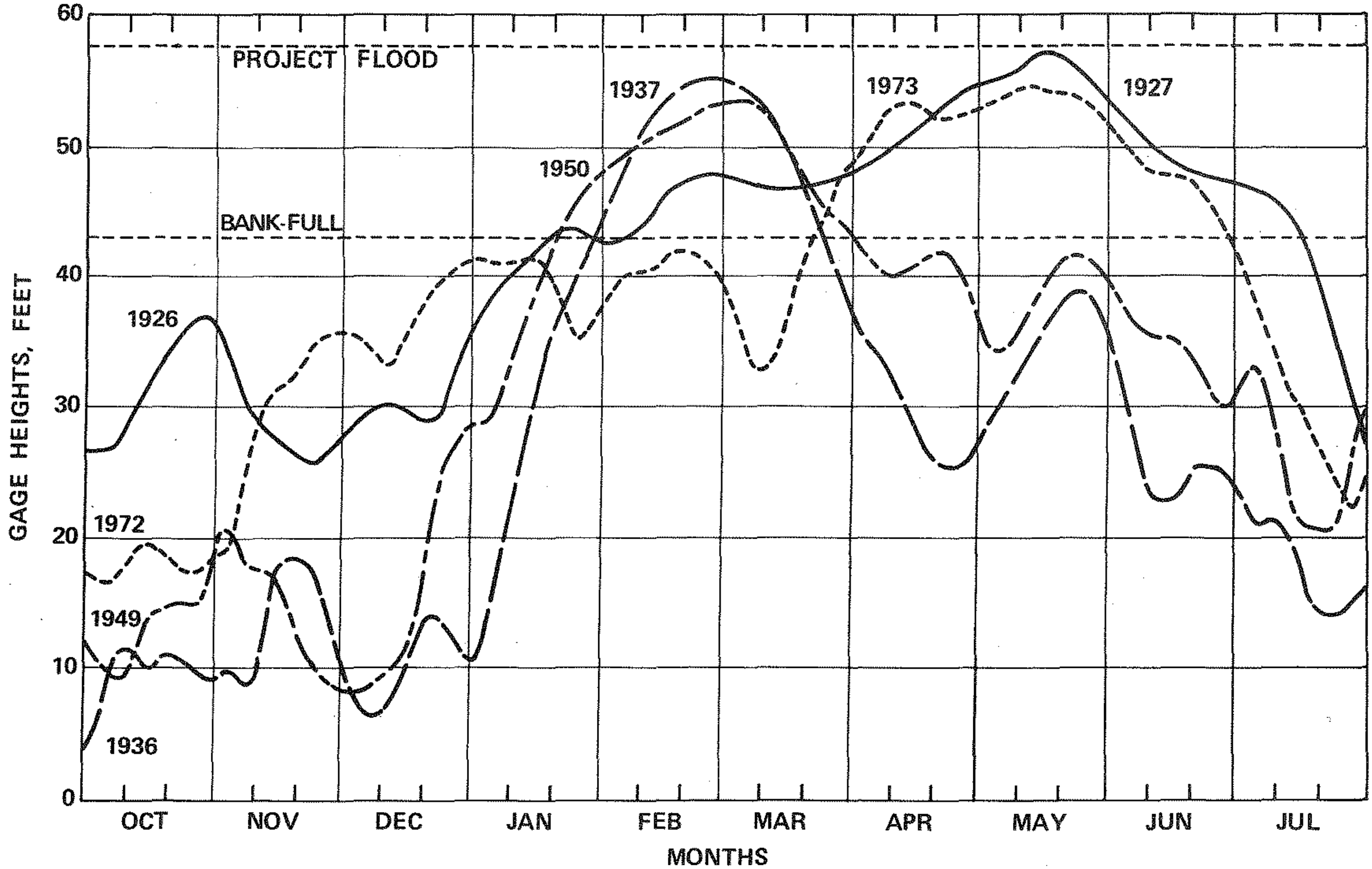


LEGEND:

MISSISSIPPI RIVER BASIN BOUNDARY

SOURCE: CHIN, E.H., SKELTON, J., AND GUY, H.P., "THE 1973 MISSISSIPPI RIVER BASIN FLOOD: COMPILATION AND ANALYSIS OF METEOROLOGIC, STREAMFLOW, AND SEDIMENT DATA." U.S. GEOLOGICAL SURVEY, PROFESSIONAL PAPER 937, 1975.

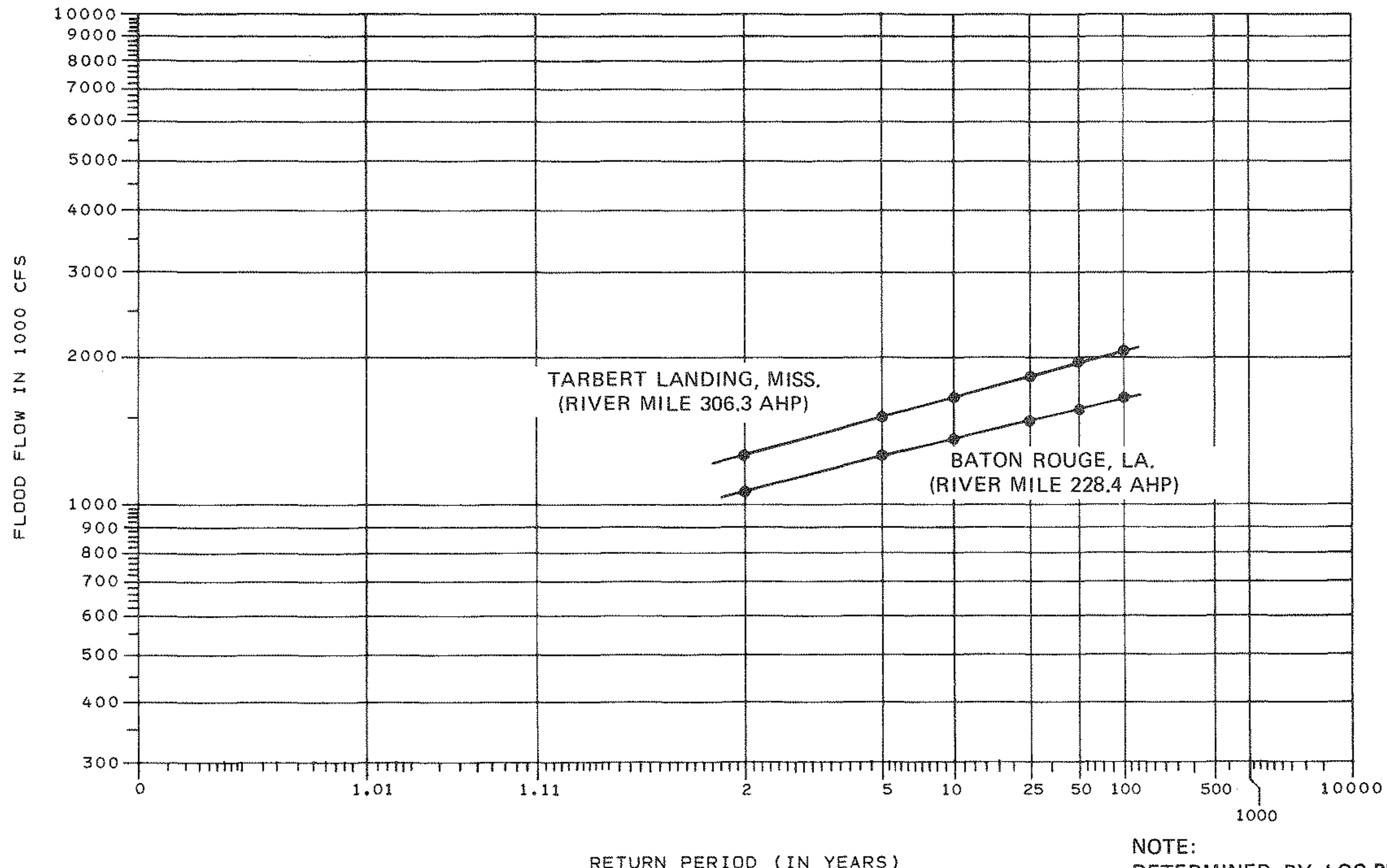
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	LOCATION OF WATERFORD 3 IN THE MISSISSIPPI RIVER BASIN	Figure 2.4-2



GAGE ZERO FEET MSL - 3.49

SOURCE: DEPT. OF THE ARMY, CORPS OF ENGINEERS, "MISSISSIPPI RIVER AND TRIBUTARIES, POST-FLOOD REPORT, 1973." JAN., 1974.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MISSISSIPPI RIVER STAGE HYDROGRAPHS AT RED RIVER LANDING, LA.	Figure 2.4-3



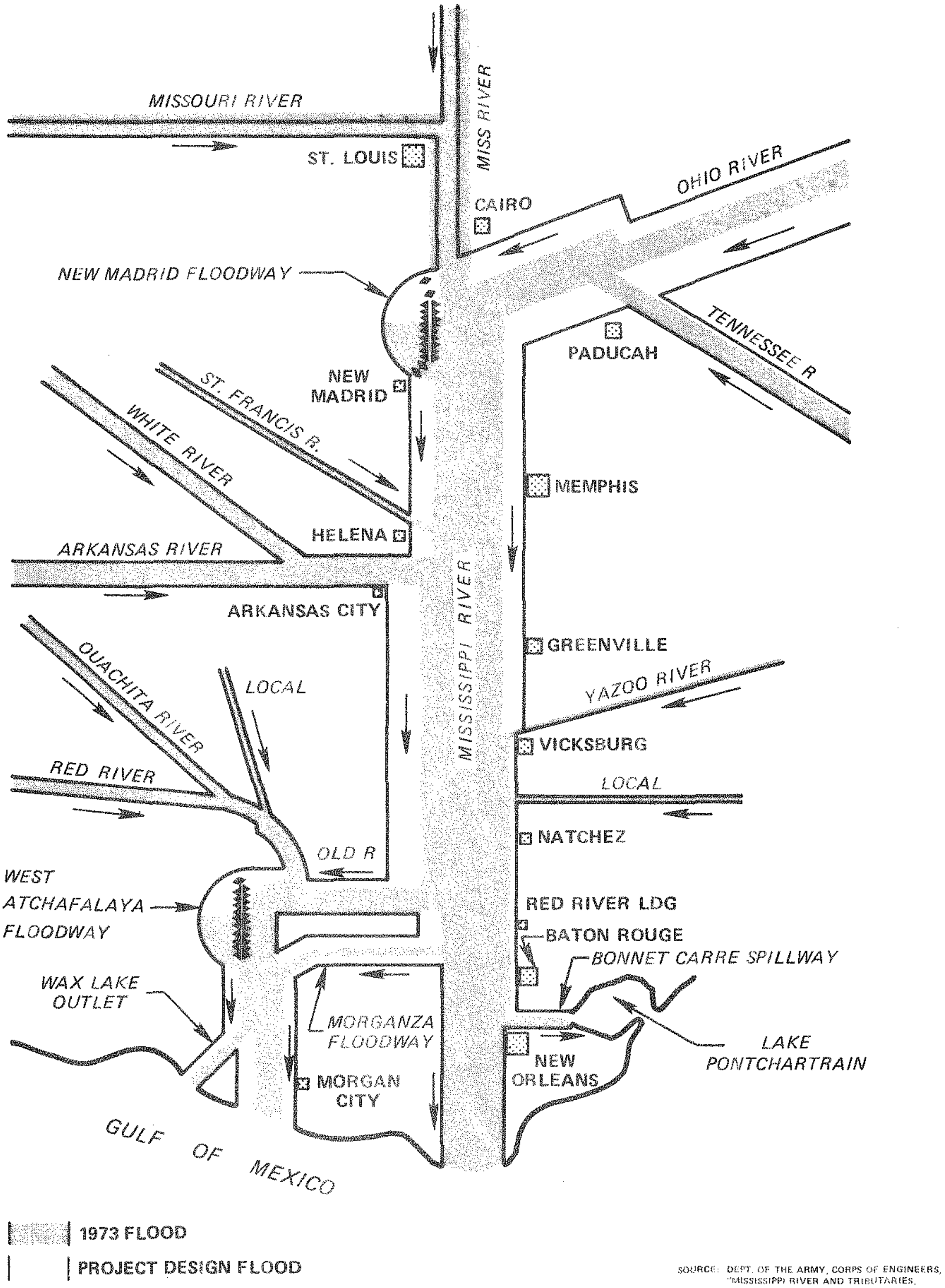
NOTE:
DETERMINED BY LOG-PEARSON TYPE III DISTRIBUTION.

PERIOD OF RECORD 1943–1976

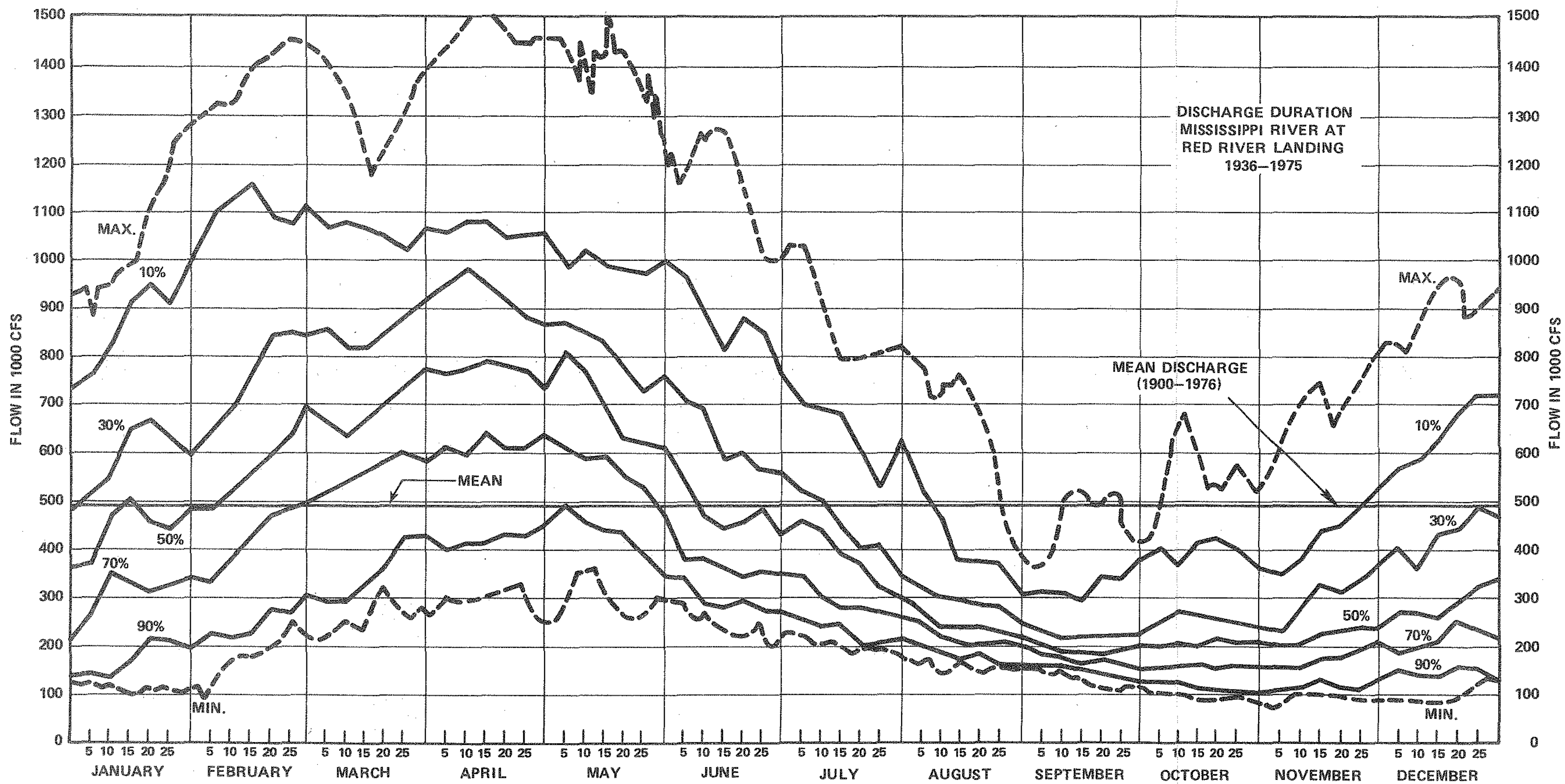
AHP – ABOVE HEAD OF PASSES, LA

AMENDMENT NO. 1 (9/79)

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MISSISSIPPI RIVER FLOOD FREQUENCY AT TARBERT LANDING AND BATON ROUGE	Figure 2.4-4



LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	COMPARISONS BETWEEN 1973 MISSISSIPPI RIVER FLOOD STAGE AND PROJECT DESIGN FLOOD STAGE	Figure 2.4-5



SOURCE: U.S. ARMY CORPS
OF ENGINEERS,
NEW ORLEANS, LA.

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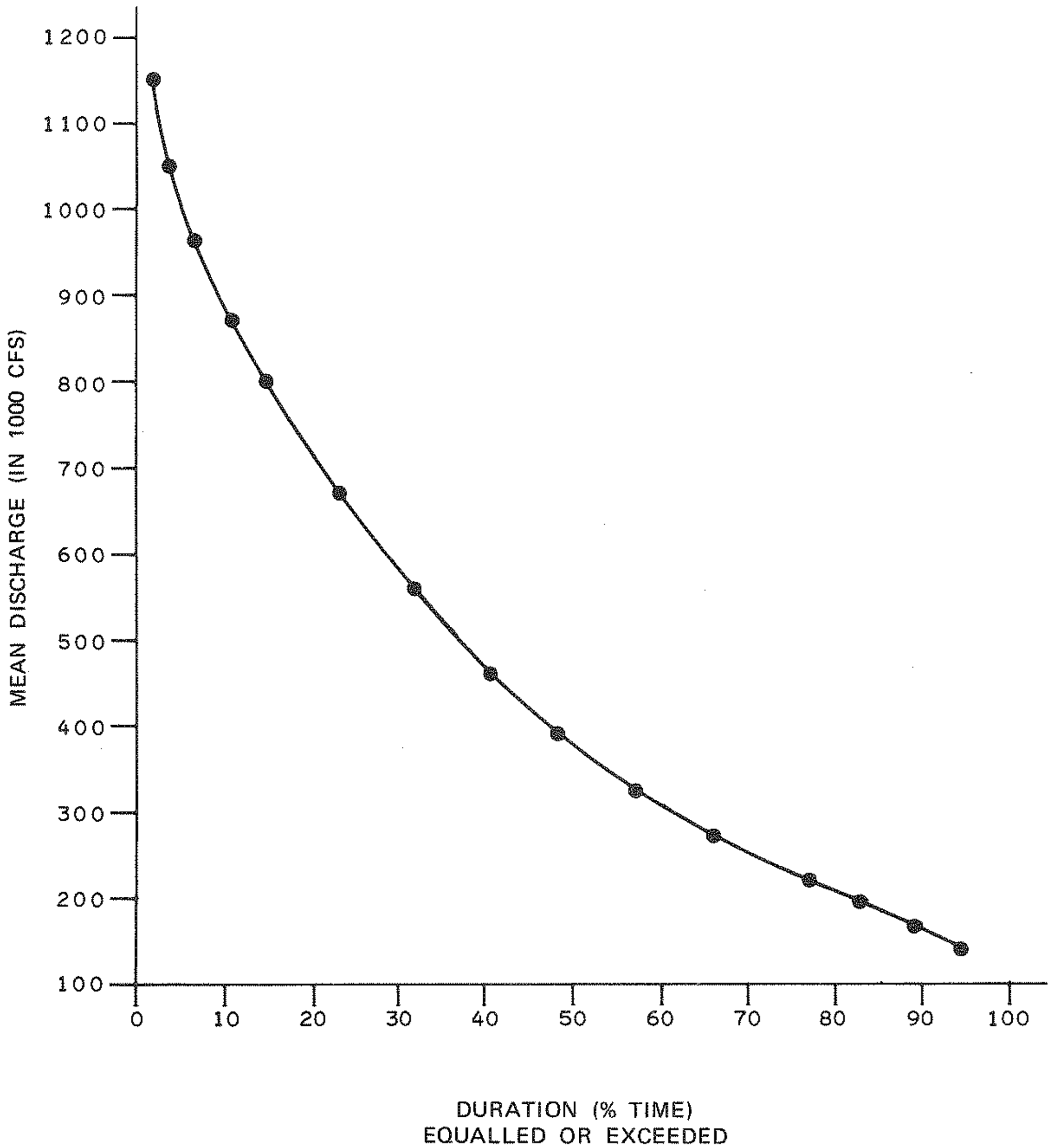
Waterford Steam
Electric Station

MISSISSIPPI RIVER SEASONAL FLOW VARIATION

Figure
2.4-6

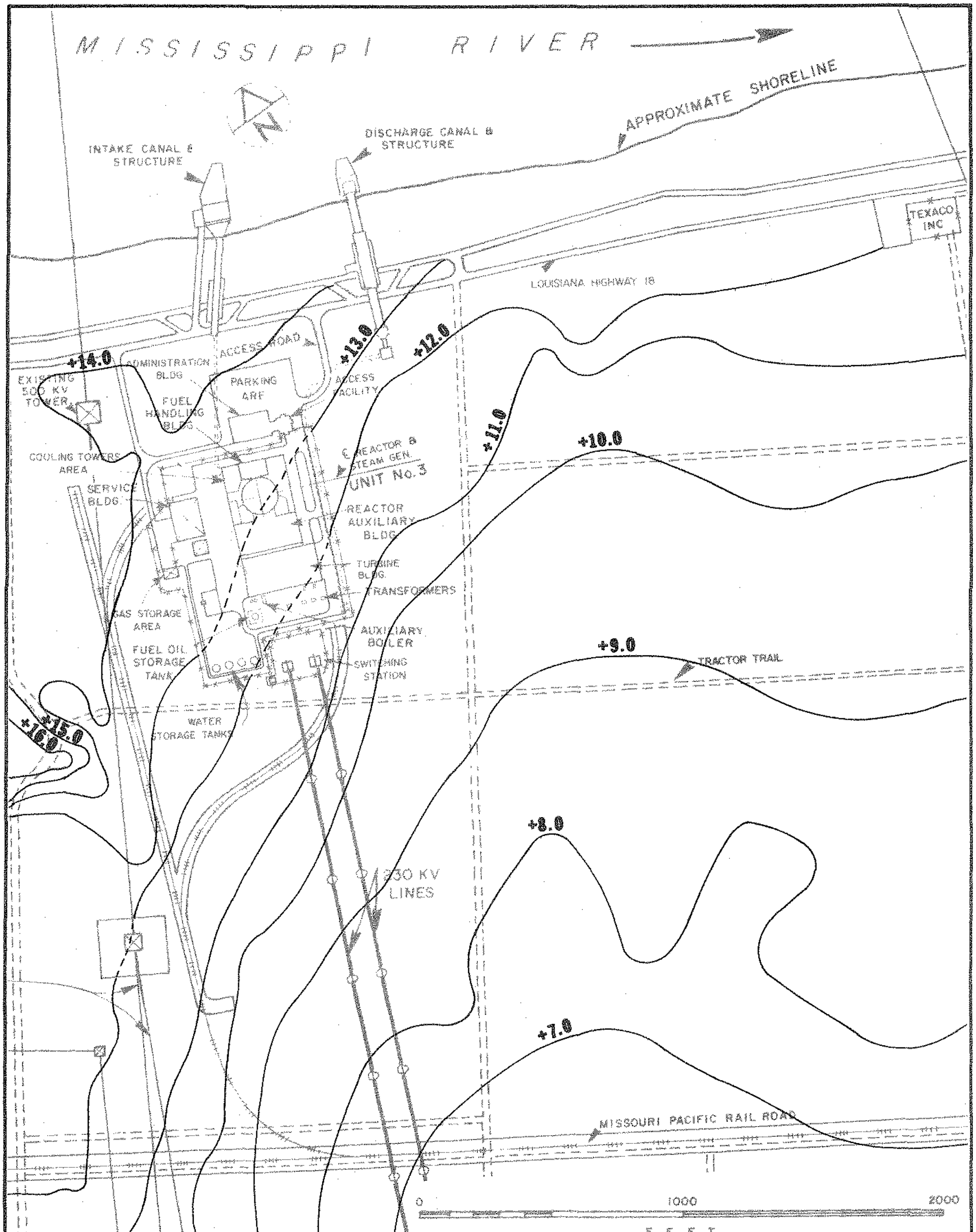
NOTE:
COMBINED DATA FROM TARBERT LANDING AND RED RIVER LANDING 1930–1975. DATA UTILIZED FOR THIS CURVE IS BASED ON DAILY FLOWS.



SOURCE:
UNPUBLISHED PRELIMINARY DATA – SUBJECT TO REVISION
U.S. GEOLOGICAL SURVEYS, BATON ROUGE, LA. 1977

AMENDMENT NO. 1 (9/79)

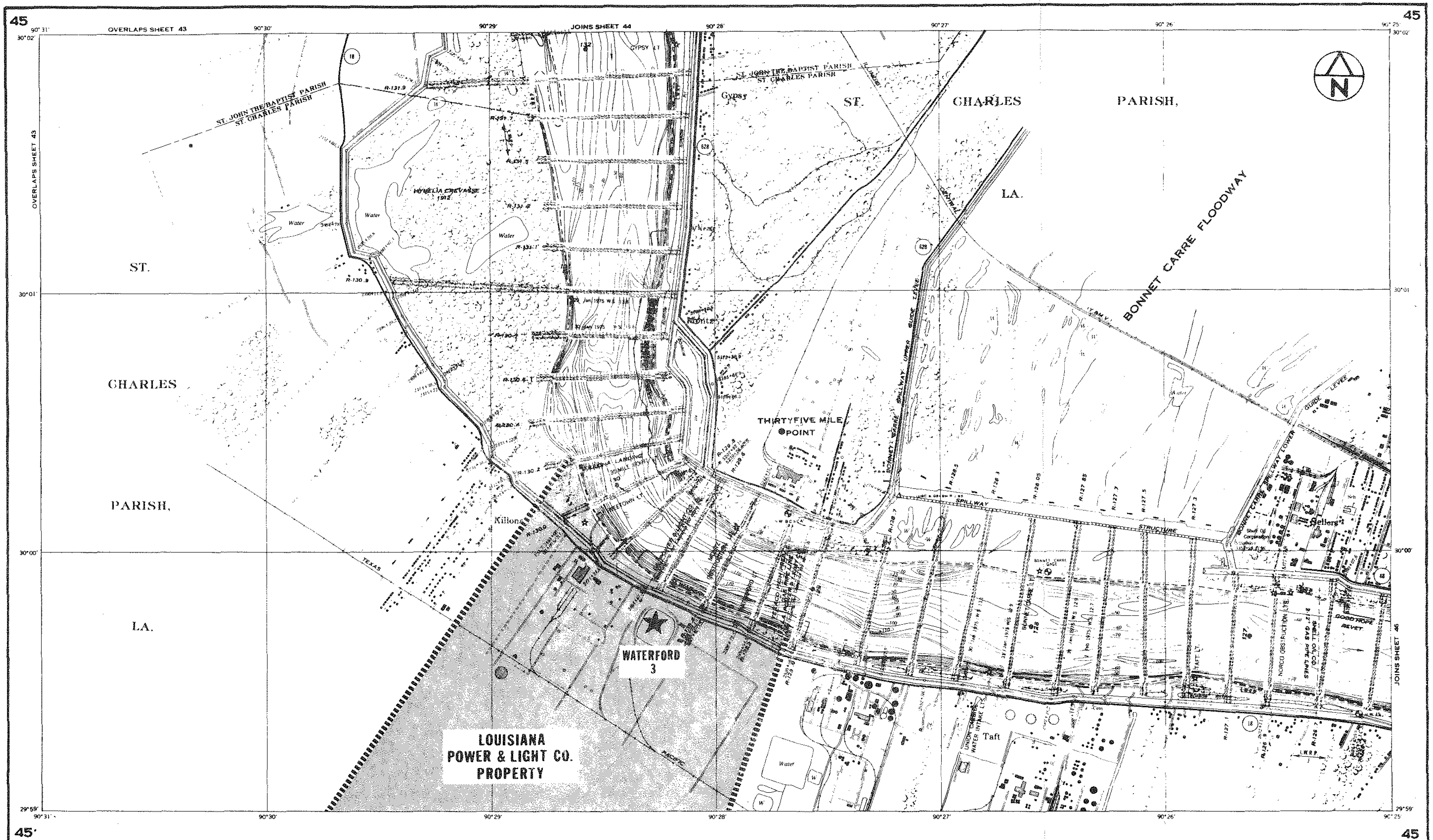
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MISSISSIPPI RIVER FLOW DURATION CURVE	Figure 2.4-7



LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

SURFACE TOPOGRAPHIC CHARACTERISTICS
WATERFORD 3 AREA

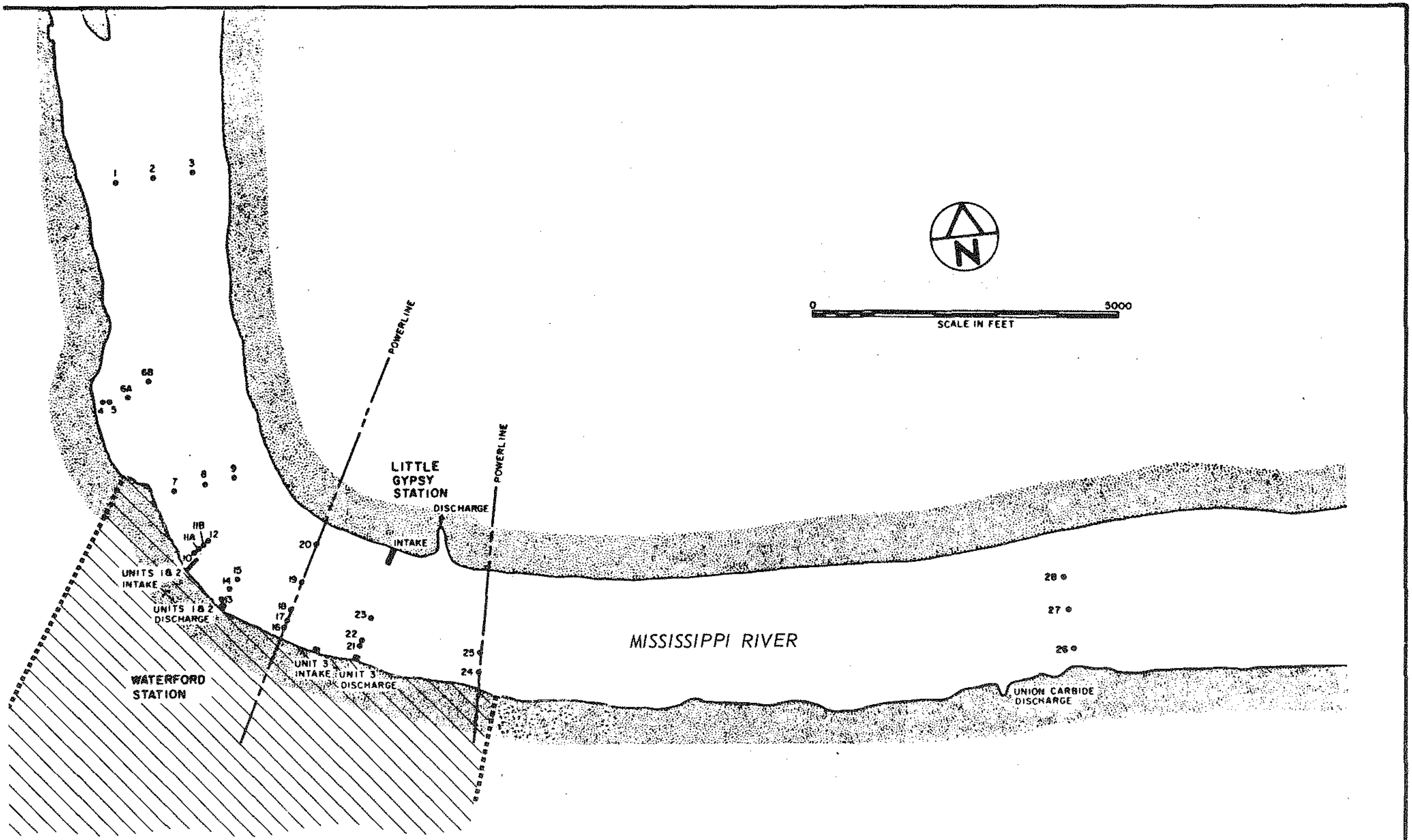
Figure 2.4-8



All elevations are expressed in feet and refer to Mean Sea Level
Contours below Low Water Reference Plane are expressed in feet at 5 and 10 ft. intervals.
Contours above Low Water Reference Plane are expressed in feet at 5 ft. intervals.
Planimetry from aerial photographs flown November 1973
● Distances on Mississippi River above Head of Passes are shown at 1 mile intervals, 1962 survey
Polyconic Projection, North American Datum
L.W.R.P. – Low Water Reference Plane

SOURCE: U.S. ARMY CORPS OF ENGINEERS, MISSISSIPPI RIVER HYDROGRAPHIC SURVEY 1973-1975 BLACK HAWK, LA. TO HEAD OF PASSES, LA. AND SOUTH AND SOUTH WEST PASSES AND PASS A LOUTRE. U.S. ARMY ENGINEER DISTRICT, VICKSBURG, MISSISSIPPI 1976

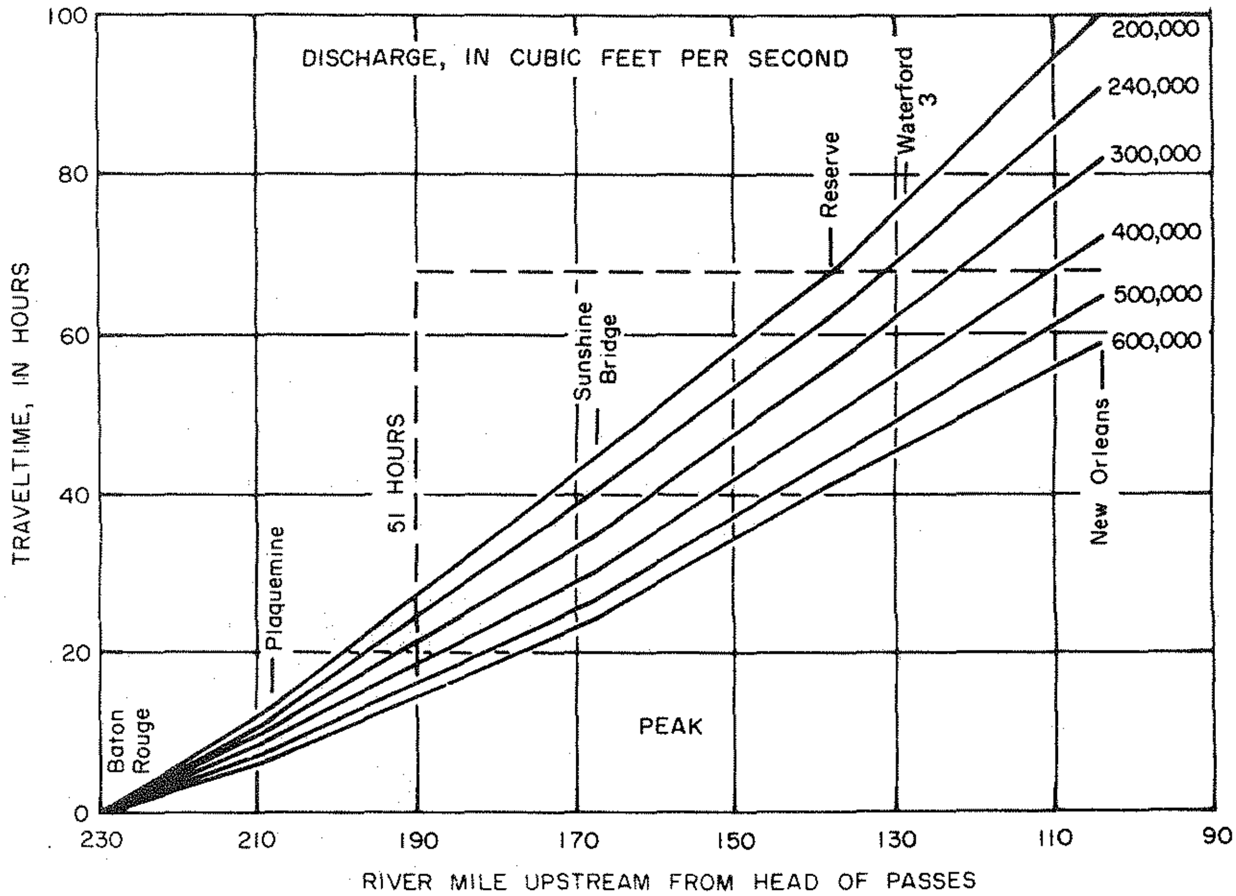
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MISSISSIPPI RIVER BATHYMETRY AT THE WATERFORD SITE	Figure 2.4-9



SOURCE:

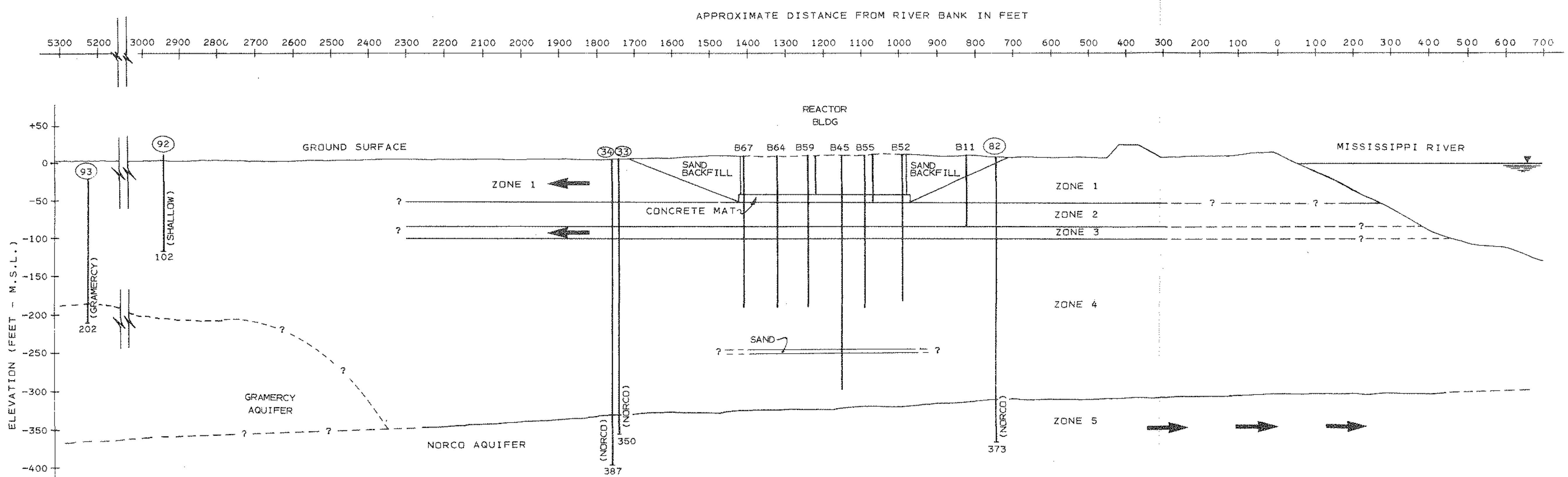
GEO-MARINE, INC., "FIRST OPERATIONAL HYDROTHERMAL STUDY, WATERFORD S.E.S., SEPT - OCT 1976".
CONDUCTED FOR LOUISIANA POWER & LIGHT COMPANY JAN. 1977.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	STATIONS FOR VERTICAL PROFILE MEASUREMENTS OF MISSISSIPPI RIVER CURRENT VELOCITY	Figure 2.4-10



SOURCE:
EVERETT, D. "HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI RIVER," TECHNICAL REPORT NO. 5, LOUISIANA DEPARTMENT OF PUBLIC WORKS, 1971

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	PLUME TRAVEL TIME FOR PEAK CONCENTRATION MISSISSIPPI RIVER	Figure 2.4-11



ZONE	AGE	DESCRIPTION	PERMEABILITY (CM/SEC)
1	RECENT	CLAY, SILT, AND SAND, DISCONTINUOUS AND UNRESPONSIVE TO FLUCTUATIONS IN RIVER LEVEL.	1.5×10^{-6}
2	PLEISTOCENE	UNIFORM STIFF/VERY STIFF SILTY CLAY AND CLAY WITH OCCASIONAL SAND LENSES, FISSURED (ALL STRATA BELOW THIS ARE CONTINUOUS AND RESPONSIVE TO RIVER LEVEL FLUCTUATIONS).	1×10^{-8}
3	PLEISTOCENE	MEDIUM DENSE SAND, SOME CLAY.	3×10^{-5}
4	PLEISTOCENE	STIFF CLAY, BUT CONTACT WITH ZONE 3 λD 42-50 P.C.F. AND SOFT.	—
5	PLEISTOCENE	VERY DENSE SILTY SAND. DRILLED FROM 330 TO 500, IT CORRELATES WELL WITH REGIONAL DATA AS THE <u>NORCO AQUIFER</u>.	—

LEGEND

B64 EXPLORATION BORINGS

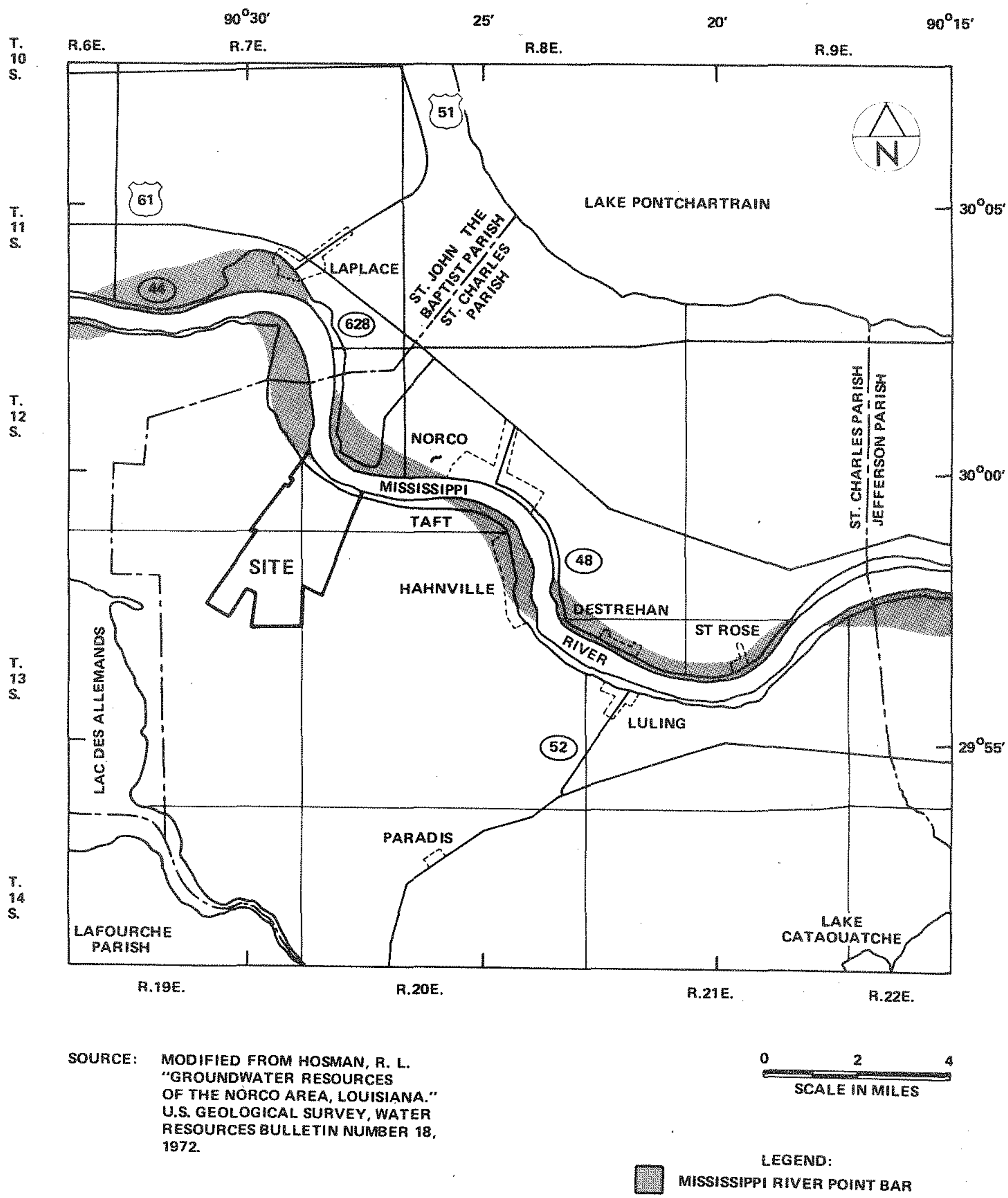
(34) FROM U.S. GEOLOGICAL SURVEY DATA FOR WELLS IN ST. CHARLES PARISH.

(NORCO) ← AQUIFER DEVELOPED

171 ← DEPTH OF WELL

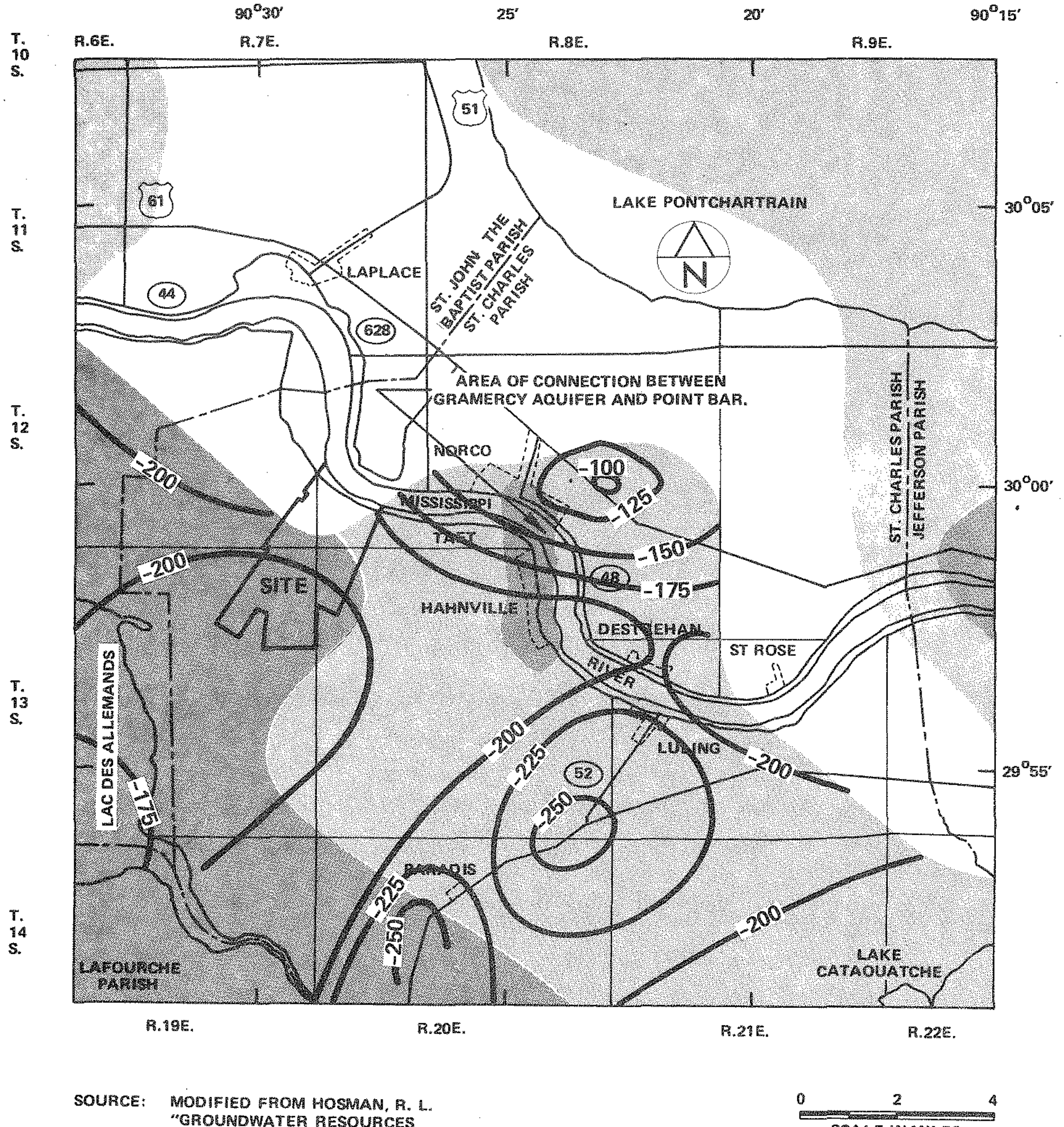
➡ GENERAL DIRECTION OF GROUND WATER

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	ZONES OF GEOLOGIC MATERIAL AT WATERFORD 3 SITE	Figure 2.4-12



SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	POINT BAR DEPOSITS OF MISSISSIPPI RIVER	Figure 2.4-13



SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

LEGEND:

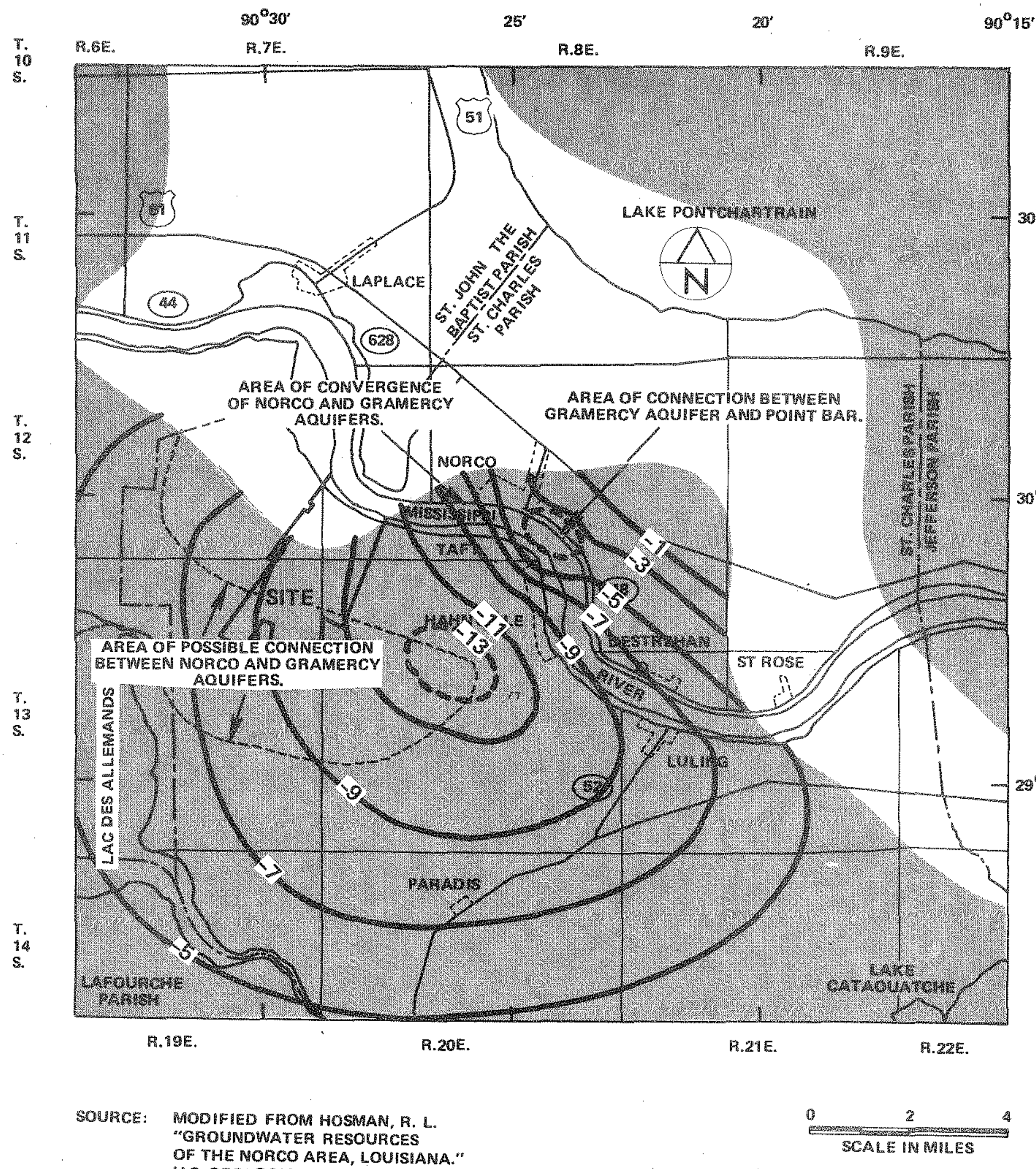
-200 STRUCTURE CONTOUR SHOWING ALTITUDE OF TOP OF AQUIFER, CONTOUR INTERVAL 25 FEET. DATUM IS MEAN SEA LEVEL.

AREA WHERE GRAMERCY AQUIFER IS CONTINUOUS.

AREA WHERE GRAMERCY AQUIFER SPLIT, THIN, OR ABSENT.

AREA WHERE AQUIFER CONTAINS SALTY WATER.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE TOP OF THE GRAMERCY AQUIFER	Figure 2.4-14



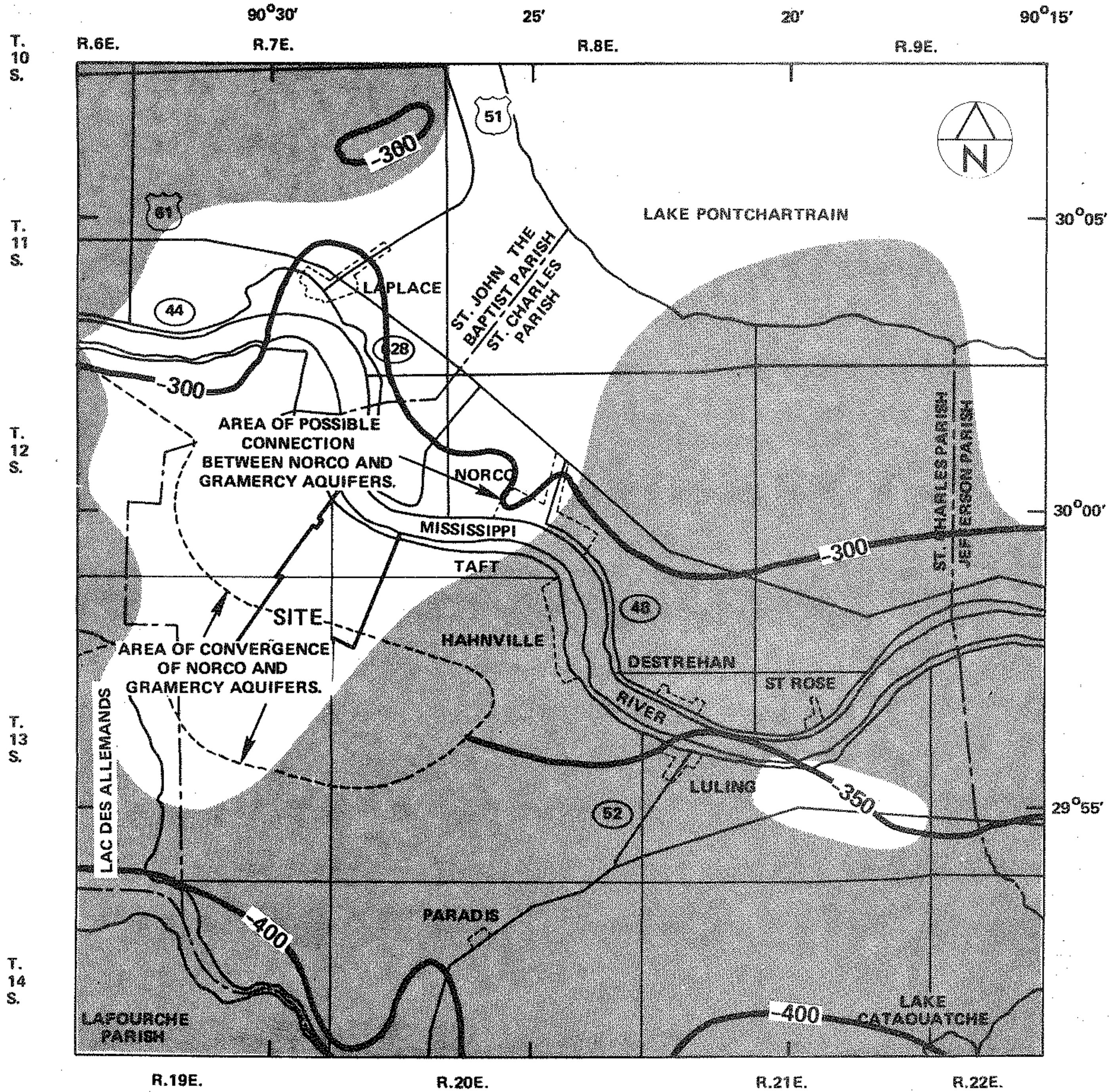
SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

LEGEND:

-5 POTENTIOMETRIC CONTOUR SHOWING ALTITUDE OF WATER LEVEL, FALL 1960. CONTOUR INTERVAL 2 FEET. DATUM IS MEAN SEA LEVEL.

AREA UNDERLAIN BY CONTINUOUS GRAMERCY AQUIFER.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE POTENTIOMETRIC SURFACE IN THE GRAMERCY AQUIFER, FALL 1960	Figure 2.4-15



SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

0 2 4

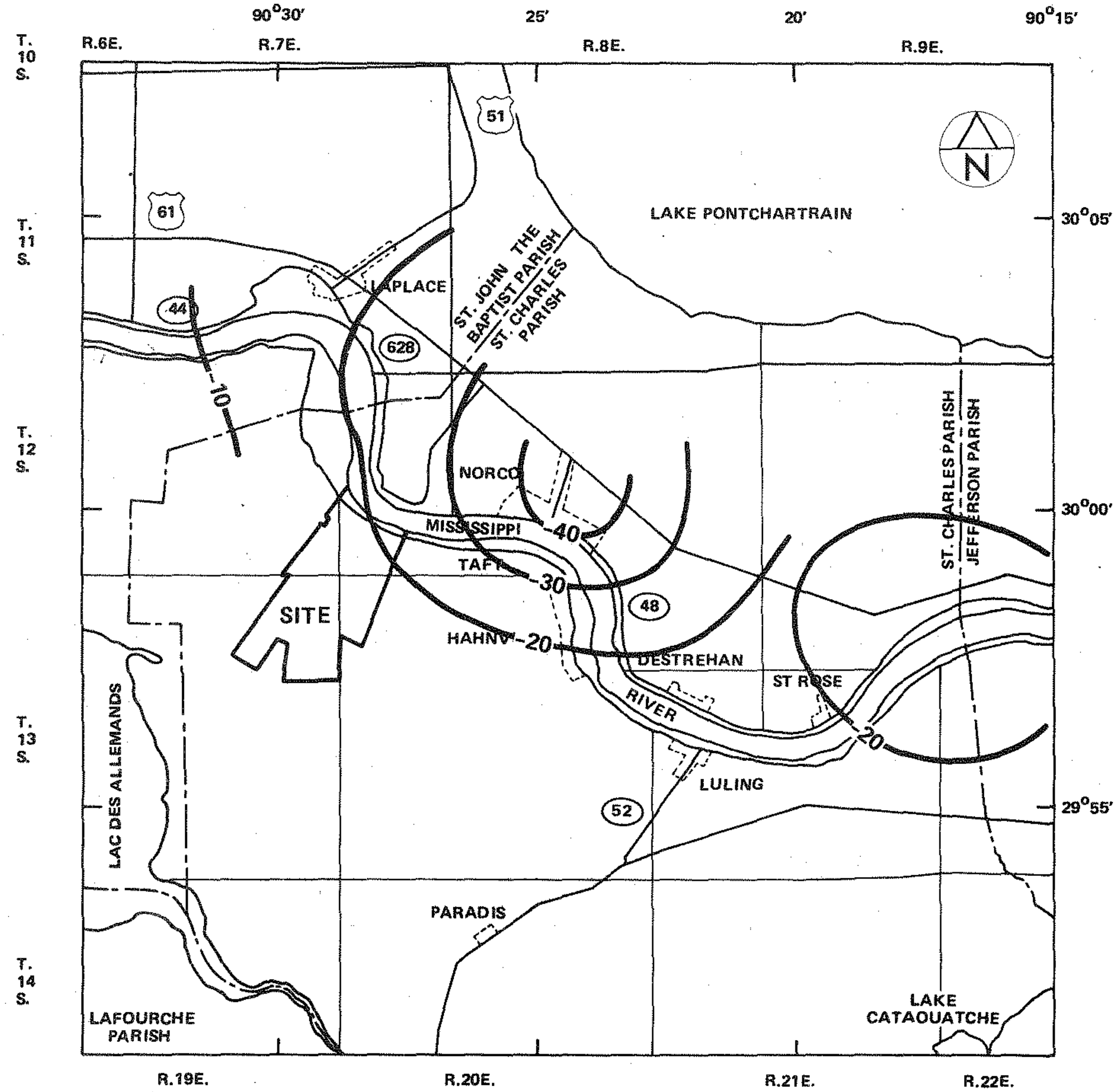
SCALE IN MILES

LEGEND:

-400 STRUCTURE CONTOUR SHOWING ALTITUDE OF TOP OF AQUIFER CONTOUR INTERVAL 50 FEET. DATUM IS MEAN SEA LEVEL.

AREA WHERE AQUIFER CONTAINS SALTY WATER.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE TOP OF THE NORCO AQUIFER	Figure 2.4-16



SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

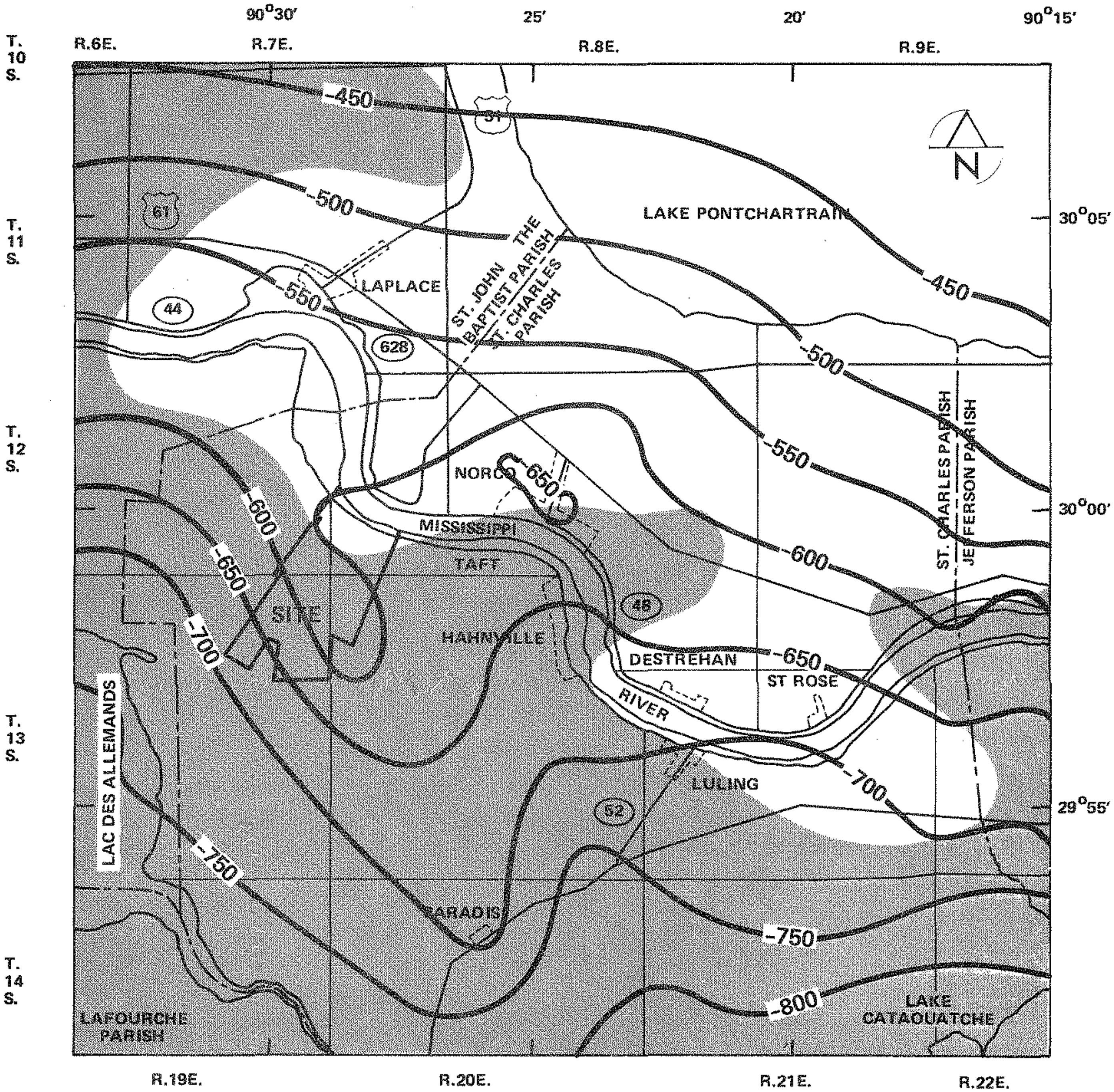
0 2 4

SCALE IN MILES

LEGEND:

-20 POTENTIOMETRIC CONTOURS SHOWING ALTITUDE OF WATER LEVEL. CONTOUR INTERVAL 10 FEET. DATUM IS MEAN SEA LEVEL.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE POTENTIOMETRIC SURFACE IN THE NORCO AQUIFER, FALL 1965	Figure 2.4-17



SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

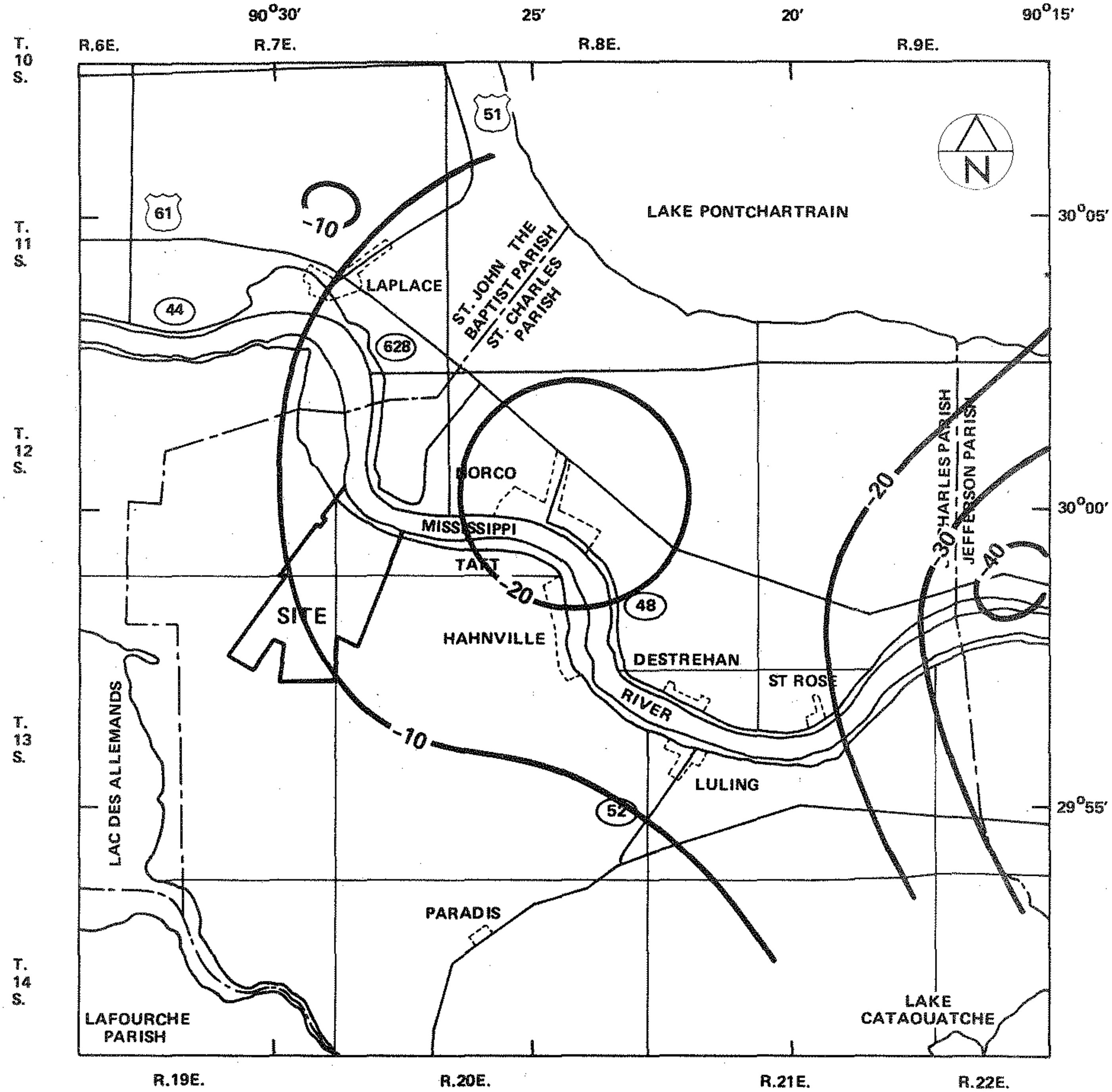
0 2 4
SCALE IN MILES

LEGEND:

-700 STRUCTURE CONTOUR SHOWING ALTITUDE OF TOP OF AQUIFER; CONTOUR INTERVAL 50 FEET. DATUM IS MEAN SEA LEVEL.

AREA WHERE AQUIFER CONTAINS SALTY WATER.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE TOP OF THE GONZALES-NEW ORLEANS AQUIFER	Figure 2.4-18



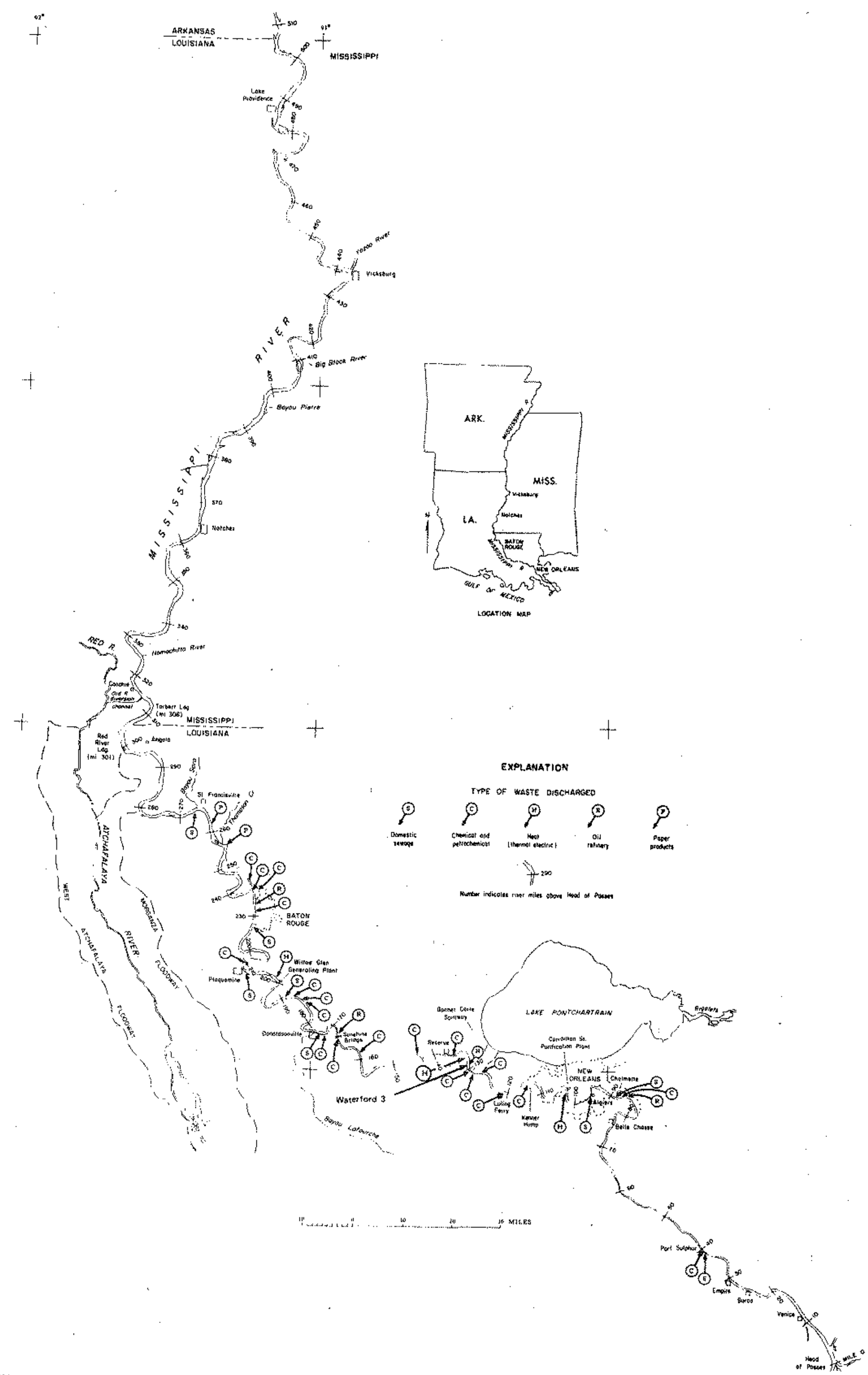
SOURCE: MODIFIED FROM HOSMAN, R. L. "GROUNDWATER RESOURCES OF THE NORCO AREA, LOUISIANA." U.S. GEOLOGICAL SURVEY, WATER RESOURCES BULLETIN NUMBER 18, 1972.

0 2 4
SCALE IN MILES

LEGEND:

-10 POTENTIOMETRIC CONTOURS SHOWING ALTITUDE OF WATER LEVEL. CONTOUR INTERVAL 10 FEET. DATUM IS MEAN SEA LEVEL.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	CONFIGURATION OF THE POTENTIOMETRIC SURFACE IN THE GONZALES-NEW ORLEANS AQUIFER, FALL 1965	Figure 2.4-19

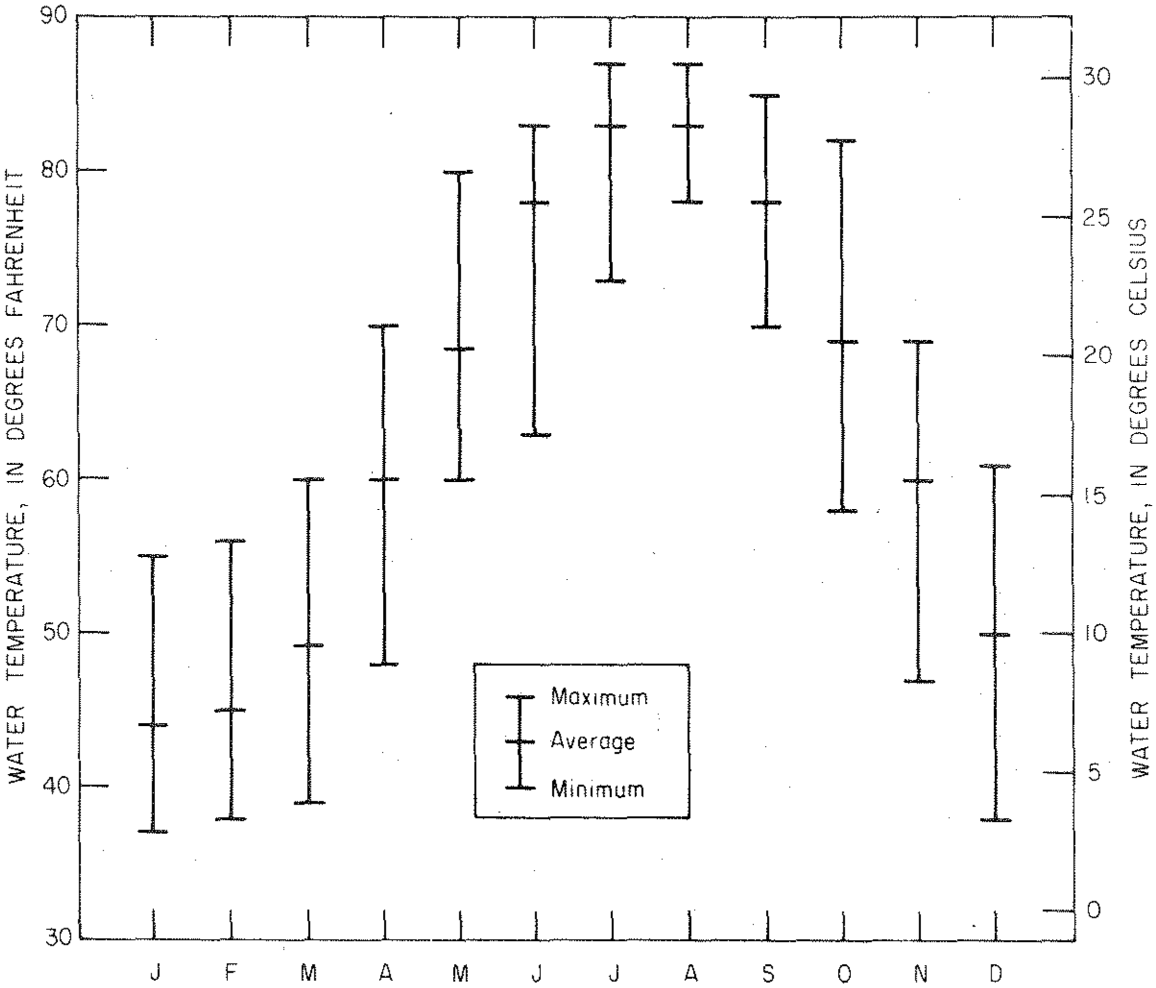


MODIFIED FROM:
EVERETT, D. "HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI RIVER," TECHNICAL REPORT NO. 5, LOUISIANA DEPARTMENT OF PUBLIC WORKS, 1971

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

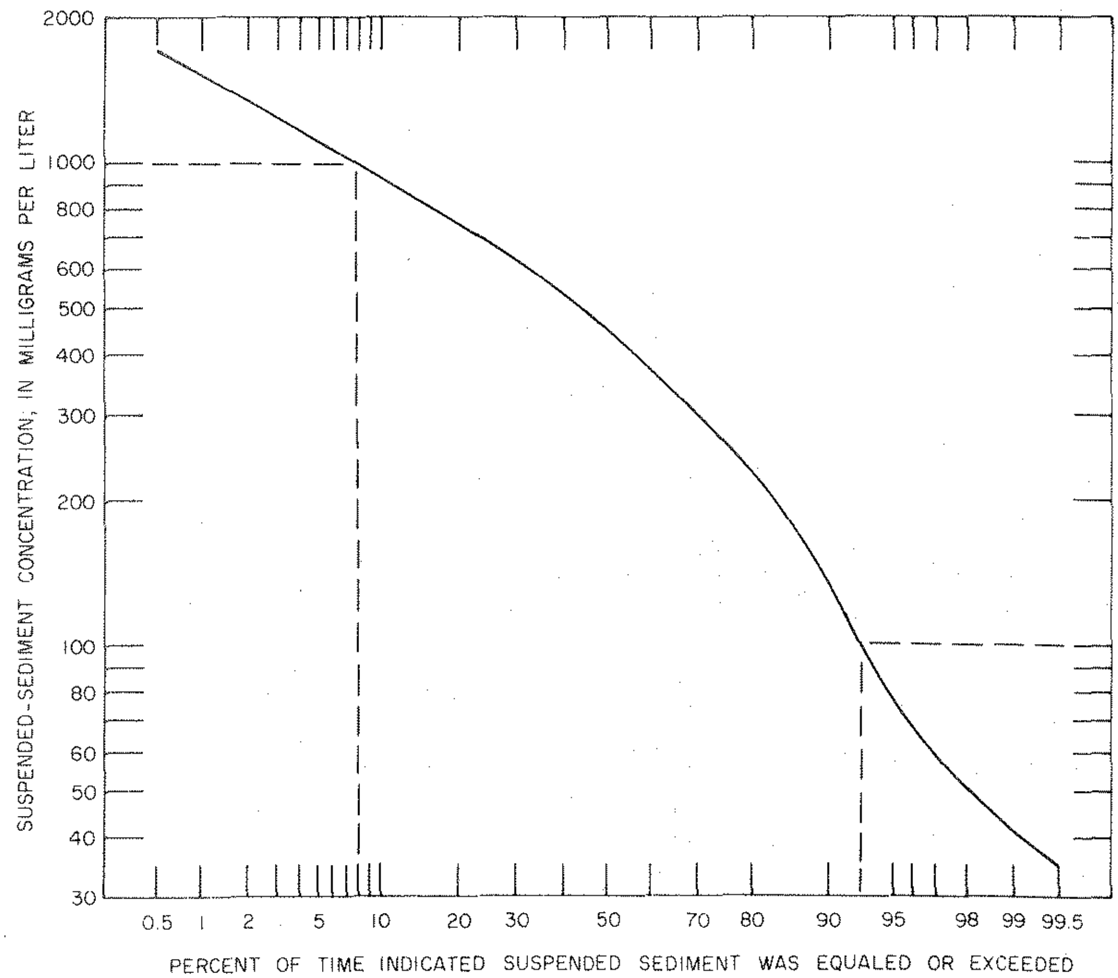
WASTE SOURCES IN THE LOWER MISSISSIPPI RIVER

Figure 2.4-20



SOURCE:
EVERETT, D "HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI RIVER," TECHNICAL REPORT NO. 5, LOUISIANA DEPARTMENT OF PUBLIC WORKS. 1971

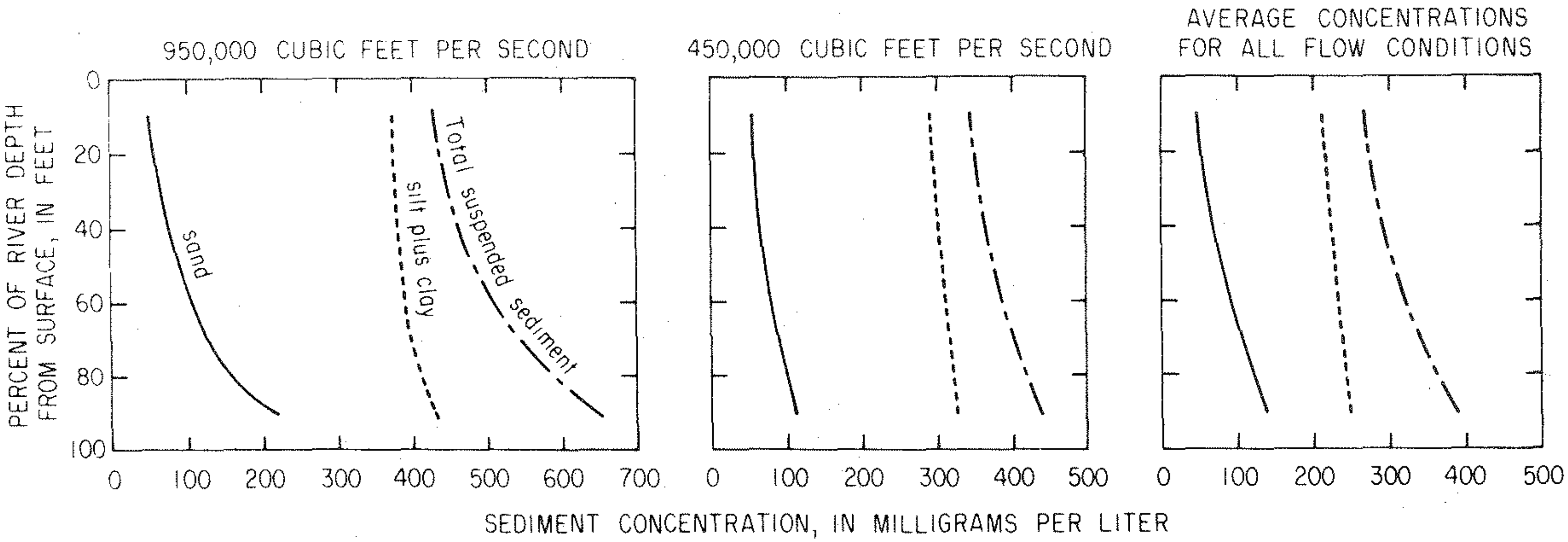
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	MONTHLY VARIATIONS IN WATER TEMPERATURE IN THE MISSISSIPPI RIVER NEAR ST. FRANCISVILLE, LA., 1954-68.	Figure 2.4-21



SOURCE: SMITH, A. B. "CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS." PROCEEDINGS OF THE FEDERAL INTER-AGENCY SEDIMENTATION CONFERENCE.

U.S. DEPT. OF AGRICULTURE, MISC. PUBLICATION 970. pp. 618-626. 1963.

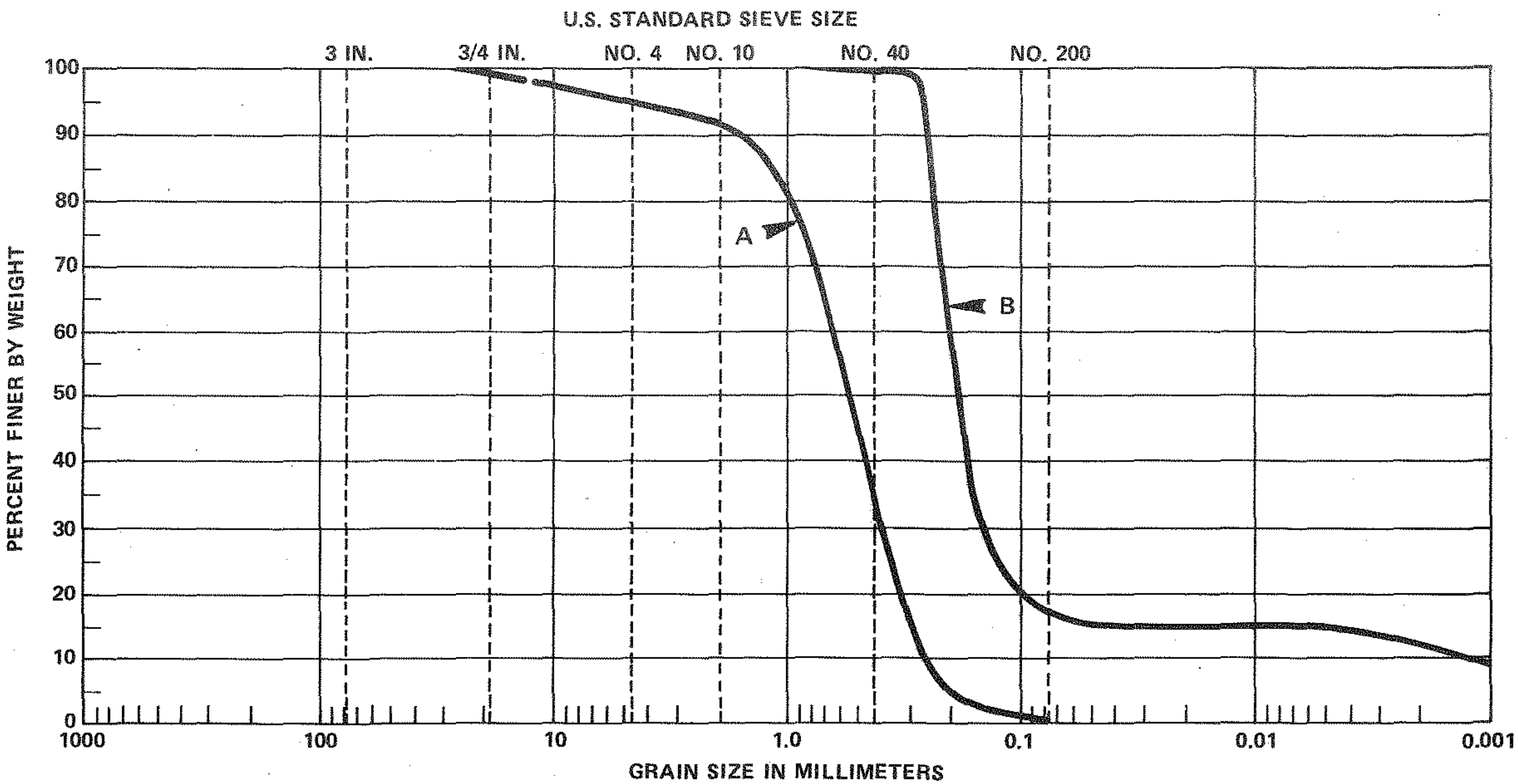
LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	DURATION CURVE OF SUSPENDED-SEDIMENT CONCENTRATION MISSISSIPPI RIVER AT RED RIVER LANDING, LA., 1949-63	Figure 2.4-22



SOURCE: SMITH, A. B. "CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS." PROCEEDINGS OF THE FEDERAL INTER-AGENCY SEDIMENTATION CONFERENCE.

U.S. DEPT. OF AGRICULTURE, MISC. PUBLICATION 970, pp. 618-626, 1963.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	SEDIMENT SIZE VARIATION WITH DISCHARGE AND DEPTH MISSISSIPPI RIVER AT RED RIVER LANDING, LA.	Figure 2.4-23



SAMPLE A OBTAINED FROM BED OF MISSISSIPPI RIVER 813 MILES ABOVE HEAD OF PASSES.
SAMPLE B OBTAINED FROM SOUTHWEST PASS NEAR THE MOUTH OF MISSISSIPPI RIVER.

SOURCE: SMITH, A. B. "CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS." PROCEEDINGS OF THE FEDERAL INTER-AGENCY SEDIMENTATION CONFERENCE.

U.S. DEPT. OF AGRICULTURE, MISC. PUBLICATION 970. pp. 618-626. 1963.

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	GRAIN SIZE DISTRIBUTION OF MISSISSIPPI RIVER BOTTOM SEDIMENT	Figure 2.4-24

2.5 GEOLOGY

The site and regional geology reflect the development of the Gulf Coast geosyncline and the depositional environment of the Mississippi River Delta. Past and present geologic processes have created a relatively stable geologic environment with little apparent hazard to the Waterford site. The geologic information presented in this section is abstracted from extensive and detailed studies conducted for the Preliminary and Final Safety Analysis Reports, and only includes such data as are necessary to adequately assess the impact of Waterford 3 on the regional and local geologic environment.

2.5.1 REGIONAL GEOLOGY

The Waterford site is located along the west bank of the Mississippi River, in the southern portion of the Gulf Coastal Plain. The Mississippi River has dominated the development of the geologic and physiographic features in this deltaic plain for approximately 22 million years. Topography in this area is predominantly low, much of it covered by water, with high ground along the natural levees of existing and abandoned stream courses. Seldom is the relief greater than a few feet.

Large accumulations (57,000 feet) of Mesozoic and Cenozoic sands, silts, and clays underlie the site region as shown in Figure 2.5-1. Diapiric movements (salt domes) and soft sediment deformation (growth faults) associated with these geosynclinal deposits have formed most of the prominent structural features in the vicinity of the site. These structures are not strictly the result of deformation of the earth's crust, but were formed in response to the gravitational forces, as explained in Section 2.4 of the Final Safety Analysis Report.

2.5.2 SITE GEOLOGY

Surficial sediments at the site, shown in Figure 2.5-2, consist predominantly of natural levee deposits, with marginal fresh water swamps occurring on the southern third of the site area. Surface elevations on the natural levee range from near sea level in the southern portions of the site to about fourteen feet (MSL) near the base of the man-made flood control levee. The crest of this levee is approximately thirty feet in elevation and represents the highest area of the site.

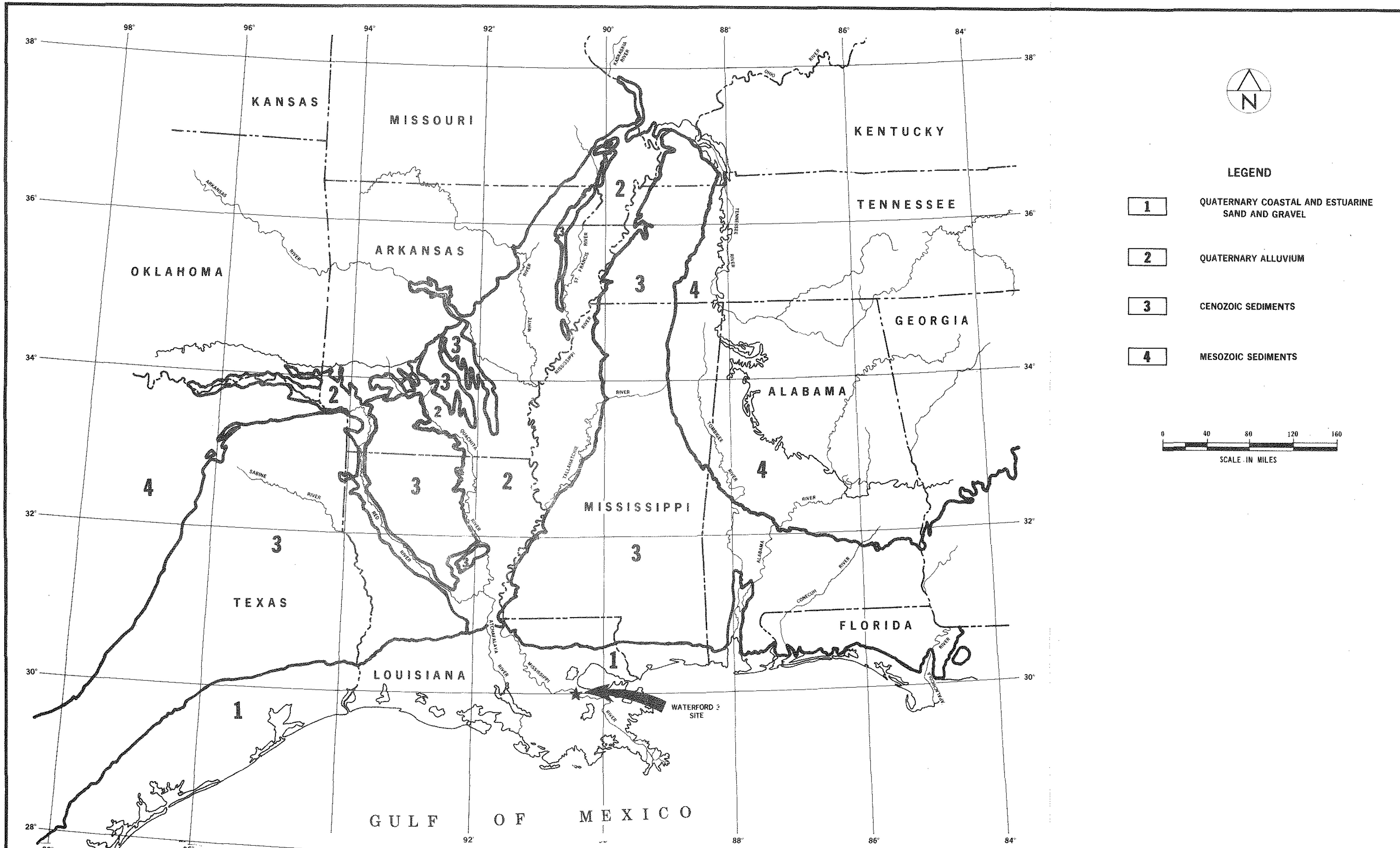
The Waterford site is underlain by a thick sequence of sedimentary rocks typical of the region. Petroleum test wells in the area show sandstone and shale at depths from -11,000 feet MSL to approximately -1,900 feet MSL. Above the sandstone and shale, interbedded sands and clays, probably representing nearshore and marine deposits, extend upward to within approximately 50 feet of the surface. Recent organic and silty clays of deltaic origin overlie these deposits (Figure 2.5-3). Site area soils are characteristically poorly drained, variable, and have low to moderate permeability.

Detailed geologic surveys show that the stratigraphy is uniform with no abrupt subsurface irregularities present within 5,000 feet of the ground surface.

Mapping of the site excavation disclosed no anomalies or discontinuities which would adversely affect the integrity of foundation materials.

2.5.2.1 Groundwater

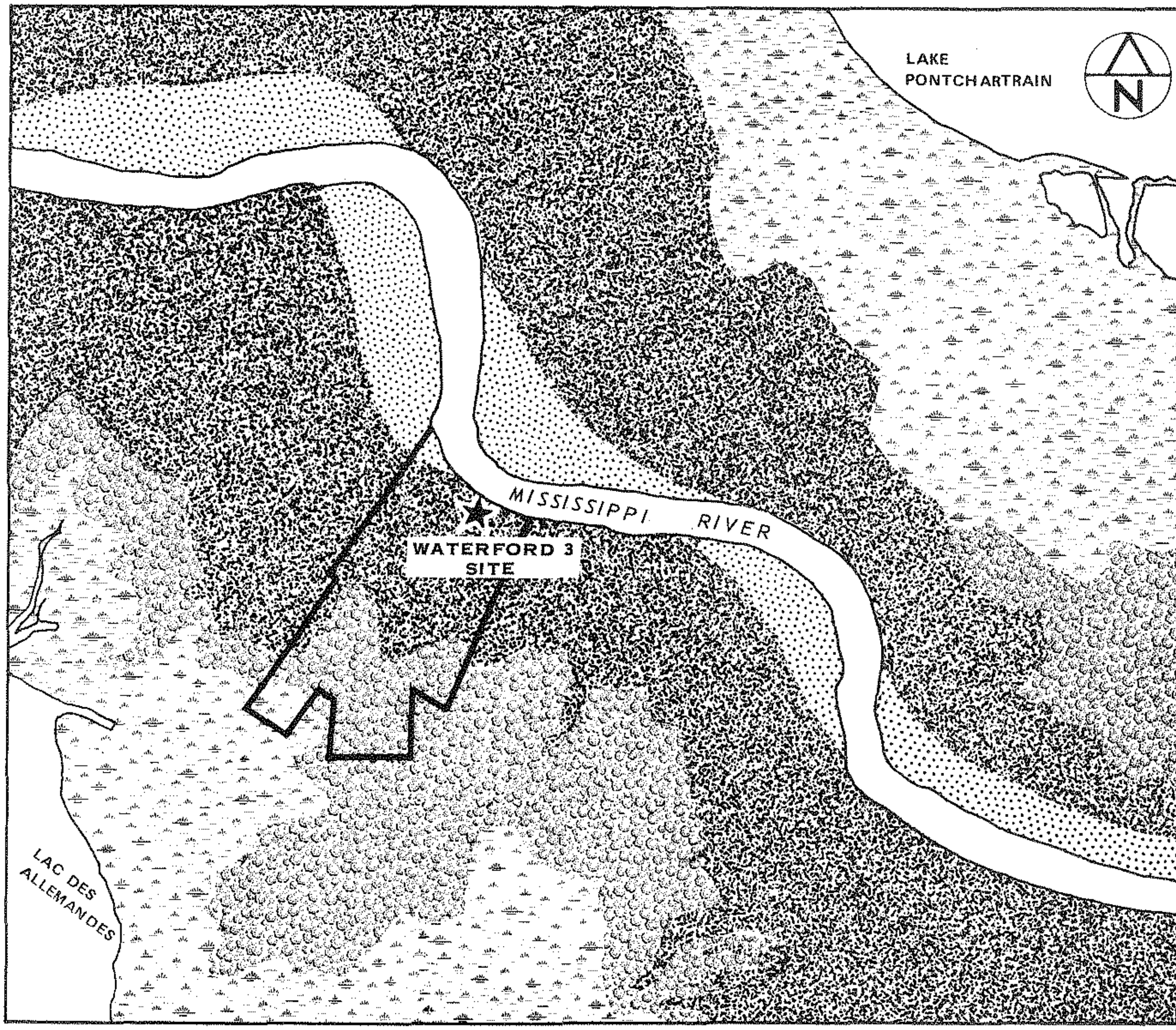
Three deep aquifiers are located in the site area. The shallowest, the Grammercy, occurs at an approximate depth of 200 feet, below which is the Norco aquifer, which occurs at a depth of approximately 325 feet. The deepest aquifier is the Gonzales-New Orleans, occurring at a depth of about 600 feet. Extensive subsurface sampling indicates that the sediments overlying these aquifiers are effectively isolated from groundwater recharge from above by nearly impervious sequences of stiff clay interbedded with dense sand. Thus the plant is effectively isolated from the groundwater system, and its operation should not otherwise affect, or be affected by, regional or local geologic conditions. The groundwater resources in the Waterford region and site area are described in detail in Section 2.4.4.



LOUISIANA
POWER & LIGHT CO.
Waterford Steam
Electric Station

REGIONAL SURFICIAL GEOLOGY MAP
GULF COASTAL PLAIN

Figure
2.5-1



LEGEND:

RECENT DEPOSITS LESS THAN 5,500 YEARS OLD

POINT BAR DEPOSITS – POORLY GRADED FINE SANDS AND SILTS. THESE DEPOSITS ARE PRESENTLY COVERED BY NATURAL LEVEE.

NATURAL LEVEE – FIRM TO STIFF SILTY CLAYS, WELL OXIDIZED. GRAIN SIZE DECREASES WITH INCREASING DISTANCE FROM RIVER

SWAMP

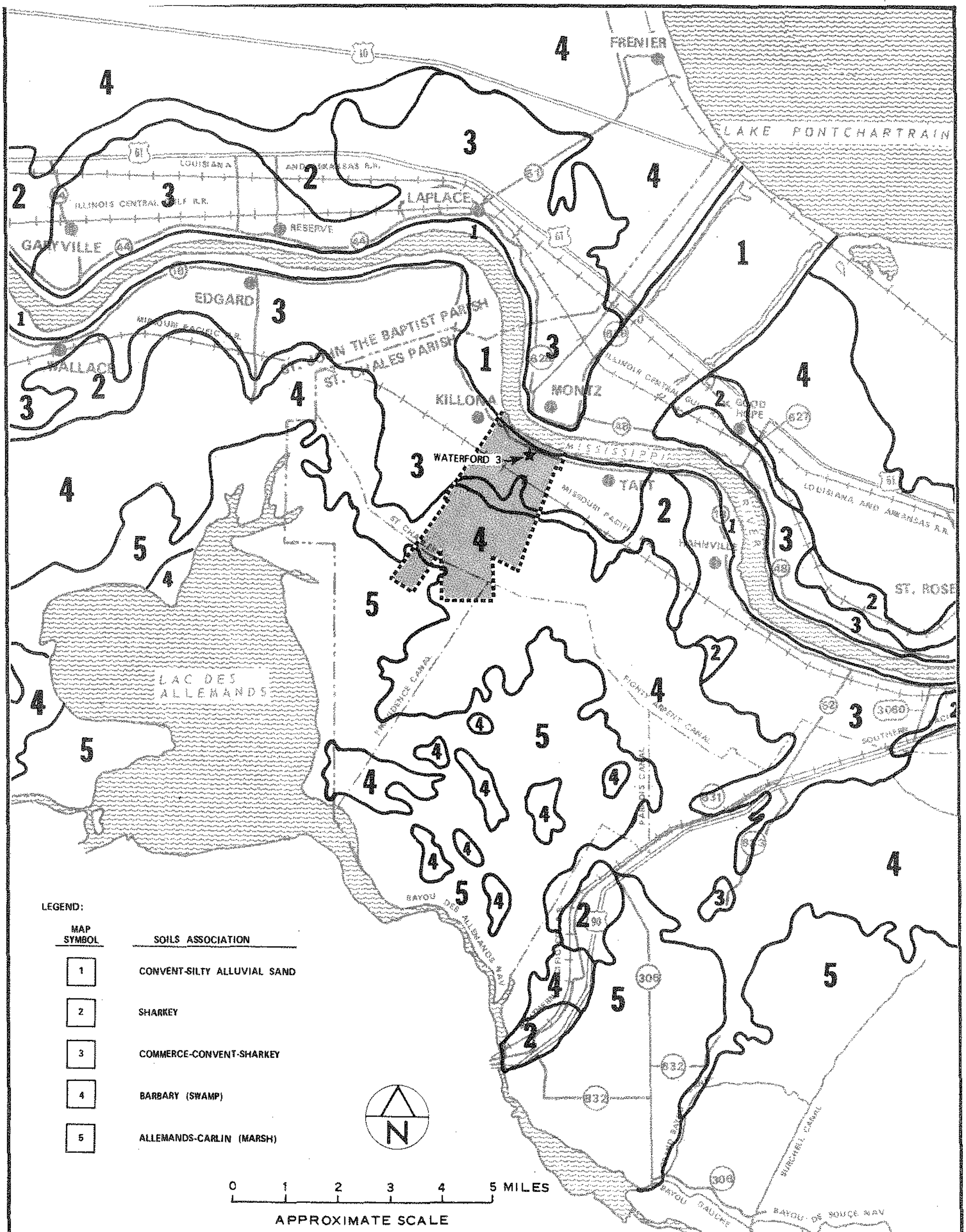
MARSH

SOFT, HIGHLY ORGANIC, WET CLAYS WITH SOME SILT AND PEAT LENSES.

0 1 2

SCALE IN MILES

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	SITE AREA SURFICIAL GEOLOGY	Figure 2.5-2



LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	GENERAL SOIL MAP WATERFORD 3 VICINITY	Figure 2.5-3

2.6 HISTORIC, ARCHEOLOGICAL, ARCHITECTURAL, SCENIC, CULTURAL, AND NATURAL FEATURES

Prior to the beginning of construction on Waterford 3, the surrounding area had already experienced substantial development of heavy industrial facilities, as described in Section 2.1.3.5. Any future development is likely to be consistent with this established character, especially in view of the zoning classifications, given in Figure 2.1-19, which have been adopted for the area. Therefore, the relationship of the operation of Waterford 3 to nearby historic, archeological, architectural, scenic, cultural, and natural features, which are described in this section, is most effectively viewed within the context of the area's existing and likely future development.

2.6.1 HISTORIC, ARCHEOLOGICAL, AND NATURAL FEATURES

Because the location of Waterford 3 is in a region of known aboriginal and historic settlement, a two-phase cultural resources survey was performed[1]. The first phase of the investigation involved archival research to determine whether any historically significant or prehistoric archeological sites had been reported or recorded in the study area. The second phase consisted of an onsite survey.

The archival research found that no sites on, nominated for, or known to be eligible for the National Register of Historic Places or the National Register of Natural Landmarks are present on the Waterford 3 site or in the immediate vicinity. Confirmation of these findings from the State Historic Preservation Office of the State of Louisiana is shown in Figure 2.6-1. A summary of the prehistoric cultural periods of the Waterford 3 area is given in Table 2.6-1.

At the time of the onsite field survey, most of the land-disturbing construction at Waterford 3 had been completed. Two major areas did remain to be disturbed, however, and therefore were evaluated during the cultural resources survey. These were the location of the 230 kV transmission lines, and the Circulating Water System intake and discharge structures, as shown on Figure 2.6-2. It was concluded that no significant historic or prehistoric cultural remains would be disturbed by the construction of the transmission lines and the intake and discharge structures.

2.6.2 RECREATION FACILITIES AND SCENIC AREAS

Recreation facilities within five miles of Waterford 3 are listed in Table 2.6-2, and shown on Figure 2.1-17[2, 3]. The closest such facility to Waterford 3 is the playground at the Killona Elementary School, approximately 0.9 miles west of the plant. The Waterford 3 structures will be visible from this facility. However, Waterford 3 only represents an addition to the industrially developed landscape already visible from this playground.

Waterford 3 will not be visible from the remaining scenic and recreation facilities within a five-mile radius. As shown on Table 2.6-2, the next nearest recreation facilities are an existing and proposed park in Montz, on the opposite side of the Mississippi River from the plant, and an existing park proposed for expansion in Killona. Waterford 3 is not visible to people utilizing these recreation facilities.

In addition to the facilities shown in Table 2.6-2 and on Figure 2.1-17, there are several proposed facilities indicated in the Community Facilities Plan for St Charles Parish[5]. All of these facilities, however, would be at a substantial distance from Waterford 3. Neighborhood parks are shown in the plan as proposed for the Hahnville and New Sarpy areas. The plan indicates the existence of a 22-acre parcel to be developed as a park in the Bonnet Carre Floodway, north of US Highway 61. There are also plans indicated for the development of recreation areas on the batture near Hahnville and New Sarpy. These would be picnic areas, hiking trails, and scenic areas[4]. At the present time, however, no plans exist to implement the acquisition or construction of these facilities[3, 4].

2.6.3 VISUAL EFFECT OF STATION OPERATION

As noted above, the playground at the Killona Elementary School is the only recreation facility from which Waterford 3 will be visible. The addition of Waterford 3 to the existing landscape will not result in a significant change to the character of the visual surroundings of this recreational facility.

The absence of sites included on the National Register of Historic Places, as well as the fact that the plant will not be visible from other recreation facilities in the vicinity, precludes Waterford 3 from having a significant visual effect on the area's cultural resources.

2.6.4 EFFECTS OF TRANSMISSION LINE CONSTRUCTION OR LOCATION

The cultural resource survey of the Waterford 3 site found that no significant historic or prehistoric cultural remains would be disturbed by the construction of the transmission line. In addition, because the transmission lines are located in an area containing other existing transmission lines, as shown in Figures 2.1-4 and 2.1-14, the visual effects of the lines that are associated with Waterford 3 will be insignificant.

an approved mitigation plan. Based upon a review of the results of this second survey, the SHPO recommended that the NRC initiate a request for a determination of eligibility of Areas 3, 4 and 5 for the National Register of Historic Places. In accordance with this recommendation, the NRC is preparing for submittal to the US Department of Interior the documentation to accompany this request. 3

There are no sites on the National Registry of Natural Landmarks present in the area.

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REFERENCES

1. This survey was performed by Robert W Newman, Curator of Anthropology, Department of Geography and Anthropology, Louisiana State University, Baton Rouge, Louisiana. July, 1977.

2. Louisiana State Parks and Recreation Commission. Unpublished inventory of recreation facilities. Baton Rouge, Louisiana. 1974.

3. Personal Communications, Director of Recreation, St Charles Parish, and Member of St Charles Parish Recreation Committee, New Sarpy, Louisiana. March 22, 1977.

4. N-Y Associates. "Community Facilities Plan, St Charles Parish, 2
Louisiana." Metairie, Louisiana. May, 1974.

5. Personal Communication, Secretary for Planning and Zoning, St Charles Parish. March 22, 1977.

TABLE 2.6-1
(Sheet 1 of 3)

SUMMARY OF PREHISTORIC CULTURAL PERIODS, WATERFORD 3 AREA

1. Paleo-Indian. 10,000 B.C.--6000 B.C.

Diagnostic Traits: Lanceolate stone projectile points with or without flutes extending up the long axis of the points. The fluting may be unifacial or bifacial.

Basis for Temporal Placement: Assignments based upon point typologies, geologic and paleontologic correlations and radiocarbon dates from the Avery Island site, Iberia Parish.

Subsistence Economy: Hunters and gatherers. Excavated sites reveal artifacts tentatively assigned to strata containing bone of extinct Pleistocene fauna.

Settlement Pattern: Archaeological deposits are indicative of small, temporary campsites.

2. Archaic. 6000 B.C.--500 B.C.

Diagnostic Traits: Medium to large, triangular projectile points having variously-shaped bases with or without notched side edges, chipped stone scrapers, knives, drills, gravers, micro-blades, ground stone beads, celts, plummets, gorgets, effigies and steatite vessels. Antler atlatl hooks, bone awls, shell ornaments and Poverty Point baked clay objects. Artifacts of exotic raw material are most commonly associated with Poverty Point components.

Basis for Temporal Placement: Projectile point typologies and radiocarbon dates.

Subsistence Economy: Hunters and gatherers. No physical evidence of horticulture.

Settlement Pattern: The enormous earthworks at the Poverty Point site, West Carroll Parish, comprised of a mound and concentric, semicircular ridges. A low, domed, earthen tumulus was tested on Avery Island; also several campsite deposits in the Lake Pontchartrain area. At the Monte Sano site, East Baton Rouge Parish, excavations revealed remains of a structure having a square floor pattern.

3. Tchefuncte. 500 B.C.--A.D. 250

Diagnostic Trait: The first major introduction of pottery. Vessels are conical with multiform, tetrapodal bases. Incised, brushed, punctated and stamped decorative motifs appear on the vessel body and rim exterior. Also introduced are decorated, tubular, clay pipes. Stone, bone and shell implements and baked clay objects are common and similar to those of the Archaic Period, but not nearly as plentiful, variable or as ornate.

TABLE 2.6-1
(Sheet 2 of 3)

SUMMARY OF PREHISTORIC CULTURAL PERIODS, WATERFORD 3 AREA

Basis for Temporal Placement: Stratigraphic excavations and radiocarbon dates.

Subsistence Economy: Hunters and gatherers. Indications of horticulture from the Tchefuncte deposit at the Morton Shell Mound, Iberia Parish.

Settlement Pattern: Sites predominate in the marsh areas of southern Louisiana and are characterized by shell middens. Inland sites consist of small, low, earthen mounds and middens containing primary flexed and secondary human interments associated with sparse amounts of artifacts. Some evidence of light-poled structures having an oval floor pattern.

4. Marksville. A.D. 250--A.D. 700

Diagnostic Traits: New pottery types comprised of bowls, globular and jar-shaped vessels elaborately decorated on the exterior with punctated, incised and stamped motifs. Vessels also decorated with red pigment and stylized zoomorphic motifs. Stone and ceramic platform pipes and effigies. Artifacts of exotic raw materials including copper, quartz crystals, asphaltum and galena.

Basis for Temporal Placement: Ceramic typology, stratigraphic tests, extensive excavations and radiocarbon dates.

Subsistence Economy: Hunters and gatherers. A single instance of corn and squash purported from the Marksville site, Avoyelles Parish.

Settlement Pattern: One extensive occupation, the Marksville site, consists of a group of earthen mounds within a semicircular ridged, earthen wall. Domed mounds for the disposal of the dead. Human interments, both primary and secondary, are deposited along with a selected quantity of pottery, stone, bone, shell and copper funerary offerings. Other sites consist of middens and/or mounds lacking enclosures. Evidence of a possible house structure, rectangular in plan with a semisubterranean floor, was exposed at the Marksville site.

5. Troyville-Coles Creek. A.D. 700--A.D. 1100

Diagnostic Traits: New ceramic typologies, clay tempered pottery and new decorative designs. Elbow-shaped clay pipes, ear spools and mealing stones. Near the end of this period the preponderance of small, finely chipped projectile points is indicative of the introduction of the bow and arrow, whereas previously the atlatl predominated.

Basis for Temporal Placement: Ceramic typology, stratigraphic tests, extensive evcavations and radiocarbon dates.

TABLE 2.6-1
(Sheet 3 of 3)

SUMMARY OF PREHISTORIC CULTURAL PERIODS, WATERFORD 3 AREA

Subsistence Economy: The first definitely documented evidence of corn and squash agriculture. The agricultural base was supplemented with hunting and gathering.

Settlement Pattern: Characteristically, three, large, pyramidal, compound mounds oriented around an open plaza. Houses with rectangular or oval floor patterns. Mounds of the Troyville site, Catahoula Parish, were surrounded by a rectangular ditch and earthen wall enclosure. Multiple primary and secondary human interments, generally without artifactual associations, are common in the mounds.

6. Mississippian. A.D. 1100--Historic Period

Diagnostic Traits: New ceramic typologies, shell tempered pottery, effigy vessels, new decorative motifs, strap handles, effigy pipes and ear spools. Late in the period native artifacts are found in association with European trade material. "Southern Cult" items are also present.

Basis for Temporal Placement: Ceramic typology, stratigraphic tests and ethno-historic documentation. Included are sites of the Plaquemine Period.

Subsistence Economy: Corn, squash and bean agriculture supplemented by hunting and gathering.

Settlement Pattern: Large, compound, pyramidal mounds oriented around an open plaza. Mounds may have stepped ramps. Round, rectangular and square house floor patterns with and without wall trenches. Some villages surrounded by a wooden palisade. Secondary, single and multiple human bundle burials occur in the mounds, primary extended and flexed human interments are also present.

TABLE 2.6-2
(Sheet 1 of 3)

RECREATION FACILITIES WITHIN 5 MILES OF WATERFORD 3 (1) (2)

Name	Description	Distance & Direction from Plant
Bethune Playground	Site of Bethune School; planned: 2 tennis courts, basketball courts, baseball field, Norco	3.1 miles ENE
Bonnet Carre Wildlife Management Area	Hunting area of 3,500 acres in the Bonnet Carre Floodway	
Fashion Golf & Country Club	9-hole golf course, Hahnville	4.0 miles SE
Hahnville High School Football Field	High School football stadium seating 3-5,000 people, Hahnville	4.2 miles ESE
Holy Rosary Playground	Playground on church grounds includes: tennis courts, baseball field, basketball courts, Hahnville	4.3 miles ESE
Killona Playground	Basketball goals, backstop; proposed expansion includes baseball field, football field, Killona	1.1 miles WNW
Laplace Trailer Park and Campground	100 trailer and tent spaces, Laplace	3.9 miles N
Montz Park	Baseball field; planned: 2-3 baseball fields, basketball courts, Montz	1.0 miles ENE
Montz area park (Proposed)	Planned facilities include: playground, picnic areas, campground, Montz	2.0 miles NE

(1) The location of these facilities is given on Figure 2.1-17.

(2) Unless otherwise mentioned, information on recreation facilities was obtained from the St. Charles Parish Director of Recreation, and a member of the St. Charles Parish Recreation Committee, New Sarpy, Louisiana. March 22, 1977.

TABLE 2.6-2
(Sheet 2 of 3)

RECREATION FACILITIES WITHIN 5 MILES OF WATERFORD 3

Name	Description	Distance & Direction from Plant
Norco Boating Club	Picnic facilities, campground, boat dock & ramp in Bonnet Carre Floodway	3.9 miles ENE
Norco Women's Club Playground	Playground less than 1 acre, Norco	3.6 miles ENE
St Charles Parish Boating Club	Boat ramp in Bonnet Carre Floodway	3.9 miles ENE
Stock Car Race Track(3)	Semi-finished raceway not presently in operation, seats 3,000 spectators, Laplace	4.2 miles N
Sugarland Beagle Club	Clubhouse and hunting area near Montz (clubhouse area only shown on Figure 2.1-17)	4.1 miles NNE
Sun Villa, Inc. Swim Club	Private Swimming pool in Norco	3.3 miles ENE
Recreation Areas at the Following Schools:		
Carver Junior High School	Hahnville	3.6 miles ESE
Good Hope Elementary School	Good Hope	3.9 miles E
Hahnville Elementary School	Hahnville	3.7 miles ESE
Killona Elementary School	Killona	0.9 miles W
Lucy School	Lucy	4.2 miles NW
Milesville School	Laplace	4.9 miles NNW
New Sarpy Middle School	New Sarpy	4.7 miles E

(3) Telephone contact, Owner of the stock car race track, Laplace, Louisiana, June 14, 1977.

TABLE 2.6-2
(Sheet 3 of 3)

RECREATION FACILITIES WITHIN 5 MILES OF WATERFORD 3

Name	Description	Distance & Direction from Plant
Norco Elementary School	Norco (2 locations)	3.0 miles ENE 3.6 miles ENE
John L Ory School	Laplace	5.0 miles N
Sacred Heart School	Norco	3.3 miles ENE
Woodland School	Laplace	4.7 miles NNW

EDWIN EDWARDS
GOVERNOR

SANDRA S. THOMPSON
SECRETARY

E. BERNARD CARRIER, PH.D.
ASSISTANT SECRETARY

State of Louisiana

Department of Culture, Recreation and Tourism

Office of Program Development

DIVISIONS

OUTDOOR RECREATION
(504) 389-5886
HISTORIC PRESERVATION
(504) 389-5086
ARCHAEOLOGY
(504) 389-6751
ARTS
(504) 389-6291

STATE HISTORIC PRESERVATION OFFICE
September 28, 1977

Mr. D. Predpall
Environmental Project Map
Ebasco Services, Inc.
Two Rector Street
New York, N.Y. 10006

Re: Cultural Resources Survey
Waterford Power Station, Unit #3
St. Charles Parish Louisiana

Dear Mr. Predpall,

The staff of the Division of Archaeology and Historic Preservation have reviewed the survey report prepared by Robert W. Newman referenced above.

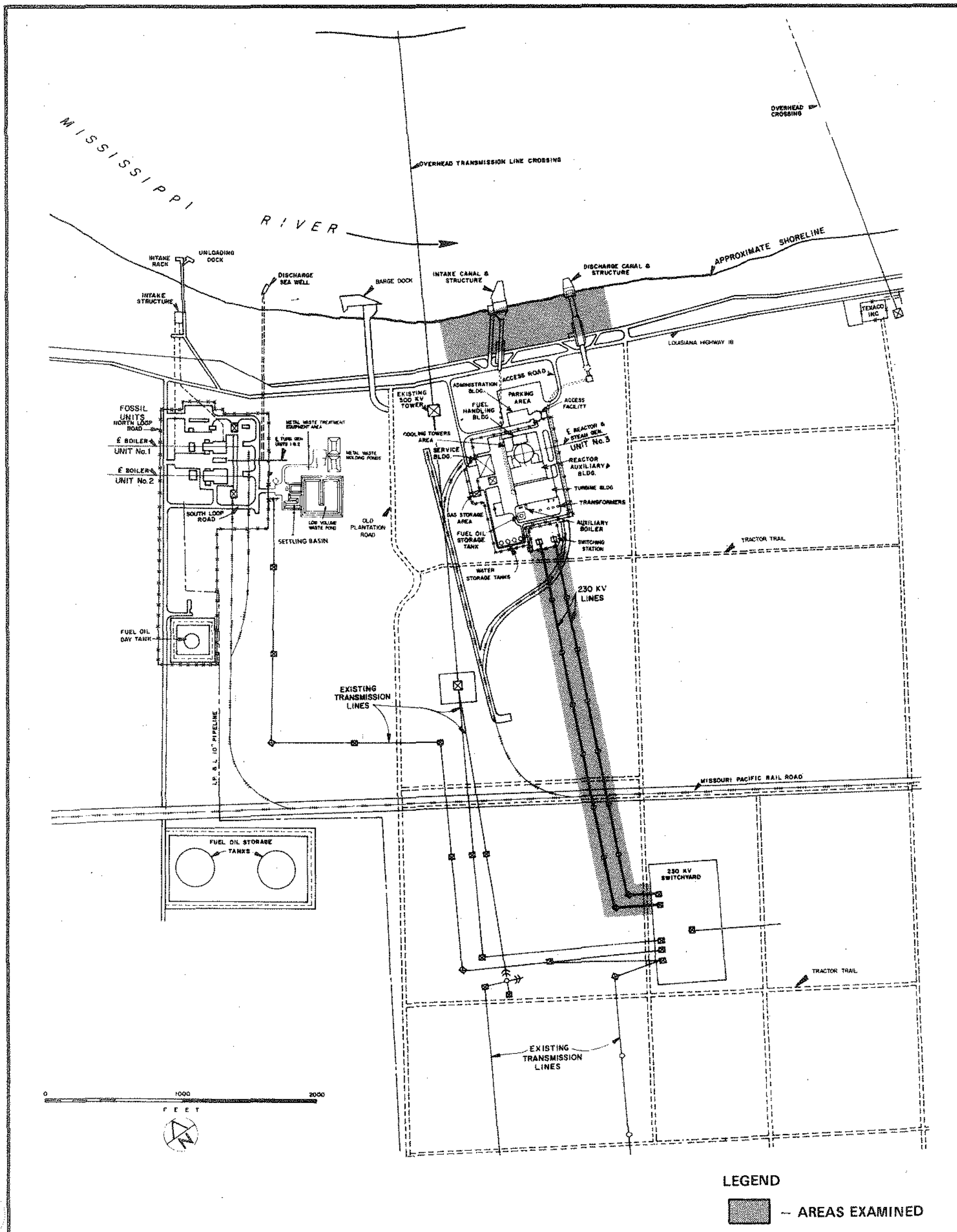
Since no properties currently listed on or eligible for inclusion in the National Register of Historic Places were located in the course of the survey we have no objection to construction in the areas surveyed.

Sincerely,

Paul B. Hartwig, Director
Division of Archaeology &
Historic Preservation

POST OFFICE BOX 44247 • BATON ROUGE 70804

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	COMMENTS OF STATE HISTORIC PRESERVATION OFFICE	Figure 2.6-1



LOUISIANA
POWER & LIGHT CO.
Waterford Steam
Electric Station

ONSITE AREAS EXAMINED
FOR CULTURAL RESOURCES SURVEY

Figure

2.6-2

2.7 NOISE

2.7.1 INTRODUCTION

A complete physical description of sound should account for its frequency spectrum and its magnitude as a function of time. To simplify this description, the most common approach is to weight the amplitudes of various frequencies of sound by measuring the "A"-weighted sound level in decibels (dB), as observed on a sound level meter. Measurements are recorded as dB(A). The "A"-weighting scale discriminates against the low frequency components of sound in a quantity proportional to the hearing ability of a person and has been found to correlate fairly well with man's perception of sound[1].

Because environmental noise is often a dynamic phenomenon which continually varies at a fixed location, a statistical approach is needed to properly describe environmental sound. This is done by showing what percent of the entire observation period each dB(A) level is being exceeded.

The sound pressure level exceeded 10 percent of the time, expressed as L_{10}, is often used to represent the higher-level short duration sounds. A measure of the median sound level is given by the L_{50}, which represents the level exceeded 50 percent of the time. The residual sound level is approximated by L_{90}, which is the sound level exceeded 90 percent of the time.

A measure accounting for both the duration and magnitude of the sound occurring during a given period is called the equivalent "A"-weighted sound level (Leq). This descriptor and the measures derived from it are being used extensively by the Environmental Protection Agency in formulating guidelines for community noise exposure[2].

2.7.2 NOISE SURVEY IN THE WATERFORD 3 VICINITY

In order to determine the environmental sound levels presently existing in the Waterford 3 site area, a sound survey was conducted during February 8-10, 1977. At the time of the survey, Waterford 3 was under construction.

2.7.2.1 Noise Measurement

Ambient sound measurements were taken both within the plant property and outside the property lines. Ambient noise levels were also obtained from the surrounding communities within a radius of five miles of the plant, as recommended in Nuclear Regulatory Guide 4.2. These measurement locations are numbered 1 to 10, and are shown in Figure 2.7-1. Locations numbered 1 through 8 are representative of noise sensitive areas surrounding Waterford 3, whereas locations 9 and 10 are within the site boundary line.

Ambient noise data were collected at the Waterford site and in the surrounding area with a GR 1945 Community Noise Analyzer, and included measurement of noise levels ranging from $L_{0.1}$ to L_{max}. In addition, brief sampling measurements were obtained by observing the residual "A"-weighted sound level, which approximates L_{90}, to supplement more complex data gathered by the Community Noise Analyzer.

Informal weather measurements of barometric pressure, wind speed and direction, and wet/dry bulb temperature were obtained at each acoustic measurement point. This was done to assure that the weather conditions permitted satisfactory acoustic monitoring; excessive wind speed, for example, can influence microphone output and cause erroneous readings. These weather observations are given in Table 2.7-1 and indicate acceptable conditions for sound monitoring.

2.7.2.2 Survey Instrumentation

The GR 1945 Community Noise Analyzer was the primary sound measuring device used in this survey. The GR 1945 Community Noise Analyzer monitors noise levels up to three sequential time periods and automatically computes and records "L" exceedance levels. The computed levels are instantly available on a digital display. For this survey, the instrument monitored ambient sound levels at selected locations for 30-minute periods. Just prior to and immediately after taking sound level measurements, the Community Noise Analyzer was calibrated with a GR 1562-A field calibrator.

Brief sampling measurements, to supplement those made by the automatic noise analyzer, were made with a GR 1933 Precision Sound Level Meter and Analyzer equipped with an electret condenser microphone. These measurements were made by observing the residual "A"-weighted sound level that is approximately equal to the L_{90} value obtained from the GR 1945 Community Noise Analyzer. The observation of the residual noise provides a check on and complements the more complete data displayed by the Community Noise Analyzer.

A microphone wind screen was used for all measurements to reduce wind effects.

The informal weather measurements were made using the following instruments held 4 to 5 feet above the ground:

a) Bendix Psychrometer Model 566,
b) Lambrecht Anenometer Model WP3, and
c) Bruel & Kjaer Barometer.

2.7.3 AMBIENT NOISE LEVELS IN THE WATERFORD 3 VICINITY

The noise level measurements taken by the Community Noise Analyzer are presented in Table 2.7-2 for the 10 locations in the Waterford 3 vicinity where measurements were made. The dB(A) measurements made with the Precision Sound Level Meter and Analyzer, which provides values approximately equal to the L_{90}, are presented in Table 2.7-3.

From the information presented in Table 2.7-2, ambient noise levels in the Waterford 3 site vicinity range between an Leq of 49 dB(A) at the Waterford 3 site to an Leq of 59 dB(A) in the towns of Lucy and Taft. Measurement of the L_{90} indicated that noise levels exceeded 90 percent of the time range from a low of 43 dB(A) in Tigerville to a high of 55 dB(A) measured in Good Hope.

The dB(A) measurements presented in Table 2.7-3, based on manual observations of residual noise level (L_{90}), show a good correlation with those made by the automated system.

This noise survey indicated that the major ambient noise sources at the Waterford 3 site and in the surrounding communities are man-made in origin, and consist primarily of transportation and industrial noises. At the time of the survey, these were supplemented by various construction activities at Waterford 3.

REFERENCES

1. U.S. Environmental Protection Agency. "Public Health and Welfare Criteria for Noise." July 27, 1973.

2. U.S. Environmental Protection Agency. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." March, 1974.

TABLE 2.7-1

WEATHER OBSERVATIONS AT WATERFORD 3 SITE AREA DURING THE ACOUSTIC MEASUREMENT PERIOD

Location	Day	Date	Time	°F dT	°F wT	RH %	Wind mph	Wind Direction	Clouds	Bar.Press mbar
(1) Hahnville	Tuesday	2/ 8/77	14:00	52	42	41	5	NE	Overcast	1030
(2) Taft	Tuesday	2/ 8/77	14:50	51	41	40	Calm		Overcast	1030
(3) Killona	Tuesday	2/ 8/77	11:15	51	40	34	Calm		Partly Cloudy	1032
(4) Lucy	Tuesday	2/ 8/77	10:15	46	39	53	3-6	NE	Partly Cloudy	1031
(5) Tigerville	Tuesday	2/ 8/77	09:00	44	37	50	5-10	E	Partly Cloudy	1031
(6) Laplace	Wednesday	2/ 9/77	12:00	64	52	43	Calm		Clear	1027
(7) Montz	Wednesday	2/ 9/77	10:30	62	50	41	Calm		Clear	1028
(8) Good Hope	Wednesday	2/ 9/77	08:45	54	45	48	0-1	NE	Clear	1028
(9) Waterford 3 Site	Thursday	2/10/77	10:20	58	51	62	4-6	NE	Clear	1030
(10) Waterford 3 Site	Thursday	2/10/77	11:20	66	56	53	6-9	NE	Clear	1030

TABLE 2.7-2

SOUND LEVELS IN WATERFORD 3 SITE AREA
AUTOMATIC OBSERVATIONS
[dB(A)]

Location	Description	Day	Date	Time	$L_{0.1}$	L_1	L_2	L_5	L_{10}	L_{20}	L_{50}	L_{90}	L_{99}	L_{min}	L_{max}	L_{eq}
(1) Hahnville	Near the courthouse	Tuesday	2/ 8/77	14:05 14:35	65	60	58	56	55	53	50	47	45	44	67	52
(2) Taft	Near residences near the ferry	Tuesday	2/ 8/77	15:10 15:40	77	69	68	65	62	58	54	50	46	45	78	59
(3) Killona	In the residential area	Tuesday	2/ 8/77	11:15 11:45	72	63	62	60	58	57	54	52	51	50	74	56
(4) Lucy	Near Lucy Elementary School	Tuesday	2/ 8/77	10:05 10:35	75	73	70	64	61	58	51	46	44	42	76	59
(5) Tigerville	In the residential area	Tuesday	2/ 8/77	09:03 09:33	69	62	56	52	51	49	47	43	41	41	77	50
(6) Laplace	In the residential area	Wednesday	2/ 9/77	12:03 12:33	63	58	57	55	54	52	48	46	44	43	65	51
(7) Montz	Near the water tank across from residences	Wednesday	2/ 9/77	10:38 11:08	64	62	61	57	55	52	50	48	47	46	65	52
(8) Good Hope	In the residential area	Wednesday	2/ 9/77	08:50 09:20	64	62	61	60	59	58	57	55	54	53	66	57
(9) Waterford 3 Site	Near the switchyard	Thursday	2/10/77	10:27 10:57	68	65	62	61	56	53	51	50	49	49	69	54
(10) Waterford 3 Site	Near the fence off La. Highway 3127	Thursday	2/10/77	11:21 11:51	64	58	56	52	50	49	48	46	45	44	66	49

TABLE 2.7-3

RESIDUAL SOUND LEVELS IN WATERFORD 3 SITE AREA
MANUAL OBSERVATIONS

Location	Description	Day	Date	Time	dB(A)
(1) Hahnville	Near the courthouse	Tuesday	2/ 8/77	14:10	50
(2) Taft	Near residences near the ferry	Tuesday	2/ 8/77	15:00	47
(3) Killona	In the residential area	Tuesday	2/ 8/77	11:18	53
(4) Lucy	Near Lucy Elementary School	Tuesday	2/ 8/77	10:10	46
(5) Tigerville	In the residential area	Tuesday	2/ 8/77	09:45	44
(6) Laplace	In the residential area	Wednesday	2/ 9/77	12:07	46
(7) Montz	Near the water tank across from residential homes	Wednesday	2/ 9/77	10:43	48
(8) Good Hope	In the residential area	Wednesday	2/ 9/77	09:00	56
(9) Waterford 3 Site	Near the switchyard	Thursday	2/10/77	10:30	50
(10) Waterford 3 Site	Near the fence off La. Highway 3127	Thursday	2/10/77	11:25	49