Before the

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-382

In the Matter of

Louisiana Power & Light Company

AMENDMENT NO. 3

FINAL ENVIRONMENTAL REPORT

Louisiana Power & Light Company, Applicant in the above captioned proceeding, hereby files Amendment No. 3 to its Final Environmental Report.

This Amendment No. 3 amends the Final Environmental Report, including updated information on continuing monitoring programs, MSU load forecast, and other miscellaneous items.

Wherefore, Applicant requests the licenses specified under Docket No. 50-382.

Respectfully submitted,

LOUISIANA POWER & LIGHT COMPANY

BY D L Aswell

D. L. Aswell
Vice President-Power Production

DATE: August 24, 1981

STATE OF LOUISIANA)
) SS
PARISH OF ORLEANS)

D. L. Aswell, being duly sworn, states that he is Vice President-Power Production of Louisiana Power & Light Company and that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this amendment.

D L Aswell
D. L. Aswell

SUBSCRIBED AND SWORN to before me, a Notary Public in and for the Parish and State above named, this 26th day of August, 1981

[signature]
Notary Public

My Commission expires:

WITH LIFE

WSES-3
ER
LOUISIANA POWER & LIGHT CO.
WATERFORD SES UNIT NO. 3
OPERATING LICENSE STAGE ENVIRONMENTAL REPORT (OLER)
AMENDMENT NO. 3

INSTRUCTION SHEET

This Amendment contains additional information which is submitted to the NRC for the purpose of presenting updated information since the last Amendment was issued.

Each revised and new text page of the Waterford-3 OLER bears the notation Amendment No. 3, (8/81) at the bottom of the page. Vertical bars with the number 3 have been used in the margin of pages, as applicable, to indicate the location of the revisions on the page.

The following page removals and insertions should be made to incorporate Amendment No. 3 into the OLER.

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CHAPTER 2: THE SITE AND ENVIRONMENTAL INTERFACES

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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 facilities as an integrated electrical system for more than forty years. These four companies also own a fuel management company, System Fuels, Inc. 3

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

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 deg . 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 Autho..ty (TVA).

1.1.2 DEMAND PROJECTIONS

1.1.2.1 Background

The l te 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 ... availability and prices of fuels employed in the production of elec... the growth in power demand, the prevailing economic conditions and ... 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 very effective in predicting future load energy requirements for LP&L during this period, particularly during more stable economic conditions. 3

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 forecasting system. This forecasting system is described in detail in the following section. 2

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 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. 2

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, 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. 2

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 commerc al 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 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. 2

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. 2

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

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 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: 3

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 capacility; 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

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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 1.1-12 contains the MSU System's planned capacity additions and retirements for the period 1981 through 1986. 3

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 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. 3

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
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.

3

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	4252	424[illegible]	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	92	220	234	288
3. Total Capability (1+2)	898	1111	1498	1715	1920	2170	2439	2735	3015	2987	3837	4008	4190	4259	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
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

3

* 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. MEU 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	3
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	

*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	459[illegible]	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	84[illegible]	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 (Cont'd)
(Sheet 3 of 4)

3

SOUTHWEST POWER POOL
ANNUAL LOAD AND CAPABILITY FORECAST*
SUMMARY 1965-1996[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)	36312	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
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

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* 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	[illegible]	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	268[illegible]	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	3
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	

* 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	[illegible]	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	[illegible]	4768	6514	6299	
10.	Percent Margin in Excess of Load (9÷8 x 100)	[illegible]	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 1[illegible], 1981. Units in megawatts unless otherwise noted.

Note (1) Grand Gulf 1, 1125 Mw Added in April
Market 1[illegible], 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 3
8.	Load Responsibility (5+6-7)	8271	8049	7380	7391	9508	10744	10744	10744	10744	8839	7898	8120
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
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

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 1.1-11
(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 3
APRIL 1970-1980

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

(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.

2

TABLE 1.1-12
(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
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
	AP&L	Jim Hill #1 (Retired)	Gas/Oil	--	December 31	-35

3

3

(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.

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
1.0	$245,130,000
2.0	$532,864,000

3

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CHAPTER 2: THE SITE AND ENVIRONMENTAL INTERFACES

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CHAPTER 2: THE SITE AND ENVIRONMENTAL INTERFACES

Amendment No. 3,(8/81)

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 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.

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 snipe, and various rodents. 3

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 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 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. 3

Cypress-gum swamplands are excellent habitats for a number of small 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, 3 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 community 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 habitat 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 eac[illegible] [illegible]ese two species. Neither species exists as a breeding bird in t[illegible] [illegible]ly area. 3

The population of the Southern [illegible] Eagle has been declining in recent years because of loss of suitable n[illegible]ng 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 occ[illegible]rence 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 zoopl? ?on during the first sampling year (Year I, from June 1973-May 1974) ? ?e 921.1 organisms/m3, while the third year (Year III, from October ?5-September 1976) average was 298.1/m3. During the second year ear II, from June 1974-August 1975), seasonal sampling indicated average densities of 1056/m3 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/m3, 1 ?0.0/m3 and 356.8/m3, respectively. Densities for the first sample of 1980 were considerably higher (4458.5/m3) than previous years. Finer mesh nets probably attributed to the increased catches of rotifers which represented 61 percent of the sample. 3

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 veloci?es (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/m2. 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	Copepod ids

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/m^2 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 x 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 x 10^4 organisms/liter) and highest in April (1.4 x 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

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/m3 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/m^3, 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 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 6.1.1-1), were found to be highest at Station B_t and lowest at Station B_{t1}. 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 1

(52/m2). 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, 197[illegible], August 22, 1973 and November 29, 1973 (Table 2.2-17). [illegible]chaetes 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/m2) 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 relationship 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 1
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 1
and 2.2-25.

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 1
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.

Table 2.2-25 indicates that the overall number of fish caught per unit | 1
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.

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.

Ichthyoplankton

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 collected during Year II, shown in Table 2.2-29, included Centrarchidae and Clupeids. The Clupeids were probably gizzard and threadfin shad. 1

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 [illegible] 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 2.2-30. 1

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_{tl} 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_{tl}) 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,[illegible]40.

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 rea - 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 are 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, 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]. 1

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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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 3
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.

There are no sites on the National Registry of Natural Landmarks present in the area.

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[3, 4]. 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[5]. At the present time, however, no plans exist to implement the acquisition or construction of these facilities[3, 5].

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.

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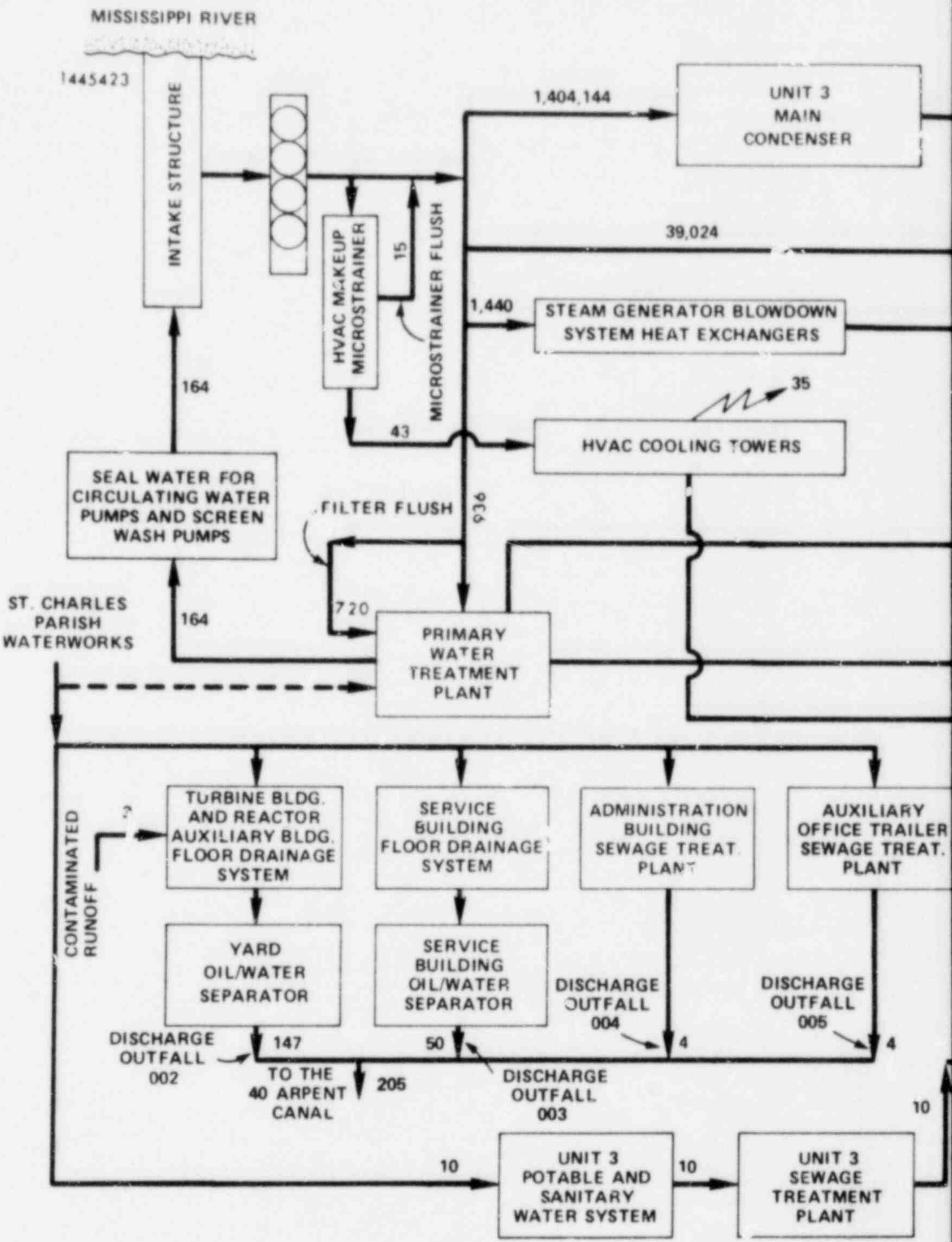
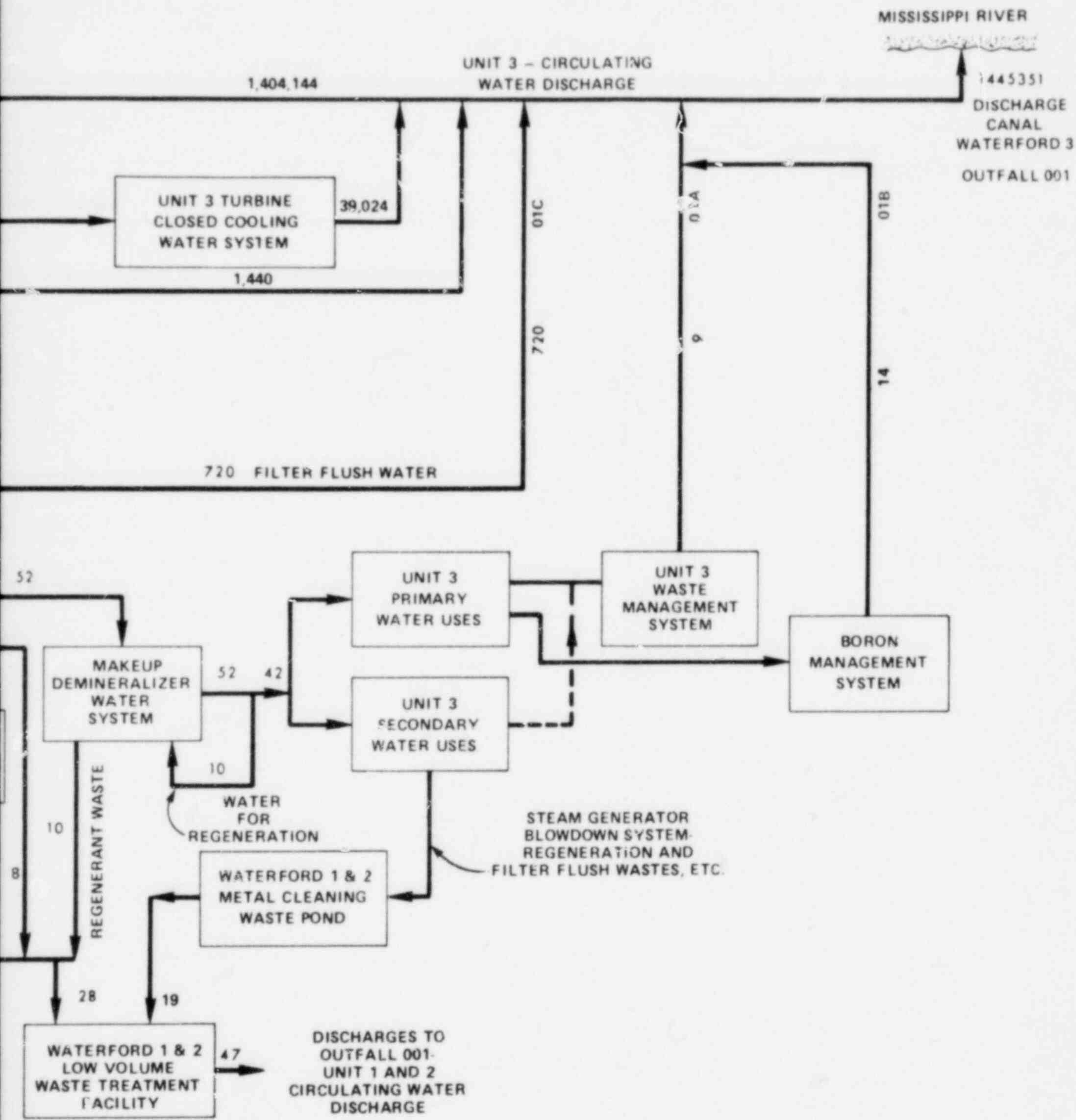


NOTES:

1. FLOWS IN THOUSAND GALLONS PER DAY.
2. PRIMARY WATER USE SYSTEMS ARE THOSE SYSTEMS WHERE WATER COMES IN DIRECT RADIOACTIVITY.
3. SECONDARY WATER USE SYSTEMS ARE THOSE SYSTEMS WHERE THE WATER DOES NOT POTENTIAL SOURCES OF RADIOACTIVITY.
4. WASTE MANAGEMENT SYSTEM AND BORON MANAGEMENT SYSTEM TREAT LIQUID RAD EACH OF THESE SYSTEMS IS ESTIMATED TO BE 20,000 GALLONS.
5. FIRE STORAGE AND THE ASSOCIATED SYSTEM DEMAND NOT SHOWN.



CONTACT WITH POTENTIAL SOURCES OF

COME IN DIRECT CONTACT WITH ANY

OACTIVE WASTES. BATCH RELEASES FROM

AMENDMENT NO. 3 (8/81)

LOUISIANA POWER & LIGHT CO.

Waterford Steam Electric Station

SCHEMATIC OF WATER FLOW, WATERFORD UNIT 3

FIGURE 3.3–1

from the 600,000 gallon (maximum) refueling water storage pool. However, since the stored energy in this pool is small compared to that in the spent fuel pool, the evaporation rate will also be relatively smaller. HVAC exhaust from the Turbine Building is also a less significant source due to a lower concentration of tritium in leakage, and the fact that large pools of water are not available for evaporation. 1

3.5.1.3 Fuel Pool System

The Fuel Pool System is designed to remove decay heat produced by the fuel placed in the pool and to remove soluble and insoluble foreign matter from the spent fuel pool. Figure 3.5-1 presents a simplified block flow diagram of the Fuel Pool System. The detailed piping and instrument diagram is presented in Section 9.1 of the FSAR, along with the principal component design data. The radionuclide concentrations in the fuel pool during plant operations and refueling are presented in Table 3.5-3.

The values presented in Table 3.5-3 are based on the assumption that, upon shutdown for refueling, the Reactor Coolant System is cooled down for a period of approximately two days. During this period, the primary coolant is let down through the purification filter, purification ion exchanger, and flash tank. This serves two purposes: removing the noble gases in the flash tank avoids large activity releases to the Reactor Building following reactor vessel head removal, and the ion exchange and filtration reduce dissolved fission and corrosion products in the coolant which would otherwise enter the Fuel Pool System and refueling water canal. At the end of this period, the coolant above the reactor vessel flange is partially drained. The reactor vessel head is unbolted and the refueling water cavity is filled with a minimum of 443,000 gallons of water from the refueling water storage pool. The remaining reactor coolant volume containing radioactivity is then mixed with water in the refueling cavity and the Fuel Pool System. After refueling, the Fuel Pool System is isolated and the water in the refueling cavity is returned to the refueling water storage pool. This series of events determines the total activity to the Fuel Pool System. The specific activities of the radionuclides given in Table 3.5-3 are based upon a volume of 292,000 gallons. These values will be reduced by decay during refueling as well as by operation of the Fuel Pool System.

The Fuel Pool System has two basis parts: a cooling subsystem and a purification subsystem.

The cooling subsystem of the Fuel Pool System is a closed loop system consisting of two half-capacity pumps and one full-capacity heat exchanger. The fuel pool water is withdrawn from the fuel pool near the surface and is circulated by the fuel pool pumps through the fuel pool heat exchanger, where heat is rejected to the Component Cooling Water System. The Component Cooling Water System is described in Section 3.4. From the outlet of the fuel pool heat exchanger, the cooled fuel pool water is returned to the bottom of the fuel pool through a distribution header. This cooling system is controlled manually from the main control room. 3

The clarity and purity of the water in the fuel pool, refueling canal, and refueling water storage pool are maintained by the purification subsystem of the Fuel Pool System. The purification loop consists of the fuel pool purification pump, ion exchanger, filter, strainers and surface skimmer. Most of the purification flow is drawn from the bottom of the fuel pool while a small fraction is drawn through the surface skimmer to remove surface debris. A basket strainer is provided in the purification line to remove any relatively large particulate matter. The fuel pool water is circulated by the pump through a filter which removes particulates larger than 5 microns, then through an ion exchanger to remove ionic material, and finally through a wye type strainer, which prevents resin beads from entering the fuel pool in the unlikely event of a failure of an ion exchanger retention element. Connections to the refueling water storage pool and the condensate storage pool are available to provide makeup water to the fuel pool through the purification loop. The refueling water storage pool and refueling canal are also provided with connections to the purification loop.

During plant operation the refueling water storage pool holds approximately 600,000 gallons (maximum) of water. At the time of refueling a minimum of 443,000 gallons of water are used to fill the reactor canal, fuel transfer canal, and refueling water cavity. 1

The release rates of radioactive materials in gaseous effluents due to evaporation from the surface of the fuel pool and refueling canals during refueling and normal operation are presented in Table 3.5-3. The assumptions upon which these values are based are presented in Table 3.5-4.

3.5.1.4 Ventilation System Exhausts

Liquid and steam leakage from various coolant and process streams can result in small quantities of radioactive gases entering the building atmospheres. Except in the Turbine Building, this activity is collected, processed, and discharged to the environment via the building ventilation and exhaust systems. These systems are described in detail in Section 3.5.3.2.

3.5.2 LIQUID RADWASTE SYSTEM

Liquid radioactive waste is processed in the Waste Management System (WMS). The Chemical and Volume Control System (CVCS), the Boron Management System (BMS) and the Steam Generator Blowdown System (SGBS) also process radioactive streams, portions of which may be discharged as processed radioactive liquid waste.

The numerical design objectives for plant releases during normal operations, including anticipated operational occurrences, are based on guidelines given in Appendix I to 10CFR50.

The design objectives are:

a) The calculated annual total quantity of all radioactive materials in liquid effluents during normal operation, including anticipated operational occurrences, should not result in a dose or dose commitment from liquid effluents for any individual in an unrestricted area

3.5.3.1 Gaseous Waste Management System

Figure 3.5-6 presents a block flow diagram of the Gaseous Waste Management System (GWMS). Section 11.3 of the FSAR presents a detailed flow diagram and a description of the equipment in the GWMS.

Waste gases which are routed to the GWMS are mainly hydrogenated, radioactive or potentially radioactive gases. Gaseous wastes are generated from reactor coolant degassing operations, processing of radioactive liquid wastes, and tank purgings. Waste gases enter the GWMS by way of the gas collection header and the gas surge header.

Gas Surge Header

The volume of gas stripped from the primary coolant and sent to the gas surge header is 30,000 scf/yr. Table 3.5-5 identifies the sources of this gas. Hydrogen and fission gases stripped into the flash tank and vented from other tanks are processed through the gas surge header and then the gas surge tank. Nitrogen gas is used in the gas surge tank to automatically maintain a slight positive pressure in the system. The gases collected in the gas surge tank are compressed into gas decay tanks by means of the waste gas compressors and retained in these tanks until activity levels are reduced by radioactive decay to appropriate levels. A storage capacity sufficient for 60 days of holdup time is provided. Three 600 ft^3 tanks, at a normal operating pressure of 345 psig and a design pressure of 380 psig, are incorporated into the design to achieve this desired 60-day holdup capability.

The gases remain in the gas surge tank until the pressure builds to a point which actuates a waste gas compressor. The waste gas compressor feeds a preselected gas decay tank until the pressure in the gas surge tank drops to a point where the waste gas compressor stops. A second waste gas compressor will start if the pressure in the gas surge tank builds due to a surge of the inputs. This automatic operation of the waste gas compressors will continue until a gas decay tank reaches its upper operating pressure. At this point, another gas decay tank will be manually lined up, by means of a remotely operated valve on the GWMS control panel, to receive the waste gas compressor's discharge. The filled tank is analyzed by the gas analyzer for hydrogen and oxygen content. Grab samples can also be taken for radioactivity analysis. The filled tank is then isolated to allow decay of the wastes.

The only process flow bypass line that exists in the GWMS leads from the gas surge tank directly to the gas discharge header and bypasses the waste gas compressor and gas decay tanks. This flow path is used mainly to purge air from components after maintenance operations, at which time the vented gas contains essentially no radioactivity. The valve on this bypass line is locked closed when the bypass is not in use, in order to ensure administrative control. The bypass flow passes through the radiation monitor in the gas discharge header.

The GWMS provides a means to control the discharge of gaseous waste. The discharges are controlled by the operator in the main control room. The operator discharges the gas decay tanks through a flow meter and recorder as well as a radiation monitor, which automatically terminates discharge flow on high activity. The release is controlled by a needle valve, preceded by a pressure regulator, to ensure constant flow rate. Both the procedure of sampling the gas decay tank prior to release and the continuous monitoring of the release protect against operator error, such as sampling one tank and lining up a different tank for discharge. The procedure for sampling and monitoring also protects against radiation monitor malfunction since the sample, prior to discharge, will be representative of tank contents. These process and effluent radiological monitoring systems are described in Section 3.5.5.

Gas Collection Header

Aerated gases from displaced air in various tanks, including the chemical drain tank, laundry drain tanks, and the boric acid and waste condensate tanks, are vented to the gas collection header. The gases are discharged through a radiation monitor, which automatically terminates flow on high activity.

3.5.3.2 Ventilation and Exhaust Systems

The major sources of building ventilation and exhaust include:

a) Reactor Building - Heating, Ventilation, Air Conditioning (HVAC) System

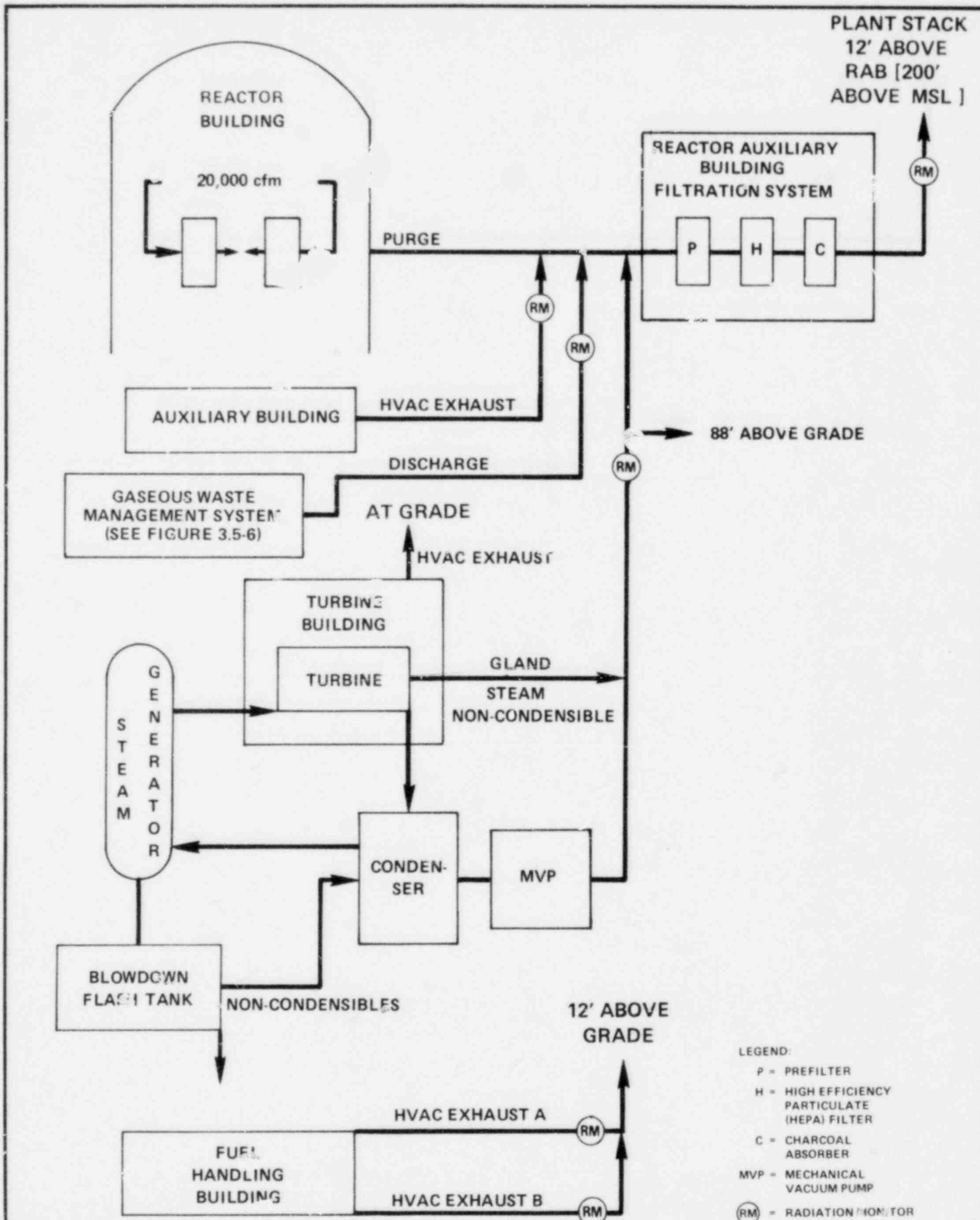
b) Reactor Auxiliary Building HVAC System

c) Turbine Building HVAC System

d) Fuel Handling Building HVAC System.

Figure 3.5-7 presents a block flow diagram of the ventilation and exhaust systems. The Reactor Building HVAC system includes an internal containment recirculation system, known as the Airborne Radioactivity Removal System (ARRS). ARRS includes 2 separate systems, each with a 10,000 cfm capacity. The system is designed to reduce airborne particulate and iodine activity within the Reactor Building to allow occupancy of the building and reduce discharge rates at times of purging the Reactor Building. The ARRS includes HEPA and charcoal filter beds. Purging of the Reactor Building atmosphere is through the Reactor Auxiliary Building (RAB) Normal Ventilation System filters which include HEPA and charcoal filters.

During plant operation, the Reactor Building will be isolated and airborne activity can accumulate due to primary coolant leakage. Based on the operating experience provided in NUREG-0017, a leak rate of 1.0 percent per day of the noble gases, and 0.001 percent per day of the iodines contained in primary coolant, will leak out of the primary coolant directly to the Reactor Building atmosphere. Some of the airborne activity will be released to the environment at times when the Reactor Building is purged. The frequency of such purging is uncertain. However, for the purpose of assessing the radionuclide release rate during purging, a purge frequency of 90 hours duration, 24 times per year was assumed. It was also assumed 3



NOTE: SYSTEM FLOW VLAUES ARE FOR NORMAL OPERATION. COMPONENT VALUES ARE FOR DESIGN CAPACITY.

AMENDMENT NO 3, (8/81)

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	BUILDING VENTILATION & EXHAUST SYSTEM SIMPLIFIED BLOCK FLOW DIAGRAM	Figure 3.5-7

3.6 CHEMICAL AND BIOCIDE SYSTEMS

3.6.1 INTRODUCTION

During the operation of Waterford 3, chemical wastes will be generated from various systems and processes such as the water treatment facilities, the corrosion control processes, laboratory analyses, the Boron Management System, the Potable and Sanitary Water System and laundry operations, etc.

Depending on its source, a liquid chemical waste may be radioactive or non-radioactive. The liquid radioactive chemical wastes are processed through the Waste Management System, where they are collected, monitored, filtered, demineralized, evaporated, or otherwise treated. The details of the Waste Management System are given in Section 3.5. This section describes the sources and treatment of non-radioactive chemical wastes.

3.6.2 CHEMICAL WASTES

The non-radioactive chemical wastewaters typically consist of demineralizer regenerants, sanitary wastes, HVAC cooling tower blowdown and floor drainage. All of these wastewaters, with the exception of floor drainage, are conveyed to the Waterford 1 and 2 waste treatment facilities. In the treatment facilities, wastes from Waterford 3 are combined and treated with wastes from Waterford 1 and 2. This treatment facility consists of a metal cleaning waste pond and the low volume waste treatment basins. The metal cleaning waste pond provides treatment for all Waterford 3 process waste streams which have the potential to contain metals concentrations in excess of applicable effluent standards and guidelines. Treated metal wastewaters are then conveyed to the low volume waste treatment facility. This facility consists of two basins in series which provide treatment for all Waterford 3 wastewaters requiring either pH neutralization and/or suspended solids removal. Treated wastes are then pumped to the discharge side of the Waterford 1 and 2 Circulating Water System for release to the Mississippi River, upstream of the intake of Waterford 3. Figure 3.6-1 shows a schematic diagram of the above described waste treatment facilities.

Contaminated floor drainage is treated in separate treatment facilities.

Table 3.6-1 presents a summary of the various chemical wastes and their sources, frequency, and concentration before and after treatment (if any). Table 3.6-2 shows the waste concentrations and applicable effluent limitations and State of Louisiana water quality standards. Table 3.6-3 gives the frequency of use of the chemicals, their purpose, and maximum and average quantities used annually.

3.6.2.1 Chemicals Released from the Primary Water Treatment Plant and the Demineralized Water System

Mississippi River water is used as a raw water source for the plant. Depending on its intended use, the water is directly used, pretreated and used, or pretreated and demineralized for use.

The Primary Water Treatment Plant provides the required pretreatment. This facility consists of two upflow filters, each having a capacity of 350 gpm. Only one filter will be working at a time. High molecular weight polyacrylamide is mixed into the river water to induce adsorption so that microscopic particles are retained in the filter media. The raw water is also continuously chlorinated to a combined chlorine concentration of 5 ppm to oxidize | 3
organic matter and inhibit biological growth on the filters. Each filter is flushed as needed. The filter flush water is mixed with Waterford 3 circulating cooling water before it is discharged to the Mississippi River. The flush water will contain suspended solids polyelectrolytes and residual chlorine. Their estimated concentrations in the wastewater, before mixing with the circulating cooling water, are indicated in Table 3.6-1.

The Demineralized Water System consists of two cation exchange units, one degasifier, two mixed bed I units, and two mixed bed II units. The mixed bed I units are weak base anion, strong acid cation exchange units. The mixed bed II units, which are also called polishing units, are strong base anion and strong acid cation exchange units. These units constitute two independent trains, each of 225 gpm capacity, and each capable of meeting the normal daily requirements.

When the cation exchangers or the mixed bed units are exhausted, they are regenerated with solutions of sulfuric acid and sodium hydroxide as follows:

a) Cation Exchangers - The weak acid cation exchange resin is regenerated with a two percent solution of sulfuric acid.

b) Mixed Bed I - The weak base anion exchange resin is regenerated with a four percent solution of sodium hydroxide. The strong acid cation exchange resin is regenerated with sulfuric acid in two steps; first with a two percent solution, then with a four percent solution.

c) Mixed Bed II - The strong base anion exchange resin is regenerated with a four percent solution of sodium hydroxide. The strong acid cation exchange resin is regenerated with a three percent solution of sulfuric acid.

The mineral constituents in the river water which are removed by the ion exchange resins are in turn released from the resins by these washings with the acid and hydroxide solutions. The estimated concentration of total dissolved solids and sulfates in the regenerant waste will be up to 10,000 ppm and 5,000 ppm, respectively. The amount of sulfate contained in the regenerant waste will be about 2000 lbs/regeneration. This will increase the sulfate concentration in the circulating water of Waterford 1 and 2 by 1.9 ppm, and in the Mississippi River by about 9.3 ppb (assuming complete mixing at a typical low flow condition of 200,000 cfs). The mean concentration of sulfate in the Mississippi River is 32.83 ppm as shown in Section 2.4, which also gives the concentrations of other chemicals found in the raw water drawn from the river.

The spent regeneration waste, about 50,000 gal/regeneration, flows to the waste collection basin for treatment and disposal, as shown in Figure 3.6-1. The spent regeneration waste is intermittent and will average about 10,000 gal/day.

TABLE 3.6-1

CHEMICAL WASTE DISCHARGE SUMMARY
(Sheet 1 of 2)

Type of Waste	Source	Frequency of Discharge	Quantity (gals/yr)	Chemical and Pollutant Content	Estimated Concentration in Waste (ppm)	Estimated Average Concentration After Treatment (ppm)	Released to:	
Reactor Coolant[c]	Boron Management System	Periodically	685,000[a]	Boron	10	10	Waterford 3 Circulating[b] Water System discharge	1
Non recoverable Water[j]	Waste Management System (Miscellaneous Waste)	Periodically	400,000[n]	Dirt	10	10	Waterford 3 Circulating Water System discharge	1
Detergent Waste	Waste Management System (Laundry Wastes)	Periodically	131,400[m]	Detergent, Dirt	1000	30	Waterford 3 Circulating Water System discharge	1
Regenerative Solutions[d]	Steam Generator Blowdown System	Periodically	145,000[d]	Total Dissolved Solids Sulfates pH	0-10,000 0-5,000 5-9	0-10,000 0-5,000 6-9	Waterford 1 and 2 Metal Waste Pond[i]	3
Electromagnetic Filter Flush[e]	Steam Generator Blowdown System	Periodically	20,000[e]	Total Suspended Solids	0-1,000	30	Waterford 1 and 2 Metal Waste Pond[i]	3
Turbine Building Drains	Condenser Feedwater Equipment Drains	Daily	60,000	Hydrazine Ammonia	.05 0-1	.05 0-1	Waterford 3 Circulating Water System discharge	
	Floor Drains[l]	Daily	67,000	Detergent, Dirt Oil & Grease Total Suspended Solids	.1 20 30	.1 15 30	Waterford 3 Storm Water Drainage System	
Regenerative[l] Solutions	Demineralized Water System	Periodically	365,000	Total Dissolved Solids Sulfates pH	0-10,000 0-5,000 5-9	0-10,000 0-5,000 6-9	Waterford 1 and 2 Low Volume Waste Treatment System[i]	1
Filter Flush Water	Primary Water Treatment Plant	Daily (2-3 times a day, each for 10 minutes)	13,140,000	Total Suspended Solids Polyelectrolyte Residual Chlorine	1,000 1-2 0-.1	1,000 1-2 0-.1	Waterford 3 Circulating Water System discharge	
Sanitary	Station Sewage Treatment Plant	Continuous	3,650,000	Residual Chlorine B O D Total Suspended Solids	0-.5 250 250	0-.5 30 30	Waterford 1 and 2 Low Volume Waste Treatment System[i]	
Sanitary	Administration Building Sewage Treatment Plant	Continuous	1,460,000	Residual Chlorine BOD Total Suspended Solids	0-.5 250 250	0-.5 30 30	Waterford 3 Storm Water Drainage System	

TABLE 3.6-1

CHEMICAL WASTE DISCHARGE SUMMARY
(Sheet 2 of 2)

Type of Waste	Source	Frequency of Discharge	Quantity (gals/yr)	Chemical and Pollutant Content	Estimated Concentration in Waste (ppm)	Estimated Average Concentration after Treatment (ppm)	Released to:
Sanitary	Auxiliary Office Trailer Sewage Treatment Plant	Continuous	1,533,000	Residual Chlorine BOD Total Suspended Solids	0-.5 250 250	0-.5 30 30	Waterford 3 Storm Water Drainage System
Chemical Cleaning Solutions(g)	Secondary System(h)	Once at the start of plant	1,800,000	Hydrazine TSS	50-90 30	Not known(k) 30	Waterford 1 and 2 Low Volume Waste Treatment System (i)
HVAC Cooling Tower Blowdown	Supplementary Chilled Water System (HVAC)	Daily	2,097,000	Total Suspended Solids	650	30	Waterford 1 and 2 Low Volume Waste Treatment System (i)

3

(a) This does not include 184,000 gal. of waste due to back-to-back cold shutdowns and startup at 85% of core life. Maximum of 144,000 gallons per day discharged.

(b) Normal Waterford 3 discharge flow is approximately 1,003,716 gpm.
Normal Waterford 1 and 2 circulating water flow is approximately 435,000 gpm.

(c) Due to fuel burnup, hot and cold shutdowns and refueling. Condensate from boric acid concentrator may be reused if it meets plant chemistry requirements.

(d) The regenerant wastes are 17,000 gallons per regeneration.

(e) The filter flush wastes are approximately 1000 gallons per flush.

(f) Includes leakage from Turbine Closed Cooling Water System.

(g) Chemical cleaning will be done during the initial start-up.

(h) Volume of Secondary System is approximately 300,000 gallons.

(i) Releases to these Waterford 1 and 2 treatment systems eventually go to Waterford 1 and 2 Circulating Water System Discharge.

(j) This does not include spent regenerant from the steam generator blowdown demineralizer.

(k) Not possible to predict.

(l) The regenerant wastes are 50,000 gallons/regeneration.

(m) Maximum combined treated laundry (10,000 gallons per day) and Waste Management (60,000 gallons per day) daily discharge is 70,000 gallons.

TABLE 3.6-2

SUMMARY OF CHEMICAL WASTE COMPLIANCE WITH APPLICABLE STANDARDS

(Sheet 1 of 2)

Waste Source	Quantity (gals/yr)	Chemical and Pollutant Content	Estimated Average Concentration After Treatment (ppm)	EPA Effluent Limitations (40 CFR . 3) (ppm)	In Average Concentration of Circulating water[b] (ppm)	State of Louisiana Water Quality Standards[a]	
Boron Management System	685,000	Boron[e]	10	-	$1.4X10^{-4}$	No standards	
Waste Management System	400,000	Detergent, Dirt	10	TSS-Avg- 30 Max-100	$9X10^{-5}$	No numerical criteria	2
Laundry, Showers	131,400	Detergent, Dirt	30	TSS-Avg- 30	$1.9X10^{-4}$	No numerical criteria	
Condenser Feedwater Equipment Drains	60,000	Hydrazine[e] Ammonia[e]	.05 0-1	- -	$5.7X10^{-9}$ $1.2X10^{-7}$	No numerical criteria No numerical criteria	
Floor Drains	67,000	Detergent, Dirt Oil & Grease (O & G) Total Suspended Solids (TSS)	0.1 15 30	 O&G: Avg- 15 Max- 20 TSS: Avg- 30 Max-100	(h)	No numerical criteria No numerical criteria No numerical criteria	
Demineralized Water System	365,000	Total Dissolved Solids[e] Sulfates[e] pH	0-10,000 0- 5,000 6-9	- - 6-9	3.8[d] 1.9 No change[f]	400 ppm 120 ppm 6.5-9.0	
Primary Water Treatment Plant Flush Water	13,140,000	Suspended Solids Polyelectrolyte[e] Residual Chlorine	1000 1-2 5	TSS-Avg- 30 Max-100 - 5	1.5[c] $[illegible].0x10^{-3}$[c] $3.8x10^{-3}$	No numerical criteria No numerical criteria No numerical criteria	3
Sewage Treatment Plant	3,650,000	Residual Chlorine B O D Total Suspended Solids	0-0.5 30 30	- Avg- 30 Max- 45	$7.9X10^{-6}$ $4.7X10^{-4}$ $4.7X10^{-4}$	No numerical criteria No numerical criteria No numerical criteria	
Administration Building Sewage Treatment Plant	1,460,000	Residual Chlorine BOD Total Suspended Solids	0-0.5 30 30	- Avg - 30 Max 45	(h)	No numerical criteria No numerical criteria No numerical criteria	
Auxiliary Office Trailer Sewage Treatment Plant	1,533 000	Residual Chlorine BOD Total Suspended Solids	0-0.5 30 30	- Avg - 30 Max 45	(h)	No numerical criteria No numerical criteria No numerical criteria	3
Preoperational Flushing & Hydrostatic Testing	15,000,000- 20,000,000	Hydrazine[e] Total Suspended Solids	Not known 30	- TSS-Avg- 30 Max-100	(g) (g)	No numerical criteria No Numerical criteria	

TABLE 3.6-3

CHEMICAL ADDITIVES AND THEIR ANNUAL CONSUMPTION

(Sheet 1 of 2)

Chemical	System Served	Use	Frequency of Use	Annual Consumption Average	Annual Consumption Maximum	
1. Boron	Reactor Coolant System	Reactivity control	Intermittent	3240 pounds		
2. Hydrazine	Reactor Coolant System; Secondary System	Oxygen control Oxygen control	Infrequent Continuous	51 pounds 4000 pounds	4600 pounds	
3. Ammonia	Secondary System	pH control	Continuous	305 pounds		
4. Polyelectrolyte	Primary Water Treatment Plant	To induce adsorption	Continuous	165 pounds	220 pounds	
5. Corrosion Inhibitor Sodium Nitriate 85% and Sodium metasilicate 15%	Closed Cooling Water Systems	To inhibit corrosion	At the start and then as needed	800 pounds[(a)]	93 pounds[(a)]	1
6. Chlorine	Sewage Treatment Plant Primary Water Treatment Plant	To kill disease-causing organisms; to oxidize organic matter	Continuous	7.1 tons	-	3
7. Sulfuric Acid	Demineralized Water System	To regenerate cation & mixed bed units	Daily	10 tons[(b)]	-	
8. Sodium Hydroxide	Demineralized Waste System	To regenerate mixed bed units	Daily	10 tons[(b)]	-	
9. Lithium	Reactor Coolant System	pH control	Intermittent	9 kilograms	-	
10. Nitrogen	Various Primary Systems	Cover gas	Intermittent	300,000 scf[(c)]	-	
11. Hydrogen	Reactor Coolant System	Oxygen control	Continuous	8,500 scf	-	
12. Detergent	Laundry	Cleaning	As needed	200 pounds	-	
13. Corrosion Inhibitor[(d)]	Supplementary Chilled Water System (HVAC)	Corrosion inhibitor	Daily	275 pounds (Typical)	-	
14. Dispersing Agent[(d)]	Supplementary Chilled Water System (HVAC)	Sequestering and dispersing agent	Daily	50 pounds (Typical)	-	

3.7 SANITARY AND OTHER WASTES

3.7.1 INTRODUCTION

This section describes the sanitary wastes and their treatment, the Storm Water Drainage System, and waste emissions from the diesel engines and auxiliary boilers. Chemical laboratory wastes, demineralizer regenerative waste, primary water treatment plant flush waste and chemical cleaning solution wastes are described in Section 3.6. Similarly, decontamination wastes and radioactive wastes from the laboratory and laundry are discussed in Section 3.5.

3.7.2 SANITARY WASTES

Sanitary wastes will originate from food preparation facilities, rest rooms and shower facilities located throughout the plant. There are three sewage treatment plants which service Waterford 3. One station sewage treatment plant services all sanitary wastes generated at Waterford 3 with the exception of the Administration Building and the auxiliary office trailer sanitary wastes. The sanitary wastes generated in the Administration Building are treated in the Administration Building sewage treatment plant and those generated in the auxiliary office trailer are treated in a separate facility. 3 3

Sanitary wastes influent to the station sewage treatment plant are collected in the station sewage treatment plant lift station. Sanitary wastes are directed to this lift station by either gravity or via pumping from the Reactor Auxiliary Building lift station.

Sanitary wastes influent to the Administration Building and the auxiliary office trailer sewage treatment plants are conveyed by gravity to separate lift stations. From these lift stations, these sanitary wastes are pumped to the respective sewage treatment plants. 3

3.7.2.1 Characteristics of Sanitary Waste

During commercial operation, the plant will be staffed by approximately 350 people in the administrative, operational, security and safety capacities. The majority of these employees will be working during the day shift. The treatment plants have a combined design capacity of 18,200 gallons per day, with an assumed BOD_5 load of 0.105 lbs. per person per day, (i.e., a total influent BOD_5 load of 37 lbs. per day). This loading corresponds to a normal sanitary waste with a BOD_5 concentration of 250 ppm. The waste is expected to be typical of sanitary wastes, and will contain a high concentration of suspended solids and a low concentration of dissolved oxygen. These design figures are based on sewage generation of 50 gallons/capita/shift and therefore have provided some excess capacity in the treatment plants. This excess capacity will enable the treatment plants to accommodate variations in influent loads such as during plant refueling when additional personnel are present at Waterford 3. 3 3

3.7.2.2 Lift Stations

There are two lift stations which convey sanitary wastes to the station sewage treatment plant: the Reactor Auxiliary Building lift station and the station sewage treatment plant lift station. The Reactor Auxiliary Building lift station is 5 ft in diameter and 8 ft 6 in. high, and is equipped with two submersible pumping units. Each of these is capable of pumping 80 gpm against a total dynamic head (TDH) of 80 ft, and can pass 2 1/2 in. diameter solids. The station sewage treatment plant lift station has a diameter of 5 ft and a depth of 10 ft 6 inch, and is also equipped with two submersible pumps. Each of the treatment plant lift station pumps is capable of pumping 100 gpm against a TDH of 30 ft, and can pass 3 inch diameter solids.

Each pump within these two lift stations is designed to meet the maximum demand of that station and, consequently, 100% standby pumping capacity will be available. The pump controls at each of those stations will automatically alternate the lead pump and also energize both pumps at a station in case of emergency high water level. Provision for manual operation exists on the control panel. The control panel at each of these lift stations is provided with indicator lights to show pump operation.

3.7.2.3 Sewage Treatment Plants

All three sewage treatment plants are factory-fabricated, package-type extended aeration treatment plants with a capacity of 10,000, 4,000 and 4,200 gallons per day for the station, the Administration Building and the auxiliary office trailer facilities, respectively. The plants will achieve 85 to 90 percent removal of BOD_5 and suspended solids from the waste. Details of the various unit operations and processes at the treatment plants are given below in sequential order. 3

a) Comminutor - The treatment plant lift station pumps the sanitary waste into the channel ahead of the comminutor. The comminutor cuts and grinds solids in the waste water to facilitate subsequent treatment processes. To permit continued treatment plant operation during a temporary malfunction or routine maintenance of the comminutor, a bypass channel, equipped with a bar screen, has been provided at the treatment plants.

b) Aeration - The comminuted waste flows into the aeration tank which provides a retention time of 24 hours. The tank is equipped with air diffusers which are located across the width of the tank, near the bottom to provide aeration and end roll. Sufficient aeration will be provided to keep solids in suspension and maintain a dissolved oxygen level of about 2.0 mg/l. During the extended aeration process, the biodegradable material is oxidized and the process operates in the endogenous respiration phase.

The aeration tank will have enough activated sludge returned to it, by air lifting from the final settling tank, that a mixed liquor suspended solids (MLSS) concentration of 4,000 to 5,000 ppm will be maintained. The aeration tank will also be equipped with spray nozzles for foam suppression.

c) Final Settling - The mixed liquor from the aeration tank discharges into the final settling tank where it is retained under quiescent condition for about five hours. The settling tank operates at an overflow rate of 200 gal/day/sq. ft. The activated sludge settles to the bottom and is returned to the aeration tank by airlifting. When the MLSS concentration in the aeration tank is more than 5,000 ppm, a part of the activated sludge is wasted to the sludge holding tank for digestion. The overflow from the settling tank flows to the chlorine contact tank for disinfection.

d) Chlorination and Disposal - The effluent from the final settling tank is disinfected by the addition of hypochlorite tablets to the chlorine contact tank. Baffles are provided in the chlorine contact tank to avoid short-circuiting of flow and provide thorough mixing of the chlorine solution and the waste water. This ensures that a contact time of more than thirty minutes is achieved in order to kill pathogenic bacteria. The chlorinated secondary effluent, with a residual chlorine concentration of approximately 0.5 ppm, flows over a V-notch weir prior to discharge. The station sewage treatment plant effluent is conveyed to the Waterford 1 and 2 waste collection basin for ultimate disposal. The Administration Building and the auxiliary office trailer sewage treatment plants effluent is discharged to the site drainage system and ultimately is drained to the 40 Arpent Canal. The average concentration of BOD_5 and suspended solids in the final effluent from both plants will not be greater than 30 ppm, and will meet applicable effluent and water quality standards.

1
3

In the waste collection basin, the chlorinated effluent from the station sewage treatment plant is mixed with other wastes, such as demineralization regeneration waste and cleaning solution wastes, from Waterford 1 and 2 and Waterford 3. The total wastewater then undergoes a treatment process, which is described in detail in Section 3.6.

e) Sludge Treatment and Disposal - The excess activated sludge from the settling tank will be wasted to the sludge holding tank. The sludge holding tank is equipped with air diffusers for aerobic digestion of the sludge. An overflow pipe will convey the overflow from the sludge holding tank to the aeration tank. The digested sludge will be removed by airlifting from the bottom of the sludge holding tank approximately once a year for offsite disposal.

3.7.3 STORM WATER DRAINAGE

Storm water is collected through roof drains, leaders and catch basins into a network of underground concrete storm sewers. These sewers discharge directly, without treatment or retention, into ditches leading to the 40 Arpent drainage canal. The storm sewer system has been designed to accommodate a 50-year recurrence storm.

3.7.4 OTHER WASTES

Because Waterford 3 is a nuclear power plant, there will be no continuous release of combustion products to the atmosphere during the normal operation of the plant. There are, however, six sources which will have temporary or intermittent emissions to the atmosphere. These are two diesel generating units, an auxiliary boiler, two diesel fire pumps, and a diesel generator for emergency purposes.

The two 4400 kW diesel engine driven generating units are part of an emergency generating system, and each diesel unit will require approximately 325 gallons of No. 2 diesel fuel per hour, when operating at full capacity. While emergency use of these generators cannot be predicted, they will be operated for about one hour per month for routine testing. The sulfur content of the diesel fuel oil will be less than 0.7 percent. Table 3.7-1 gives the combustion products normally released (in pounds per 1000 gallons of diesel fuel consumed).

The auxiliary boiler is sized to provide 75,000 lbs of steam per hour, at 200 psig, and is fired by No. 2 fuel oil. The auxiliary boiler will be available to provide steam to the Waste or Boron Management System concentrators, one of which will operate for approximately three hours every three days during each shutdown. This will occur mainly during refueling, and boiler operation is anticipated for about 200 hours per year. In addition, each start-up will require steam at an estimated 30,000 lbs per hour for the deaerator and 2[illegible],000 lbs per hour at 160 psig for the turbine steam seals. This steam is also to be provided by the auxiliary boiler. Finally, during the period preceding the initial plant start-up, the auxiliary boiler will be used to provide steam for cleaning of various plant components. This preoperational cleanup is typically six to eight months in duration. The expected waste emissions from the auxiliary boiler (in pounds per hour) are presented in Table 3.7-2.

The two-150 hp diesel fire pumps are to be utilized during emergency conditions at the station. Each pump has a capability of pumping 2000 gpm, and requires approximately 11 gallons of No. 2 diesel fuel per hour, when operating at full capacity. The pumps are tested approximately one hour per year.

An 160 kW diesel generator is to be utilized for emergency purposes during periods of complete blackout at the station. The generator utilizes No. 2 diesel fuel, and requires approximately 11.0 gallons per hour, when operating at full capacity. This generator is checked by operation for approximately one hour each month. The combustion products normally released in pounds per 1000 gallons of diesel fuel consumed for both the diesel generator and the two diesel fire pumps are given in Table 3.7-1.

of discharge are expected to reach 0.2-0.5 ppm for 2 hours/day when chlorination is necessary.

Assuming that entrainment is nonselective and the distribution of organisms in the water body is homogeneous, then the relative number of organisms withdrawn from the community will be directly proportional to the relative amount of water withdrawn from the river. This assessment of the impact of entrainment on plankton communities in the lower Mississippi River is greatly influenced by the low percentage of river flow expected to be withdrawn by Waterford 3. As described in Section 2.4.2.2, the minimum expected river flow is 100,000 cfs. On a daily basis (see Table 2.4-2), flows of this order of magnitude might occur in any give year. However, sustained flows (i.e., 7 days) of 100,000 cfs occur only about every 36 years based on daily flow duration data obtained from the USGS for the period of record 1942-1976. As noted in Section 2.4, river flows of 200,000 cfs are more representative of average, long term (e.g., monthly) typical low river flow conditions. Therefore, flows of 200,000 cfs are considered to be more representative and probably provide a more realistic basis upon which to estimate impacts during low flow conditions. Nevertheless, the effects of Waterford 3 operation are analyzed for both low 1
flow conditions, herein.

As presented on Figure 2.4-6, minimum river flows in the range of 200,000 cfs and and 100,000 cfs occur most frequently in the summer and fall seasons, respectively. Based on the average seasonal river water temperature and the CWS operating mode (presented in Section 3.4), the Waterford 3 intake withdrawal rate for the summer and fall seasons is 2235 cfs and 1831 cfs respectively. Therefore for the 200,000 cfs river flow condition, only 1.1 percent of the river flow is entrained through the plant and for the 100,000 cfs case, 1.8 percent is entrained. As shown in Table 5.1-8, flows are at a maximum during the spring when most fish spawn. Based on average spring flows (1942-1976), the percentage of river flow and/or organisms entrained would be only 0.30 percent.

5.1.3.1.2.1 Phytoplankton 3

The impact on phytoplankton entrainment in cooling water systems appears to be due principally to temperature increases. Experiments conducted at Indian River in Delaware showed that mechanical effects of entrainment had relatively little effect on Carbon-14 (^{14}C) uptake rates of phytoplankton, which is an indicator of algal productivity. However, thermal elevaton during entrainment greatly influenced ^{14}C uptake[25]. A 11.7°F (6.5°C) ΔT, when ambient temperature were below 71.6°F (22°C), resulted in increased ^{14}C uptake. A similar ΔT, when ambient temperatures were above 71.6°F (22°C), resulted in reduced ^{14}C uptake. 2

At another location (Lake Wylie, North Carolina) where intake temperatures varied from 49°F (9.4°C) to 84° (28.9°C), ΔT's of 10°F, 20°F and 30°F (5.6°C, 11.1°C and 16.7°C) all resulted in decreased ^{14}C intake[26]. In general, productivity tended to decrease when intake temperatures increased. For example, the ratio of the test ^{14}C uptake to the control ^{14}C uptake dropped from 0.76 to 0.35 with increasing intake temperature. Mechanical stresses did not seem to affect ^{14}C uptake. Diatoms, which were the most abundant phytoplankton group in the river 2 at Waterford (see Section 2.2.2.2.1), are generally tolerant to temperatures below 86°F (30°C)[27]. Temperatures greater than 86°F (30°) would be expected to affect diatom productivity adversely. Based on average monthly ambient temperatures, given in Table 2.4-14, and the temperature elevations expected within the Waterford 3 Circulating Water System, water temperatures within the plant would be expected to exceed 86°F (30°C) 50 percent of the time i.e., when ambient river temperatures are greater than or equal to 68°F (20°C). 2

Effects of phytoplankton entrainment on lower Mississippi River energy flow are expected to be insignificant, even if productivity was temporarily depressed during 50 percent of the year in less than 1.3 percent of the river flow. This is due to the following characteristics of the phytoplankton population:

a) Phytoplankton communities in the vicinity of Waterford 3 are not diverse and occur in low density (see Sections 2.2.1.1.2 and 2.2.2.6). 3

b) It appears that detritus is more important than phytoplankton in the lower Mississippi River food chain. (see Section 2.2.2.6) 3

c) Phytoplankton have relatively short generation times. Doubling time for <u>Coscinodiscus</u> sp, for example, is approximately 30 hours at 18°C (64.4°F). and doubling time for <u>Asterionella formosa</u> is 9.6 hours at 20°C (68°F)[28]. Therefore, it is likely that if production is taking place in the river any phytoplankton losses would be compensated for within a short distance of the Waterford 3 discharge. 2

d) The percentage of the total river flow entrained through the plant is low enough that changes in standing crop available to phytoplanktivorous organisms are expected to be inconsequential.

5.1.3.1.2.2 Zooplankton

Studies on the effects of entrainment on zooplankton show variable results. The impact of entrainment on zooplankton at the Connecticut Yankee Plant was primarily a result of thermal effects[29], and it was found that mechanical damage accounted for less than 1 percent of the impact[30]. 2
When discharge water temperatures were above 31.0°C (87.8°F), mortality of the zooplankton was 100 percent[30]. During cooler periods, most of the zooplankton survived. 2
When discharge temperatures at the J M Stuart Station on the Ohio River reached 35-37.2°C (95-99°F), 100 percent of the entrained zooplankton were killed (Milburn as cited in[31]). Studies at Millstone Point Generating Station showed, on the contrary, that 70 percent of entrained copepods were killed by mechanical or hydraulic stresses (Carpenter <u>et al</u>, cited by Marcy[24]). At the Zion Generating Station on Lake Michigan, it was also found that mortality of entrained zooplankton (averaging 8.7 percent) was primarily due to mechanical factors[32]. Cooley[33] found no inhibition of cladoceran feeding after passage through condensers. 2 2 2

If it is assumed that zooplankton entrained in the Waterford 3 Circulating Water System will suffer similar mortalities, 100 percent of the entrained zooplankton would be expected to be killed when discharge temperatures reach 99°F. This would occur when ambient temperatures are 83°F or greater, which would be 25 percent of the year, as indicated in Table 2.4-14. During most of the year, however, mortality of entrained zooplankton would be expected to be lower. The effect of zooplankton entrainment is not expected to be significant for several reasons. Zooplankton samples at Waterford generally show no variation by station (Table 2.2-8) or depth Table 2.2-9), and therefore, entrainment should be proportional to percent of river flow withdrawn. This is expected to be less than 1.3 percent (on an average minimum monthly basis), as shown in Table 5.1-8. In addition, the relatively short generation times of most planktonic invertebrates allow populations to recover rapidly from effects of entrainment. For 2
example, using a test pond, Hall et al[34] estimated that rotifers have a 3-fold turnover per week during summer. Studies conducted under natural conditions indicated relative rates of increase for rotifers of 8 percent per day (Keratella aculeata), and 34 percent per day (Asplanchna pridodonta) (Colditz, 1914, and Ahlstrom 1933, cited by Edmondson).(35) 2
Doubling times for small crustaceans such as copepods and cladocera range from 0.2 to 2 days (Edmondson et al, 1962 and Hall, 1964, cited by Lauer et al[36]). Therefore, effects of zooplankton entrainment by Waterford 3 2
on the lower Mississippi River are anticipated to be noticeable only in the immediate discharge area where densities may be slightly decreased when ambient temperature are above 83°F.

Decapod larvae appear in the river from May to September and are most abundant in June and July. Although larvae were not identified to the generic level during the Environmental Surveillance Program, they were probably river shrimp (Macrobrachium ohione). Summer entrainment is expected to affect an average of only 0.8 percent of the total river volume, even though the volume entrained during summer is the highest of the year. If it is assumed that the distribution of river shrimp larvae is uniform, as the distribution of zooplankton appears to be, the percentage of larvae entrained would be the same as the percentage of the river flow entrained. In Section 2.2.2.3.2 it was indicated that the distribution of zooplankton appeared homogeneous based on statistical analysis of the monitoring program sampling data (Table 2.2-11 and 2.2-12). Thus, the assumption that the percentage of the zooplankton community entrained by Waterford 3 should 1
be equivalent to the percentage of river flow entrained seems reasonable. An entrainment rate of less than 1.0 percent would not be anticipated to affect the river shrimp population significantly in the lower Mississippi River. As described in Section 5.1.3.2.1.2, river shrimp (including those carrying eggs) have been found throughout the lower Mississippi River.

The numbers of drift macroinvertebrates entrained into the Circulating Water System are expected to be extremely low because of the low densities of benthos and the fact that the most common benthic organisms are not generally found in drift communities[37]. Numbers of insect larvae collected in zooplankton samples taken at Waterford were extremely low (see 2
Appendix 2-4).

5.1.3.1.2.3 Ichthyoplankton and Juvenile Fish

Mortality of entrained ichthyoplankton and juvenile fish is generally high.
Mortality from mechanical damage of fish entrained by a plant on the Con-
necticut River has been estimated to be between 72 and 82 percent[38]. Of 2
the fish entrained, clupeids comprised 97.6 percent by number. Other
studies have also found mechanical damage to be the greatest single cause
of entrainment mortality of fish[38]. Mechanical injury, in general, 2
appears to increase with size of organism entrained[38]. However, not
all results are in agreement on the source of entrainment mortality. Kedl
and Coutant[39] found that fluid-induced stresses generated in a conden- 2
ser tube system, simulating that of a steam electric plant, resulted in
minimal mortality of larval fish and _Daphnia_.

Although no studies have specifically examined the effects of entrainment on species present in the Mississippi River at Waterford it can be assumed that mortality would be comparable to that described in other studies. To be conservative, mortality of entrained juvenile fish, eggs and larvae is assumed to be 100 percent in this analysis.

Ichthyoplankton data from the Environmental Surveillance Program indicate
that fish egg and larval densities in the lower Mississippi River main-
stem are low. Data from zooplankton samples collected in 1973-1974 showed
that ichthyoplankton were present in May, June, August and November. In
fact, ichthyoplankton were probably present throughout the period extending
from May through August. In 1974-1975, ichthyoplankton were sampled in
November, February, April and August. Greatest densities were encountered
in August, 1975 (mostly Centrachidae) and November, 1974 (mostly Clupeids)
(0.024 and 0.027/m^3, respectively). The 1975-1976 sampling showed that
ichthyoplankton were present from March through August, with densities
ranging from 0.002/m^3 to 0.1/m^3. The total sample densities of fish
species caught in ichthyoplankton nets from July 1977 to January 1980
generally fell within this range as well. Exceptions were noted in
August 1977 (e.g. freshwater drum - maximum 1.22/m^3); April 1978 3
(e.g. carpsucker - maximum 0.80/m^3; gizzard shad - maximum 2.71/m^3);
and July 1979 (freshwater drum - maximum 0.13/m^3).

Other studies conducted in the lower Mississippi River mainstem reached
similar findings. Although 10 species of ichthyoplankton were commonly
encountered near St Francisville (RM 256-266), only three of these (chubs,
carpsuckers and drum) were confined to the mainstem[40]. Other species 2
were often more abundant in "extra riverine areas"[40] and may have
washed into the mainstem from such habitats. Maximum densities of ichthyo-
plankton in the mainstem near St Francisville were between 50 and 90 fish/
100 m^3, which occurred in areas of greatest turbulence[41]. Life 2
history information presented in Appendix 2-3 suggests that most important
fish species probably spawn largely within shallow backwater areas.

The water withdrawn by the Circulating Water System from April through June
is expected to be approximately 0.3 percent of the average river flow, as
shown in Table 5.1-8. Water withdrawal during average flow conditions in
July and August would account for approximately 0.7 percent of the river
discharge. Since larval fish densities appeared fairly homogeneously dis- 3
tributed throughout the water column in 1973-1976 (see Section 2.2.2.3.4),

the percentage of fish larvae would be estimated to be the same as the percentages given above. The percentage of fish eggs entrained by the Circulating Water System would be expected to be lower than the percentage of water entrained since most of the important species found in the river near Waterford have demersal adhesive eggs. The only exception is the freshwater drum, which has buoyant pelagic eggs. 3

Juvenile fish in the Mississippi River near Waterford would be subject to entrainment in the Circulating Water System when they are an inch or less in length. The smallest fish impinged during February 1976 to January 1977 at Waterford 1 and 2 which have 1/4 inch mesh traveling screens like Waterford 3, were [42]: 2

Gizzard shad	1.2 inches (31 mm)
Threadfin shad	1.1 inches (27 mm)
Blue Catfish	1.0 inch (26 mm)
Freshwater Drum	0.79 inch (20 mm)

Fish smaller than these would be expected to be entrained. The Waterford 3 Environmental Surveillance Program, using trawls, gill nets and electrofishing, revealed only 8 juvenile blue catfish smaller than 30 mm (July 1973). Freshwater drum smaller than 30 mm were collected most abundantly in June 1976, July 1973 and 1976, and September 1973. Gizzard shad smaller than 40 mm as well as threadfin shad smaller than 29 mm were collected most abundantly in July 1973 (Table 2.2-23). 1

During the months of June, July and September, Waterford 3 intake flows will withdraw approximately 0.4-1.0 percent of the total average river flow. As discussed previously, mechanical injury increases with size of entrained fish[38]. Also, the high suspended solids load may further increase mortality of entrained fish by causing abrasion[38]. However, entrainment of fewer than 1 percent of those juveniles present in the Waterford area would occur. This would not be expected to affect the fish population of the lower Mississippi River significantly even if 100 percent mortality of the entrained fish is assumed. As discussed in Section 2.2.2.2.4, the Waterford area is not unique with respect to fish distribution. 2

5.1.3.1.2.4 Cumulative Effects of Entrainment

In order to more completely assess the effect of withdrawal of river water by the Waterford 3 Circulating Water System on the lower Mississippi River plankton and fish populations, the effects of entrainment of Waterford 1 and 2 and Little Gypsy should also be considered. Under typical low flow conditions (200,000 cfs), the relative quantity of river flow withdrawn by the three Waterford units and Little Gypsy would be 2.3 percent if all units were operated at full capacity. Similarly, for the extreme low flow conditions (100,000 cfs), about 4 percent of the river flow would be entrained. This represents an increase of approximately one and one half times the present cumulative entrainment rates during the extreme low flow condition at Waterford 1 and 2 and Little Gypsy. Table 5.1-9 presents the 1 percent of the monthly average river flow predicted to be withdrawn by Waterford 1 and 2 and Waterford 3.

As described in the preceeding sections, the effects of entrainment by the Waterford 3 Circulating Water System on phytoplankton, zooplankton, and ichthyoplankton on the lower Mississippi River ecosystem are expected to be insignificant. The cumulative water withdrawal of Waterford 1 and 2, Waterford 3 and Little Gypsy also appear very low in relation to river flow. The low percentage of river flow withdrawn and the non-uniqueness of the river in the Waterford area (eg, fish spawning is not concentrated in this area in preference to other areas) result in the cumulative effects of entrainment also being insignificant to the lower Mississippi River ecosystem.

5.1.3.2 Effects of Thermal Discharge

The predicted temperature changes which will occur in the lower Mississippi
River as a result of the combined thermal discharges of Waterford 3, Water-
ford 1 and 2 and Little Gypsy, are presented in Table 5.1-4 and Figures 1
5.1-2 through 5.1-11.

The ecological effects of the thermal discharge on the lower Mississippi River ecosystem are expected to be insignificant. This conclusion is based on the following factors: in the Waterford area of the Mississippi River, there are no threatened or endangered aquatic species; the dominant indigenous species present have relatively high thermal tolerances; the habitats characterizing the area are not unique, there is a lack of critical spawning areas; and the thermal plume is basically a surface phenomenon.

5.1.3.2.1 Effects of Thermal Discharge on Phytoplankton Communities

In summer, when average river temperatures are 83-86°F (28.3-30°C), the optimum temperatures of the dominant phytoplankton in the Waterford area, diatoms (see Section 5.1.3.1.2.1), will be exceeded inside the 5°F (2.8°C) isotherm of the plume. Ambient temperatures will be expected to be above 82°F approximately 16 percent of the year. However, travel time through the plume would only be 64 minutes. The generally low densities of phytoplankton and the several factors limiting production (discussed in Section 2.2.2), indicate that this community would not be stressed or changed. Therefore, the impact of thermal discharge on the lower Mississippi River phytoplankton community would not be expected to be significant.

Nuisance species, such as some species of blue-green algae, had low relative
abundance in 1973-1976 (Table 5.1-10). As reported in Section 2.2.2.1
however, blue-green algae were found in higher absolute and relative
abundance in 1977-1980 (Table A2-7.2). Though the reasons for this are
unclear, the difference was reported uniformly above and below the existing 3
Waterford 1 and 2 generating stations. Therefore, presence of the Waterford
1 and 2 discharge plume did not seem to alter phytoplankton growth or com-
munity composition. Similarly, it would not be expected that the addition
of Waterford 3 would affect this composition. The results of the Environ-
mental Surveillance Program have indicated that "algal blooms" in the sense
that blooms are usually construed and noticeable as surface mats or odors 1
variously described as "septic", "fishy", "grassy", etc. have never been

observed. Based on river morphometry, river flows and the areas of high temperature increase and the travel time through the high temperature area of 1 the plume; algal blooms would not be expected. Nevertheless, during extreme 2 low flow conditions (100,000 cfs), phytoplankton doubling time data[28] suggest that travel times through the combined plume created at such times (9 hours through the entire extent of the 3.6°F excess temperature isotherm) might cause a local increase in the productivity of some blue-green algae. In addition it should be noted that the nine hour exposure to these excess temperatures is toward the lower limit of the doubling time range and taking into consideration both the areas affected and the nature of the riverine habitat it is unlikely that a situation where blue-green growths due to the 1 Waterford 3 discharge would create noticeable tastes or odors for downstream users or affect dissolved oxygen concentrations in the plume area. Without the Waterford 3 discharge, the travel time through zones of excess temperature greater than 3.6°F created by the combined thermal plumes (Waterford 1 and 2 and Little Gypsy) during the extreme flow condition is about eight hours. This eight hour travel time is only one hour less than the postulated situation with Waterford 3 operating.

5.1.3.2.2 Zooplankton

Plume temperatures in the immediate vicinity of the discharge (ΔT = 16.1°F, 8.9°C) during the summer would exceed the lethal thresholds of some of the zooplankton species present in the Mississippi near Waterford (Table A2.2.2-1). The average ambient summer temperature within the river is 84.3°F (29.1°C) (Table 5A-8). However, the exposure time of zooplankton to elevated temperatures at 10°F (5.6°C) would be short (less than 30 minutes), and the area within the 10°F (5.6°C) isotherm (which is much larger than the area which would be encompassed by a ΔT of 16.1°F) during summer average flow conditions, for example, comprises a maximum of only 2.2 percent of the cross-sectional area of the river, as shown on Table 5.1-4.

During extreme low flow conditions, the 10°F ΔT isotherm from Waterford 1 and 2 and Little Gypsy occupies a volume conservatively estimated at 2[illegible] acre-feet and a maximum of two percent of the river cross-section. Addition of the Waterford 3 discharge approximately doubles these figures. Cumulative travel times, however, through the greater than 10°F excess temperature zones on the Waterford side of the river, are predicted to be 1 unchanged after the addition of the Waterford 3 discharges (i.e., 2 hours). Therefore, the addition of the Waterford 3 thermal discharges to those presently occurring does not significantly change the thermal impacts on the aquatic community near Waterford.

Zooplankton densities in the lower Mississippi River are low, and many of the species present appear to be washed into the river from other habitats (i.e., backwater areas, sloughs, etc.). Zooplankton productivity in the lower Mississippi River is probably limited (Section 2.2.2.2.2), and the potential effects of any changes in the zooplankton community resulting from thermal discharges are expected to be insignificant.

5.1.3.2.3 Benthic Invertebrates

Benthic invertebrates in most of the Waterford area would not be expected to be affected by the combined thermal plume of Waterford 1 and 2, and Waterford 3 and Little Gypsy since the 3.6°F (2°C) isotherm does not extent deeper than about 11 feet below the surface during average seasonal flow conditions, or abour 14 feet during typical low flow conditions (Table 5A-11). However, the 3.6°F portion of the plume may touch submerged bank areas of a cross-section of the river at Waterford (up to 39,900 ft^2, which represents 1.9 percent of wetted perimeter during average winter and spring flow conditions).

During the typical low flow conditions (200,000 cfs), the 3.6°F (2°C) excess isotherm of the Waterford 1 and 2 thermal plume extends 3 ft (1 m) below the surface of the river and contacts up to 22,187 ft (approximately 1/2 acre) of river bottom. The addition of Waterford 3 will not significantly increase this exposure. During average spring and winter flow conditions, the addition of Waterford 3 will increase the area of bottom in contact with the 3.6°F (2°C) ΔT isotherm by approximately 1 acre.

During the extreme low flow conditions of 100,000 cfs, 2 acres of benthic area on the Waterford shore would be affected by temperatures in excess of 3.6°F above ambient under present conditions (i.e. that affected by the 1
operation of Waterford 1 and 2, and Little Gypsy). Waterford 3 is estimated to increase the total benthic area affected to 2.6 acres. Altogether, this is a very small portion of the available benthic habitat in this area of the Mississippi River.

Densities of benthic macroinvertebrates in the Waterford area were found to be extremely low (Section 2.2.2), and considering the low percentage of wetted perimeter affected, no significant effect of thermal discharge on the benthic community is expected. The dominant benthic taxa collected at the site were Corbicula and oligochaete worms. Corbicula has an upper tolerance of approximately 93.2°F (34°C) (Table A2.2.2-1). Aquatic oligochaetes also generally have high tolerances to environmental stresses[43]. 2
Therefore, no significant effect on these organisms is expected as a result of incorporation of organisms into the discharge plume.

5.1.3.2.4 Pelagic Invertebrates

River shrimp (Macrobrachium ohicne) is the only common commercial shellfish present in the Waterford area; it has an upper temperature tolerance which appears to be about 86°F (39°C) (Table A2.2.2-1). Under average summer seasonal flow conditions, when ambient temperatures are greater than 81°F (27.2°C), temperatures within the 5°F ΔT isotherm will exceed 86°F. Average ambient temperatures are above 81°F about 20 percent of an average year. The 5°F ΔT isotherm would occupy 4.5 percent of the river cross-sectional area during summer average flow conditions, to a maximum depth of 10 feet, comprising 472 acre-feet. Travel time through the maximum length of this isotherm would be approximately 1 hour. At other times of the year, the plume volume exceeding 86°F would naturally be smaller. For example, 3 acre-feet would be affected when the 16.1°F ΔT is superim- 1
posed on ambient temperatures of 69.7°F (Spring), and 450 acre-feet are

affected by the $10^{o}F\ \Delta T$ isotherm if ambient temperatures of $76^{o}F$ and extreme low flows (100,000 cfs) happen to coincide. 1

As indicated in Sections 2.2.2.3.3 and 5.1.3.1.1.2, the Mississippi River near the Waterford site is not unique in terms of habitat for M. ohione. Because the Waterford 3 discharge will affect only a small portion of its habitat, no significant effect on the river shrimp population is expected.

5.1.3.2.5 Fish

5.1.3.2.5.1 Thermal Tolerance

As indicated in Section 2.2.2.4, most of the fish collected during the 1973-1976 Waterford 3 Environmental Surveillance Program were juvenile blue catfish, juvenile gizzard shad, juvenile threadfin shad, juvenile freshwater drum, and striped mullet. Thermal tolerances for these species are presented in table A2.2.2.-1.

During most of the summer, temperatures within the $10^{o}F$ ($5.6^{o}C$) isotherm would be close to but would probably not exceed the lethal thresholds for most of these species, especially given the short exposure time (31 minutes) and possibility of escape. However, when ambient temperatures are above 86^{o} ($30^{o}C$), temperatures within the $10^{o}F\ \Delta T$ isotherm would exceed tolerances of some fish (eg, freshwater drum[44], small gizzard shad). This occurs during 2.5 percent of the year. Nevertheless, a combination of factors would suggest that insignificant damage to juvenile and adult fish would occur as a result of elevated summer temperatures. Principal among these are the small area affected by the $10^{o}F\ \Delta T$ isotherm (2.2 percent of the cross-sectional area), and the fact that the $10^{o}F$ isotherm extends down to a depth of only approximately 7 feet as shown in Table 5A-11. All of the commercial species, as indicated in Section 2.2.2.4.1, are primarily bottom feeders and should not be greatly affected by a surface thermal plume. It is expected that most fish would avoid areas of significantly unfavorable temperature, irrespective of their capabilities to tolerate such elevated temperature for limited time periods. 2

5.1.3.2.5.2 Cold Shock

During the winter months (January, February, March), it would be expected that fish would be attracted to the warm water of the thermal plume. From 1951 through 1978, the average monthly Mississippi River water temperature at the Ninemile Point Generating Station (25.6 miles downstream of the Waterford site) was $45^{o}F$ ($7.2^{o}C$) in January and February, and $51^{o}F$ ($10.6^{o}C$) during December, as given in Table 2.4-14. Minimum temperatures of $39^{o}F$($3.9^{o}C$) and $40^{o}F$ ($4.4^{o}C$) were reported for January and February, respectively. 1

The U S Environmental Protection Agency[45] has developed a graph to estimate allowable winter temperature increases such that cold shock will not occur. The graph is given in Figure 5.1-16. In the immediate vicinity of the Waterford 3 discharge, where ΔT's are about $25^{o}F$ in winter, the potential for cold shock will exist when ambient temperatures are less than $48^{o}F$ (which occurs approximately 20 percent of the year). However, an extremely small volume of water (about 2 acre-feet), would be affected by a 2

ΔT greater than 25°F (13.9°C) and that should preclude extensive cold shock damage should it occur. Gizzard shad, one of the dominant fish species in the Waterford area, would be especially susceptible to cold shock. Table A2.2.2-1 cites a case of the J M Stuart Plant in Ohio where an instantaneous temperature drop from 78°F (25.6°C) to 48°F (8.9°C) was implicated in the death of 7540 fish. Gizzard shad and threadfin shad in the immediate vicinity of the discharge would probably suffer some mortality as a result of shutdown when ambient temperatures are below 48°F. Catfish would be expected to survive a shutdown, although juveniles might theoretically be subject to increased predation in the immediate discharge vicinity (Table A2.2.2-1). Again, the small area involved would eliminate the possibility of a significant number of fish being affected by cold shock.

5.1.3.2.5.3 Effect on Spawning Fish

The Mississippi River in the vicinity of the Waterford 3 site does not provide a habitat suitable for spawning of most fish species. To the extent that sheltered locations are available (including cans, snags, etc), a limited number of catfish may spawn near the Waterford 3 site. Other species that may be capable of spawning in this portion of the river include freshwater drum, gizzard shad, threadfin shad, river carpsucker and skipjack herring, although the spawning habitat appears suboptimal even for these species. This is supported by the low densities of ichthyoplankton taken as part of the Environmental Surveillance Program. Many of the ichthyoplankton found in the area are probably washed out of more favorable spawning habitat in upstream areas.

Except for the freshwater drum, whose eggs are buoyant, those species expected to spawn near the Waterford 3 site have demersal and/or adhesive eggs. Because of the buoyant character of the thermal plume, most eggs are not likely to be exposed (even briefly) to large increases in water temperature if they remain intact in their expected habitat. No significant reduction in the number of adult freshwater drum is expected to result from exposure of younger life stages to the thermal discharge, in view of the low numbers of larvae collected in the river (Section 2.2.2.2.4) and
the high fecundity of the species (approximately 200,000 to 350,000 eggs 2
per female[46]).

5.1.3.2.5.4 Zone of Passage

The predicted extent of the thermal plume from the Little Gypsy and the Waterford 1 and 2, and Waterford 3 discharges for average flow conditions during each of four seasons is given in Table 5.1-4 and Figures 5.1-2 through 5.1-5. These show the 3.6°F (2°C) ΔT surface isotherm encompasses the entire width of the river during average summer and fall flow
conditions. However, the typical low flow cross-sectional profile (Figure 1
5.1-9) indicates that a large zone of passage will exist beneath the plume even during the typical low flow conditions. The depth of the 3.6°F isotherm will extend from approximately 6 to 11 feet during various parts of the year. The isotherm extends deeper in summer and fall than in winter and spring. The zone of passage will represent 90 percent of the river cross-sectional area in fall and 96.6 percent in spring.

Figures 5.1-10 and 11 illustrate the predicted thermal plume cross-sectional profile at river mile 129.2 and 128.5, respectively, for the extreme low flow condition. Each of these figures is based on full load operation of all the power generating units at both the Waterford and Little Gypsy 1
stations. During these rare occasions, (i.e., extreme low flow and all units operating at peak load), the zone of passage at the Little Gypsy - Waterford transect (River Mile 129.2) is conservatively estimated to be approximately 83 percent of the river cross-section.

5.1.3.2.5.5 Discharge Canal

Temperatures in the discharge canal are expected to be greater than or equal to 97°F (36°C) during 22 percent of the year. Extended exposure to such temperature should result in mortality of some species found in the Waterford area if they were confined to the canal. However, the volocity at the distal end of the discharge canal would be approximately 7.6 ft/sec. This velocity would prevent organisms from entering the canal via the river and would thus obviate exposure to lethal temperatures in the canal. The fate of organisms entrained into the Circulating Water System and subsequently through the discharge canal is discussed in Section 5.1.3.1.2.

During January and February, when monthly ambient river temperatures average 46°F (7.8°C), temperatures in the canal will approach 72°F (22.2°C) and velocities at the river end of the canal will be 1.2 to 4.7 fps. These warmer temperatures and lower current velocities could result in fish being attracted to the canal, which, in the event of shutdown, could cause cold shock to fish in the discharge canal. This would be similar to that discussed for the immediate discharge area in Section 5.1.3.2.5.2. That volume affected within the canal (when water levels are not higher than the canal walls) would be 11,124 cubic yards (6.9 acre feet).

5.1.3.2.5.6 Overall Effect of Thermal Plume on Fish Community

As discussed above, discharge temperatures would not be expected to be lethal for most of the fish species found in the Waterford area during most of the year. This excess heat is quickly dissipated in the Mississippi River, and the effect of any impact which may result from the thermal discharge of Waterford 3 would be extremely localized. Furthermore, since the river near the Waterford site is not unique when compared to other portions of the lower Mississippi River and because this area is not known to be critical and/or threatened habitat type for any fish species, the thermal effects of the operation of Waterford 3 are not anticipated to be significant.

5.1.3.3 <u>Subsequent Observations, 1977-1980</u>

Results of recent quarterly sampling (i.e. 1977-1980) reported in Section 2.2.2.3 basically do not change impact predictions formed earlier about Waterford 3. Interpretations are based largely on the apparent resilience 3
of the Waterford area aquatic communities and the small percentage changes in river water withdrawal volumes and discharge volumes and plume area caused by the addition of the increased environmental stresses expected from the operation of Waterford 3.

Parish Water Works District #1 (River Mile 125.1). The surface water users downstream of Waterford 3 are listed in Table 2.1-23.

With approximately 20.5 percent of the land within a five mile radius of Waterford 3 devoted to agriculture, there exist three additional potential routes of internal exposure to man. These routes result from the deposition of radioactive wastes discharged into the atmosphere. The first route is air-grass-milk-man; the second, the air-vegetable-man route; and the third, the air-grass-meat-man route. Statistics indicate a rapid decline of all agriculture except cattle-raising in St. Charles Parish, while agriculture in general has continued to grow in St. John the Baptist Parish. Agricultural uses of land in the Waterford 3 area are described in detail in Section 2.1.3.5.3.

Historically, most crop land in the area has been devoted to sugar cane production. Recently, however, cattle-raising, soybean production, and hay production have increased in importance. The nearest vegetable gardens to the reactor are located in Killona and Montz, and the closest garden 500 square feet or larger is located 0.9 miles from the site in the NE sector as shown in Table 2.1-16. The agricultural activity which occurs on the Waterford 3 site is restricted by terms within the lease, which prohibit cultivation of leafy vegetables. 3 Cattle-raising is becoming an increasingly important pursuit in both St. Charles and St. John the Baptist Parishes. In 1974, 99.8 percent of all cattle in both parishes were beef cattle with those closest to the site being located 0.9 miles out in the NW sector. While the milk cows closest to Waterford 3 are located at 0.9 3 miles in the NW sector according to the June 1979 survey, there were only eight dairy cows in the two parishes in 1974, and no milk has been produced in either parish for commercial consumption since 1959. Section 2.1.3 contains additional description of land uses in the region.

5.2.2 RADIOACTIVITY IN THE ENVIRONMENT

In Section 3.5, the radionuclides discharged in the liquid and gaseous effluents are provided. This section will consider how these effluents are distributed in the environment surrounding the Waterford site. Specifically, estimates have been made for the radionuclide concentration: a) in the water and sediment of the Mississippi River (which receives all Waterford 3's liquid radioactive effluent); b) in the atmosphere around the site; and c) on land areas and vegetation surrounding the plant.

The highest ground level airborne concentrations in the vicinity of the plant have been calculated using meteorological data given in Section 2.3. These concentrations are presented in Table 5.2-1 and occur at the site boundary (0.808 miles) in the NW direction. Estimates of relative concentration (D/Q) for noble gas effluents and relative concentration depleted by deposition for radioiodine and particulate effluents are provided in Table 5.2-2 and 5.2-3, respectively, for a distance extending to 50 miles in each of the 16 sectors of the compass.

The amount of crop land which is irrigated is extremely small (less than 0.02% in St. Charles and St. John the Baptish Parishes); therefore, the concentrations of radionuclides on the ground and in vegetation will be controlled entirely by the deposition of gaseous effluents. These maximum concentrations are also provided in Table 5.2-1 at the same location as the maximum airborne concentrations. Table 5.2-4 provides estimates of the relative deposition (D/Q) for radioiodine and particulate effluents to a distance extending to 50 miles in each of the 16 sectors.

5.2.2.1 Surface Water Models

A simplified approach has been used to predict the transport of liquid radioactive effluents in the Mississippi River. This approach is conservative in that it will overestimate the radiological impact of the normal operation of Waterford 3. Discussions of the basic hydrologic and water use data of the area are provided in Sections 2.1.3 and 2.4.

5.2.2.1.1 Transport Models

Liquid radioactive wastes will be diluted by the Waterford 3 Circulating Water System flow prior to being released to the Mississippi River. Assuming discharge flow rate of 2235 cfs (corresponding to the 4-pump mode of operation, as described in Section 3.4) and the release quantities from Section 3.5, the expected annual average discharge concentrations of radionuclides are presented in Table 5.2-5. Since releases from the various plant processing systems will be on a batch or intermittent basis, peak concentrations have also been calculated and are included in Table 5.2-5. Upon discharge, the plant effluents will be further diluted in the Mississippi River, and an estimate of these diluted concentrations has also been included in Table 5.2-5. A dilution factor of 221 has been calculated using the ratio of the discharge flow to the river flow (for 77 years of record, the average annual flow is 494,000 cfs, as described in Section 2.4.2.2). To calculate the maximum radiological impact, it was assumed that the critical biota, including man, are exposed to discharge concentrations, while the diluted concentrations were used to calculate the integrated population doses.

5.2.2.1.2 Sediment Uptake Models

An estimate of the concentrations of radionuclides in the river sediment was made using the "effective" surface model presented in the Nuclear Regulatory Commission Regulatory Guide 1.109. Column 4 of Table 5.2-5 presents the expected activity of the sediment.

Although radionuclide concentrations in the river sediment have been calculated, no credit has been claimed for concentration reductions of radionuclides in the surface water resulting from sediment uptake.

5.2.2.1.3 Water Use Models

To calculate the radiological impact of liquid effluents from the normal operation of Waterford 3, it has been assumed that the present water use conditions as described in Section 2.1.3, will prevail for the life of the plant. The present use of the Mississippi River is such that any future expected use will have negligible effects on the river's flow characteristics. However, the doses to a theoretical maximally-exposed

TABLE 5.2-1

GASEOUS EFFLUENT CONCENTRATIONS*CONTRIBUTED TO THE BACKGROUND

	Airborne (Ci/m^3)	On Ground (Ci/m^2)	In Vegetation (Ci/kg)	
Kr-85m	2.45(-10)**	-	-	
Kr-85	1.95(-10)	-	-	
Kr-87	6.97(-13)	-	-	
Kr-88	3.49(-12)	-	-	
Xe-131m	2.58(-11)	-	-	
Xe-133m	1.92(-11)	-	-	
Xe-133	2.79(-9)	-	-	
Xe-135	9.41(-12)	-	-	
Xe-138	3.49(-13)	-	-	
I-131	6.62(-15)	1.40(-11)	2.13(-12)	
I-133	5.57(-15)	1.58(-12)	3.59(-13)	
Mn-54	1.64(-15)	1.29(-10)	5.34(-13)	
Fe-59	5.57(-15)	6.54(-12)	1.45(-13)	
Co-58	5.57(-15)	1.03(-10)	1.58(-12)	
Co-60	2.54(-15)	1.10(-9)	8.75(-13)	3
Sr-89	1.18(-16)	1.61(-12)	3.18(-14)	
Sr-90	2.16(-17)	1.78(-11)	8.32(-15)	
Cr-134	1.64(-15)	3.18(-10)	5.43(-13)	
Cr-137	2.72(-15)	2.28(-9)	9.84(-13)	
Ar-41	8.72(-12)	-	-	
C-14	2.79(-12)	3.96(-6)	1.94(-9)	
H-3	3.49(-12)	3.34(-4)	1.65(-8)	

* Concentrations calculated at the site boundary due to routine operation of Waterford 3.

$\chi/Q = 1.10 \times 10^{-5}\ sec/m^3$

$D/Q = 2.30 \times 10^{-8}/m^2$

** ( ) Denotes power of 10

TABLE 5.2-9

COMPLIANCE WITH 10CFR50, APPENDIX I

Type of Dose	Appendix I Guidelines	Waterford 3 Calculated Exposure	
A. LIQUID EFFLUENTS			
Dose to whole body (mrem/yr) from all pathways	3	1.4(-1)*	
Dose to any organ (mrem/yr) from all pathways	10	4.1(-1)	
B. GASEOUS EFFLUENTS			
Gamma air dose (mrad/yr)	10	1.1	
Beta air dose (mrad/yr)	20	3.4	
Dose to whole body (mrem/yr) of an individual	5	6.3(-1)	
Dose to skin of an (mrem/yr) individual	15	1.9	3
Radioiodines and particulates released to the atmosphere (ci/yr)	1	8.0(-2)	
Resulting dose to any organ (mrem/yr) from all pathways	15	9.1	

*( ) Denotes power of 10.

5.4 EFFECTS OF SANITARY WASTE DISCHARGE

5.4.1 INTRODUCTION

The sanitary wastes from Waterford 3 are treated in a factory-fabricated, package-type extended aeration treatment plants, which are described in 3
Section 3.7. These plants will achieve 85 to 90 percent removal of BOD_5 and suspended solids. The effluent will meet Environmental Protection Agency criteria.

5.4.2 MIXING AND DILUTION

The plant effluents from the station sewage treatment plant flows to the waste collection basin of Waterford 1 and 2, where it is mixed with other wastes. The total wastewater then undergoes treatment described in Section 3.6. The treated waste is released to the Waterford 1 and 2 circulating water which is then discharged to the Mississippi River. The effluent from the Administration Building sewage treatment plant and the auxiliary office 3
trailer treatment plant flow by gravity (via the site drainage system) to the 40 Arpent Canal.

5.4.3 IMPACTS ON THE WATER QUALITY OF THE MISSISSIPPI RIVER

Of the three sewage treatment plants the effluent from only the station sewage treatment plant discharges to the Mississippi River.

The concentration of BOD_5 in the effluent of all three treatment plants will be less than 45 ppm and 30 ppm for the seven consecutive day average and the thirty consecutive day average, respectively. Suspended solids will also be present in the effluent at the same concentrations. The 3
increase in the concentration of these pollutants in the Waterford 1 and 2 circulating water due to the station sewage treatment plant has been estimated to be approximately 4.7×10^{-4} ppm each (Table 3.6-2) which is below the limit of detection. Dilution in the river will further reduce this concentration. No short term or long term effects on the water quality of the Mississippi River are expected from the release of sanitary wastes.

6.1 PREOPERATIONAL ENVIRONMENTAL PROGRAM

6.1.1 SURFACE WATERS

The operation of Waterford 3 necessitates the discharge of various liquid wastes to the Mississippi River. All liquid wastes generated are released to the river through the discharge canals of the Circulating Water Systems of either Waterford 1 and 2 or Waterford 3. The wastes to be discharged, as well as the treatment processes they undergo, are discussed in Sections 3.5, 3.6, and 3.7. The physical and chemical changes that could occur in the Mississippi River in the vicinity of the Waterford site, and could affect aquatic life inhabiting this portion of the river, are described in Section 5.1, 5.3 and 5.4. Therefore, a Preoperational Environmental Surveillance Program of the Mississippi River is being undertaken to establish the physical, chemical, and biological conditions in the river prior to the operation of Waterford 3. The information gathered from this surveillance program will provide a basis for both establishing the effects to the Mississippi River which are a result of the operation of Waterford 3, as well as estimating their magnitude and significance.

The Preoperational Environmental Surveillance Program of surface waters consists of two basic portions: first, a program to establish the present level of selected physical and chemical parameters in the waters of the Mississippi; and second, a program to determine the present ecological conditions of the river.

To facilitate analysis, both programs share a set of common sampling stations. Because the discharge canal of Waterford 3 is located at River Mile 129.4 on the west bank (right descending), and the discharge canal of Waterford 1 and 2 is located at River Mile 129.8 on the west bank, five stations have been selected between River Miles 126 and 132 in order to establish conditions in the river both upriver and downriver of the point where Waterford 3 will discharge its wastes. Table 6.1.1-1 identifies the sampling stations, gives their location, and discusses the rationale for their selection. Figure 6.1.1-1 locates the sampling stations on a map of the Mississippi River in the vicinity of Waterford 3. Figure 6.1.1-1 also summarizes the biological and water chemistry sampling activities undertaken at each station.

In addition to these stations, two other stations were established to continuously monitor certain physical and chemical parameters. These stations are shown in Figure 6.1.1-2.

6.1.1.1 Physical and Chemical Parameters

The present physical and chemical parameters of the Mississippi River are being established by a three-part program. Sampling of an extensive variety of chemical constituents is being undertaken in a program of monthly and seasonal sampling from the stations identified in Figure 6.1.1-1, selected parameters are being sampled in a program of continuous water quality monitoring, and hydrographic surveys are being conducted to provide detailed data on the temperature distribution in the Mississippi River.

6.1.1.1.1 Monthly and Seasonal Water Quality Monitoring

a) Sampling Schedule

Because Waterford 1 and 2 and Waterford 3 are located adjacent to each other, and are becoming operational at different times, an extended sampling program is being conducted both to separate the effects of Waterford 1 and 2 from Waterford 3 and provide a basis to determine their interaction. In order to accomplish this objective, the Preoperational Environmental Surveillance Program utilizes the following schedule and frequency of water quality sampling:

1973-74: Monthly sampling to collect data prior to the operation of Waterford 1 and 2, and Waterford 3.

1974-75: Six seasonal samplings to provide continuity of information.

1975: Waterford 1 and 2 completed and begin commercial operation.

1975-76: Monthly sampling to assess the effects of Waterford 1 and 2, and establish a base-line condition of water quality prior to the operation of Waterford 3.

1976-80: Four seasonal samplings per year to provide continuity | 1
of information prior to the start-up of Waterford 3.

1981-82: Monthly sampling for one year immediately prior to | 3
the operation of Waterford 3.

The actual sampling dates for the first three years of the program (1973 to 1976) are given in Table 6.1.1-2.

This sampling schedule will provide both extensive information on the physical and chemical properties of the Mississippi River from the three years of monthly sampling, and provide a better understanding of the seasonal variations due to the seasonal sampling.

b) Parameters Sampled

The selection of the physical and chemical parameters to be sampled was responsive to criteria established by the expected waste constituents of the discharges from Waterford 3, the requirements of various government permits and regulations, and known or suspected pollutants found in the Mississippi River which may hold potential for interaction with the discharges of Waterford 3.

samples are shown in Table 6.1.1-7.

Benthic data gathered with a No.80 sieve were verifiable for all three sampling years, as shown in Table 6.1.1-8. The great majority of the benthic data obtained with the larger meshed sieves (Nos. 30 and 10) was found to be verifiable for Years I and II of the Environmental Surveillance Program. Year III data, beginning in November 1975, were not verifiable, and consequently were not used in quantitative interpretations of the data. The number of verifiable data points is shown in Table 6.1.1-9, and the aquatic biological data, as a whole, are contained in Appendix 2-4.

The three years of sampling during the Environmental Surveillance Program provided a substantial data base from which to develop the thorough description of the aquatic community in the Mississippi River, as discussed in Section 2.2.2 and to complete the assessment of the aquatic biological effects of the operation of Waterford 3, contained in Section 5.1.3. The continuation of the Preoperational Environmental Surveillance Program with three additional years of seasonal sampling and one additional year of monthly sampling, as described in Section 6.1.1.2.4, will significantly enlarge this data base. The total data from seven years of sampling will then be available, prior to the operation of Waterford 3, for refinement of the analyses contained in this Environmental Report, for determining the sensitivity of the analyses to the deletion of unverifiable data, and for providing a firmly established baseline of aquatic information upon which to evaluate the biological data gathered following the start of operation of Waterford 3.

6.1.1.2.3 Impingement Study at Waterford 1 and 2

In order to determine which species would be subject to impingement at Waterford 3 and to develop a first approximation of numbers and biomass of organisms which might be impinged there, a screen wash study was conducted at Waterford 1 and 2, which are operative. The study was done from February 1976 to January 1977. It involved semi-monthly monitoring at the intake screening structures of Waterford 1 and 2.

A 24-hour period was sampled on each sampling date. The screens were rotated, washed and cleared at the outset of each period. Baskets were then placed in series within the sluiceway carrying impinged organisms back to the waterbody, as shown in Figure 6.1.1-4. Two 1/4" expanded metal baskets were placed closest to the screens; a 1/2" hardware cloth basket was placed behind them as a backup. Collections were made when one or more screens were in operation during the 24-hour sampling period.

All organisms collected during each sampling period were identified to species level, except when the organism's physical condition precluded identification. Physical injuries were noted. All fish and crustaceans were individually weighed and measured, with the exception of some bay anchovy and river shrimp samples. These were subsampled; i.e., measurements were taken on 25 randomly selected individuals. Total weights were computed for all species. Weights were measured on an O Haus Dial-O-Gram balance, with a precision of $\pm$ 0.1 gram.

Lengths of organisms were measured to the nearest millimeter. Fish were measured in standard length; shrimp were measured from the tip of the rostrum to the tip of the telson; blue crab were measured by the carapace width. 2

During the sampling periods, physical and chemical data were collected from the Unit 1 West and the Unit 2 East intake pump screen wells at approximately six-hour intervals. Dissolved oxygen, water temperature and conductivity were measured in situ. Water samples were collected from the appropriate wells, and pH was measured within 30 minutes of sample collection.

6.1.1.2.4 Methodology of Sampling - Program Continuation (1977-1982) 3

For the period 1977 through the first half of 1980, the seasonal sampling surveys for the Environmental Surveillance Program of the aquatic ecology of the Mississippi River utilized essentially the same sampling locations, techniques, and methodologies that are described above. However, the Seasonal Sampling Program was slightly modified in 1977 to comply more closely with the sampling program described in Supplement 6 to the Construction Permit Environmental Report for Waterford 3, which has been accepted by the Nuclear Regulatory Commission. These minor modifications are detailed in Appendix 6-2, included in this Environmental Report.

In addition, prior to the initiation of the monthly sampling surveys for the year preceding the fuel load date (see Section 6.1.1.1.1), a re-evaluation of the program sampling methods and materials was performed to investigate their utility in obtaining the desired baseline information on the river's aquatic ecology. This investigation has resulted in the revisions to various portions of the program. The purpose of these revisions is to improve the sampling program by obtaining more meaningful and representative data. Specifically, the revisions result in the following improvements: 2

- Modifying sampling techniques and replications to reduce the large variability and/or redundancy in measurements from the previous program;
- More effectively observe natural seasonal trends;
- Adjust sampling frequencies to be commensurate with the probable level of impact expected; and
- Incorporate improved sampling techniques which are more suitable for the physical conditions of the Mississippi River.

The revisions have been submitted to the Nuclear Regulatory Commission for review and comment. The revised program specification is presented in Appendix 6-3, included in this Environmental Report.

projections using the reported growth factors for each mode of travel were summed and presented in tabular form (see Table 2.1-8). For highway related activity, a vehicle occupancy factor of 1.5 was used to produce total traffic on the highway network[25], and for vehicles on ferries, a 1.79 occupancy factor was used[28].

Industrial Employment

Industrial employment within 10 miles of Waterford 3 was estimated for 1977 from information provided by industries in the area, which are listed in Section 2.1.2.3. Industrial employment shown in Table 2.1-9 includes only the peak number of workers on a plant site at any given time, which in most cases is during the day shift.

The number of workers was allocated to annular sectors by superimposing a diagram of annular sectors over a base map showing the developed industrial properties. This allocation is given in Figure 2.1-11. Where a property was overlain by two or more annular sectors, the employment numbers were divided among the annular sectors according to the proportion of the industrial property in each.

Future industrial employment was projected as follows:

a) The 1977 industrial employment was divided according to categories utilized by the U.S. Department of Commerce, Bureau of Economic Analysis[30]. The categories used in this projection were the following:

   1) Chemical and Allied Products,

   2) Petroleum Refining,

   3) Food and Kindred Products, and

   4) Paper and Allied Products.

b) Growth rates for each of the above industrial employment categories were projected to 2030 by analyzing regional projections by the U.S. Department of Commerce[30], and projections prepared for the Louisiana Offshore Oil Port (LOOP) environmental impact assessment[31]. Where these sources disagreed, an average growth rate figure was utilized.

c) Known future expansions for each industry, derived by surveys of the companies involved, were added to 1977 employment figures.

d) Growth rates arrived at in Step "b" were applied to 1977 employment totals to arrive at projected employment for each projection year (1980, 1981, 1990, 2000, 2010, 2020 and 2030). Known future expansion totals from Step "c" for each industry were compared with these projections and the higher total was utilized.

e) Projected employment by industries was allocated to annular sectors as follows:

Section 2.1.3.5.2. Undeveloped portions of existing industrial properties were also included on this map.

2) The annular sector grid was placed over the map of industrial sites developed above. Projected industrial employment was apportioned according to the percentage of all available undeveloped industrial land falling within each annular sector. The following assumptions were made in this apportionment:

   (a) Known expansions of employment would be allocated to the appropriate developed industrial property;

   (b) Incremental employment projections above known expansions were allocated evenly to all undeveloped industrial properties; and

   (c) Those portions of undeveloped industrial tracts including wetlands would remain undeveloped.

6.1.4.3 Ecological Parameters

To gather information on the terrestrial ecology of the Waterford 3 site area, a terrestrial ecology portion of the Environmental Survelliance Program for Waterford 3 was undertaken. The program consists of two phases. Phase One was conducted between April 1973 and August 1976 and it studied the "batture", the area between the Mississippi River and the manmade levee, on a seasonal basis. At this time, it was considered important to study the batture because it is the closest area to Waterford 3 which is not being disturbed by agriculture. Supplement Number 6 to the Construction Permit Environmental Report, dated December 6, 1973, confined the intensive terrestrial ecology sampling to the batture area.

Phase Two of the terrestrial ecology portion of the Environmental Surveillance Program expanded the program to include additional onsite areas which may be affected by the operation of Waterford 3. The Phase Two program specifications, which were prepared by the LP&L in 1979 and subsequently approved by the NRC, improved program sampling procedures by incorporating knowledge gained from site specific Phase One sampling for the purppose of obtaining more information on the terrestrial ecology of the site. Phase Two of this program was initiated in 1979 and continued through the 1981 surveys. 3

The following sections describe the Phase One and Phase Two program survey methodologies on a flora and fauna basis.

6.1.4.3.1 Floral Community 3

a) Phase One Survey Methodology

Six plant communities are located within the batture: grass (levee), pasture, abandoned field, immature willow, mature willow, and riverfront hardwood. Ground surveys were conducted to obtain information concerning the vegatative composition of the various communities in the area, to acquire knowledge of the different stages of ecological plant succession present in the terrestrial site, and to aid in the preparation of a vegetation map of the study area.

The vegatation surveys consisted of general walk-through and systematic transect lines, that run in a north-south direction. The location of the transect lines is given in Figure 6.1.4-2. Nested plots were located along the transect lines at specified distances, determined by pacing, to sample both overstory and understory plant species. The first sampling plot was established by using two forester's chains (a forester's chain equals 66 feet) from the starting point of each transect line, and every plot thereafter was situated five chains apart. Species occurring within the plots were recorded, and any additional plants that did not occur in the plots, but were observed within the area, were also tallied. Overstory species were sampled by using one-quarter acre circular plots, with a radius of 58.9 feet, and understory plants were examined by using plots with a radius of 3.7 feet. Where possible, plants were identified in the field. Where this was not possible, a specimen was brought back to the laboratory and identified through the use of a suitable key.

The vegetation surveys were used in combination with recent topographical maps to construct a vegetation map of the batture for each year of sampling. Ground surveys of the vegetation types, the vegetation maps, and a review of available literature sources assisted in determining the different stages of plant succession in the study area. Soil characteristics and species composition were some additional factors considered in defining the successional stages of the vegatation types.

b) Phase Two Survey Methodology

The purpose of the Phase Two vegetation sampling effort is to monitor changes in floral composition of major habitat types and occurrences of vegetation damage possibly related to facility construction or operation. An evaluation of the station's expected impacts on the terrestrial ecology of the site revealed that a potential impact could arise from alteration of drainage patterns. The swamp forest communities were determined to be the most likely areas to be impacted by water drainage alteration. In addition to its relatively higher potential for impact, the swamp forest community and its transition zone were considered appropriate for vegetation monitoring since this community provided greater wildlife habitat diversity, 3
was less disturbed than other site community types, including the batture, and by virtue of being a wetland was a community of particular ecological significance. To maintain continuity between Phase One and Phase Two of this program, the batture area is also monitored as a part of the Phase Two activities.

Vegetation data were recorded during the fall from thirteen, 1 x 10 meter, quadrats which are designated as quadrats A through M as shown on Figure 6.1.4-3. Each quadrat was marked with plastic flagging in the field. Quadrats A and B were established in representative communities of the batture. Quadrat A was established in a young-growth willow stand, and quadrat B in a mixture of sugarberry (Celtis laevigata), sycamore (Platanus occidentalis) and ash (Fraxinus pennsylvanica). Ten quadrats, denoted as C through L, were established in forest habitat along two transects of five each. Transects C through L generally followed a northeast - southwest course, with the northeast termini located in bottomland and hardwoods forest and the southwestern in portions of cypress-gum swamp. A segment of the eastern transect utilized an old spoil bank. One quadrat, M, was located in a representative area of wax myrtle (Myrica cerifera) thicket, a seral community type characteristic of abandoned agricultural lands.

In each 1 x 10 meter plot, observations of cover/abundance were recorded separately for herbaceous and shrub strata. Canopy stratum in the plot vicinity was generally characterized by noting species presence. Cover values estimated for the shrub stratum were limited to woody individuals and both woody and non-woody vines extending 2m or less above the ground surface. The herbaceous stratum included all herbaceous species and woody individuals less than 50 cm tall. Cover/abundance classes utilized were adapted from Mueller-Dombois and Ellenberg(32). In addition to data collected from plots, general observations were recorded along transects noted in Figure 6.1.4-3. Pertinent information included; characteristic or important species of each stratum; plant damage (insect attack, premature senescence, etc.); and location of edges of transitions between vegetation communities. Flowering specimens of species found within plots were collected from areas near the sample plots. In addition, specimens of species of unknown or questionable identity were also collected for subsequent identification. Specimens were collected during May. Plant nomenclature followed that of Radford et al(33). 3

6.1.4.3.2 Faunal Community

a) Phase One Survey Methodology 3

Various techniques were employed to determine and sample the terrestrial animals present in the Phase One batture analysis.

i) Amphibians

The primary method used in sampling amphibians was that of hand collecting. During these periods, logs or other ground cover were turned with the aid of potato rakes and carefully checked. At least one and one-half hours were devoted to collecting each morning.

Undisturbed one-quarter acre herpetological plots, shown in Figure 6.1.4-2, were established during the survey periods to gain some estimate of the abundance of the various species. These plots were surveyed by the methods described above.

Other survey techniques included monitoring the calls of frogs and toads at night during the breeding season to identify and count species; driving the roads of the area after sundown and collecting any amphibians seen; and using spot lights at night to scan ditches, stream banks, and the edges of ponds.

ii) Reptiles

Surveys of reptiles were performed in conjunction with amphibian surveys. Most of the same techniques used to sample amphibians were also used for reptiles. Hand collecting was the primary technique used and the same one-quarter acre herpetological plots were used to determine abundance of various reptiles. In addition, wherever possible, turtles were collected using baited turtle nets placed in streams and ponds of the area.

iii) Birds

Bird surveys were made primarily through field identification, using both binoculars and mist nets for specimen collection. Walking transects were run through the study area during each survey period and all birds observed were tallied by species and number. In some instances, where field identifications were uncertain or impossible, specimens were collected, positive identifications made, and the specimens preserved.

During each survey period, a minimun of five 40 ft x 7 ft nylon nets with 1 1/4 inch mesh were strung either on aluminum poles or between the tops of two trees to capture birds, in locations shown on Figure 6.1.4-2. Two or three times daily, the nets were checked, and any birds caught were tallied and released.

iv) Small Mammals

Small mammals were sampled in a number of ways. Snap traps were used for small mammals such as mice and shrews. During each sampling effort, 99 Museum Special Traps, which are traps with very sensitive triggers, and 10-15 rat traps were utilized. These traps were baited and arranged in two ways: (1) a line consisting of 50 Museum Special Traps set at 20-foot intervals and marked by survey flags; and (2) saturation of a one-half acre square with 49 Museum Specials set in seven rows of seven traps and spaced at approximately 25-foot intervals. The line permitted the sampling of as much area as possible, while the saturated square facilitated the determination of population levels by selective trapping of small mammals within the one-half acre area. All traps were checked daily and catches were identified and recorded. Special note was made of the number and species of those mammals caught, and on which row of the saturated square each was caught.

v) Large Mammals

Large mammals were surveyed through sightings, trapping, and observation of tracks. Although sightings were occasionally made during the day, this sampling method was most effective at night, since most large mammals are primarily nocturnal. Night sampling was facilitated by a high-intensity spotlight. The trapping technique involved the use of single and double spring steel traps. These were used because their performance was found to be far superior to live traps. Whenever possible, sets were made in areas where animal activity was believed to be high. In areas where activity was low, bait or scent was used to attract animals to the traps. Tracks and other signs of large mammals were also used to determine presence and abundance of species. A minimum of one hour was spent each day searching for tracks. On the basis of these observations, species identifications were made and the numbers of animals were estimated. In several cases, tracks and other signs were the only indications of the presence of certain species within the area.

b) Phase Two Survey Methodology

The Phase Two terrestrial faunal monitoring program, conducted during February and May, assessed impacts of facility development and operation on the distribution and relative abundance of important species on the Waterford site. Impacts, both adverse and beneficial, on resident migratory and breeding vertebrate populations brought about by habitat modification, disturbance, or enhancement were assessed. Assessments of potential impacts are particularly directed at changes in diversity and overall wildlife production potential.

Terrestrial survey routes were established in the riparian forest, agricultural, and swamp forest areas and a boat survey route was established along the canals bordering the swamp forest as shown on Figure 6.1.4-3. One river observation point was also established south of the intake structure. 3
At least two surveys were conducted each season in each major habitat type; swamp forest, riparian forest (batture area), and agricultural. During the terrestrial survey the number and identity of all species encountered were recorded. During the boat surveys only waterfowl, wading birds, and raptors were enumerated since engine noise drowned out small birds' vocalizations.

The relative abundance of each species of bird was calculated for each habitat type. Occurrence of mammals, reptiles and amphibians were recorded by habitat type. Assessments were based on yearly changes in species composition within the habitat types.

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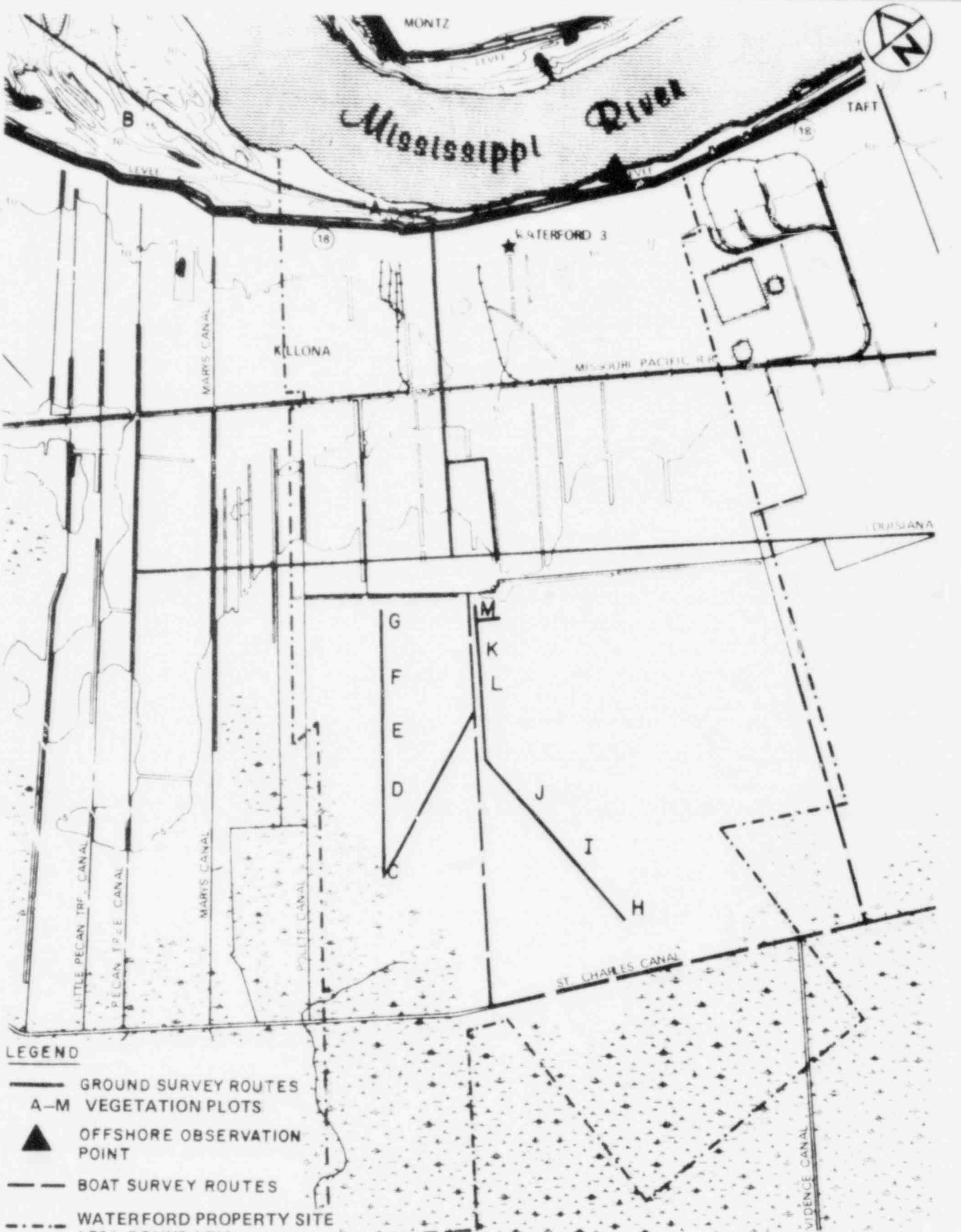

AMENDMENT NO. 3 (8/81)

LOUISIANA POWER & LIGHT CO. Waterford Steam Electric Station	TERRESTRIAL ECOLOGY MONITORING SURVEY ROUTES	Figure 6.1.4–3

TABLE 6.1.5-5

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
1	W-3	Composite Surface River Water	^{3}H, γ spectral analyses.	^{3}H composite quarterly, γ spectral monthly.	Homogenous 4 liter sample from composite sampler.	1 (1000 m downstream of Waterford 3 discharge)
2	W-4	Composite Surface River Water	^{3}H, γ spectral analyses.	^{3}H composite quarterly, γ spectral monthly.	Homogenous 4 liter sample from composite sampler.	1 (2000 m upstream of Waterford 3 discharge)
3	W-7	Composite Drinking River Water	^{3}H, γ spectral ^{131}I, gross β	^{3}H composite quarterly, γ spectral monthly, ^{131}I semi-monthly gross monthly	Homogenous 2 liter sample semi-monthly Homogenous 4 liter monthly	1 (2 mi downstream of Waterford 3 discharge)
4	W-8	Composite Drinking River Water	^{3}H, γ spectral ^{131}I, gross β	^{3}H composite quarterly, spectral monthly, ^{131}I semi-monthly gross β monthly	Homogenous 2 liter sample semi-monthly Homogenous 4 liter monthly	1 (7.5 mi SE of Plant)
5	W-3	Shoreline Sediment	γ spectral	Semi-annual	2Kg	1 (1000 m downstream of Waterford 3 discharge)
6	W-4	Shoreline Sediment	γ spectral	Semi-annual	2Kg	1 (2000 m upstream of Waterford 3 discharge)

3

TABLE 6.1.5-[illegible] (Sheet 2 of 8)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
7	W-3	Suspended Sediment	γ spectral	Quarterly Composite	Suspended sediment from one month (4 liters) composite sampler	1 (1000 m downstream of Waterford 3 discharge)
8	W-4	Suspended Sediment	γ spectral	Quarterly Composite	Suspended sediment from one month (4 liters) composite sampler	1 (2000 m downstream of Waterford 3 discharge)
9	W-3	*Fish (separated by two major species)	γ spectral	Semi-annual	500 grams	1 sample of each species
10	W-4	*Fish (separated by two major species)	γ spectral	Semi-annual	500 grams	1 sample of each species
11	F-1	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (ESE of plant in 230 KV substation for Hooker Chemical)
12	G-8	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (SE of plant and presently called A-1)
13	N-1	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (WNW of plant)

3

TABLE 6.1.5-5

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
14	O-1	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (NW of plant and presently called A-15)
15	O-50	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (NW of plant and presently called A-17)
16	P-1	Air particulates & air iodine	Gross β, γ spectral, Iodine 131	Weekly Gross β (particulates) and air iodine, γ spectral on quarterly particulates composite.	10,000 ft^3/week, 130,000 ft^3/qtr.	1 (NW of plant and presently called A-15)
17	A-1	TLD	TLD	Quarterly	N.A.	2 (1.2 mi N of plant)
18	B-1	TLD	TLD	Quarterly	N.A.	2 (0.75 mi NNE of plant)
19	C-1	TLD	TLD	Quarterly	N.A.	2 (0.8 mi NE of plant)
20	D-1	TLD	TLD	Quarterly	N.A.	2 (0.2 mi ENE of plant)
21	E-1	TLD	TLD	Quarterly	N.A.	2 (0.2 mi E of plant)
22	F-1	TLD	TLD	Quarterly	N.A.	2 (1.1 mi ESE of plant)

3

TABLE 6.1.5-5

(Sheet 4 of 8)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
23	G-1	TLD	TLD	Quarterly	N.A.	2 (approximately 1 mi SE of plant)
24	H-1	TLD	TLD	Quarterly	N.A.	2 (1.5 mi SSE of plant)
25	I-1	TLD	TLD	Quarterly	N.A.	2 (1.5 mi S of plant)
26	J-1	TLD	TLD	Quarterly	N.A.	2 (0.9 mi WSW of plant)
27	K-1	TLD	TLD	Quarterly	N.A.	2 (1.0 mi SW of plant)
28	L-1	TLD	TLD	Quarterly	N.A.	2 (0.7 mi WSW of plant)
29	M-1	TLD	TLD	Quarterly	N.A.	2 (1.3 mi W of plant)
30	N-1	TLD	TLD	Quarterly	N.A.	2 (0.8 mi WNW of plant)
31	O-1	TLD	TLD	Quarterly	N.A.	2 (0.8 mi NW of plant)
32	P-1	TLD	TLD	Quarterly	N.A.	2 (0.5 mi NNW of plant)
33	A-5	TLD	TLD	Quarterly	N.A.	2 (4.5 mi N of plant)
34	B-4	TLD	TLD	Quarterly	N.A.	2 (3.75 mi NNE of plant)

3

TABLE 6.1.5-5

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
35	C-5	TLD	TLD	Quarterly	N.A.	2 (4-5 mi NE of plant)
36	D-4	TLD	TLD	Quarterly	N.A.	2 (4.0 mi ENE of plant)
37	E-4	TLD	TLD	Quarterly	N.A.	2 (4.2 mi E of plant and presently called (A-14)
38	F-4	TLD	TLD	Quarterly	N.A.	2 (3.5 mi ESE of plant)
39	G-3	TLD	TLD	Quarterly	N.A.	2 (3.0 mi SE of plant)
40	H-5	TLD	TLD	Quarterly	N.A.	2 (4-5 mi SSE of plant)
41	N-6	TLD	TLD	Quarterly	N.A.	2 (5.6 mi WNW of plant)
42	O-6	TLD	TLD	Quarterly	N.A.	2 (5.7 mi NW of plant and presently called A-18)
43	P-6	TLD	TLD	Quarterly	N.A.	2 (5.3 mi NNW of plant and presently called A-13)
44	E-10	TLD	TLD	Quarterly	N.A.	2 (10 mi or greater, E of plant)

3

TABLE 6.1.5-5

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	# OF SAMPLES VOLUME	(GENERAL LOCATION)
45	F-10	TLD	TLD	Quarterly	N.A.	2 (10 mi or greater, E of plant)
46	G-8	TLD	TLD	Quarterly	N.A.	2 (8.1 mi SE of plant and presently called A-11)
47	I-12	TLD	TLD	Quarterly	N.A.	2 (12 mi S of plant and presently called A-12)
48	O-50	TLD	TLD	Quarterly	N.A.	2 (approximately 50 mi NW of plant and presently called A-17)
49	O-1	Cow Milk	^{131}I, γ spectral available (when on pasture) & monthly at other times.	Semi-monthly as available (when on pasture) & monthly at other times.	4 liters	1 (Cow @ 0.8 mi NW of plant)
50	C-1	Cow Milk	^{131}I, γ spectral	Semi-monthly as available (when on pasture) & monthly at other times.	4 liters	1 (Cow @ 1.3 mi NE of plant)
51	O-50	Cow Milk	^{131}I, γ spectral	Semi-monthly as available (when on pasture) & monthly at other times.	4 liters	1 (Cow 50 mi NW at Baton Rouge)

3

TABLE 6.1.5-5 (Sheet 7 of 8)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
52	O-6	Cow Milk	^{131}I, γ spectral	Semi-monthly as available (when on pasture) & monthly at other times.	4 liters	1 (Cow 5.7 mi NW of plant)
53	O-1	Grass	^{131}I, γ spectral	Collected when cow milk not available	3Kg	1 (0.8 mi NW of plant)
54	C-1	Grass	^{131}I, γ spectral	Collected when cow milk not available	3Kg	1 (1.3 mi NE of plant)
55	O-50	Grass	^{131}I, γ spectral	Collected when cow milk not available	3Kg	1 (50 mi NW of plant)
56	O-6	Grass	^{131}I, γ spectral	Collected when cow milk not available	3Kg	1 (5.7 mi NW of plant)
57	O-1	Food Products	γ spectral	*At time of harvest one sample of each of the following classes of food products 1______ 2______ 3______	3Kg	1 (0.8 mi NW of plant)
58	E-1	Food Products	γ spectral	* At time of harvest one sample of each of the following classes of food products 1______ 2______ 3______	3Kg	1 (0.2 mi E of plant)

3

TABLE 6.1.5-5 (Sheet 8 of 8)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

No.	Location	SAMPLE TYPE	ANALYSIS	FREQUENCY	VOLUME	# OF SAMPLES (GENERAL LOCATION)
59	C-1	Food Products	γ spectral	* At time of harvest one sample of each of the following classes of food products 1______ 2______ 3______	3Kg	1 (1.3 mi NE of plant)
60	GW-1	Ground Water	^3H, γ spectral	Quarterly	4liter	1 (Riverside of plant)
61	GW-2	Ground Water	^3H, γ spectral	Quarterly	4liter	1 (Lakeside of plant)

3

*These three slots have been left blank (just as NUREG-0472 has presented) and samples should be determined with respect to consumption and availability. The three food products presently suggested include turnip greens, sugar cane, and soy beans.

8.1 BENEFITS

This section describes the social and economic benefits associated with the operation of Waterford 3. The benefits and costs of alternative sites, generating units, and waste management processes, are discussed in detail in the Construction Permit Environmental Report for Waterford 3.

NRC Regulatory Guide 4.2 R2(1976) categorizes benefits as either primary (direct) or secondary (indirect). Primary benefits derived from Waterford 3 include the expected average annual generation of electricity, customer savings due to the commencement of commercial operation in 1983, reduction of LP&L's reliance on expensive fossil fuels and the enhancement of greater system reliability. Secondary benefits of the operation of Waterford 3 will include tax revenues generated, increased employment opportunities, increased regional income and increased knowledge of the environment as a 2
result of research and monitoring.

The productive life of Waterford 3 is 40 years. For the purposes of this chapter, all monetary values from 1975 to 1982 are expressed in current dollars for the specific year while monetary values for 1983 to 2023, are discounted to 1983 dollars by a 2.02 percent discount rate. This discount rate is based on LP&L's 1980 capital structure and the rates of return for long term debt, common equity and preferred stock, resulting in a weighted cost of capital of 11.43 percent. The inflation factor has been removed 3
resulting in a real or constant dollar discount rate. The inflation factor is 8.56 percent derived from the implicit price deflator for fixed investment (non-residential) from 1979 to 1980[1].

8.1.1 PRIMARY BENEFITS

The major primary benefit of Waterford 3 is the production of electricity. Waterford 3 will generate a net of 1104 megawatts of electrical power (MWe, net), and assuming operation at an average 75 percent capacity factor will distribute 7.253 billion kilowatt-hours of electrical energy to LP&L customers annually. Table 8.1-1 shows the distribution of this energy by user class. The average annual revenues produced from the sale of elec- 3
tricity during the operational phase is expected to be about $388.0 million (in 1983 dollars) per year.

As a result of the fact that all of LP&L's generating capacity is either oil or gas fired and that oil and natural gas prices have rapidly escalated during the 1970's and are expected to continue escalating in the 1980's and beyond, it is readily apparent that a primary benefit is the 1983 commercial operation for Waterford 3 which will result in very substantial savings for LP&L's customers. According to the customer savings analysis in Chapter 1, which is based upon a late 1982 commercial operation, a six (6) month delay in commercial operation of Waterford 3 would result in 2
LP&L's customers incurring an additional cost of about $201.6 million over a ten (10) year period. These additional costs are induced by the required rate of return on Waterford 3, a loss of capacity equalization charges from other MSU companies and the higher cost of the alternative fossil fuels. For a one year delay of the commercial operation of Waterford 3, LP&L customers will be faced with about $245.1 million in additional costs over a ten (10) year period while a two year delay would result in LP&L

customers incurring about $532.9 million in additional costs over a ten (10) year period.

The commercial operation of Waterford 3, in 1983, will reduce LP&L's reliance on expensive fossil fuels. The availability of cheap natural gas will be diminishing throughout the 1980's due to expiration of long-term contracts and by prohibition of the use of natural gas as a primary energy source in power plants created by the Power Plant and Industrial Fuel Use Act of 1978. The available substitutes to LP&L will be either nuclear power or expensive No. 6 oil. 3

In 1983, fuel costs to LP&L for No. 6 oil are expected to be 63.7 mills per kilowatt-hour (mills/kWh), while nuclear fuel costs will be 10.0 mills/kWh. By 1989, No. 6 oil is forcasted to cost 141.0 mills/kWh in comparison to 12.5 mills/kWh for nuclear fuel. Therefore, the commercial operation of Waterford 3, in 1983, will greatly reduce the reliance of LP&L on natural gas and oil and decrease fuel cost.

Another primary benefit will be the reserve margin added to the MSU system by Waterford 3 which will enhance system reliability, and in turn reduce outage costs to consumers. According to a recent study done by the Electric Power Research Institute[2], four case studies showed that reserve margins in the range of 15 to 40 percent minimized customer costs.

8.1.2 SECONDARY BENEFITS

Throughout the construction and operational phases of Waterford 3, revenues will be generated that will benefit a variety of local, state and Federal revenue systems. For the purpose of this chapter, the local economy consists of the political jurisdiction of St Charles Parish. The regional area is referenced to the area within which construction and operation workers could be expected to reside in. The regional area includes the following parishes: Ascension, Assumption, East Baton Rouge, Jefferson, LaFourche, Livingston, Orleans, Plaquimines, St Charles, St James, St John the Baptist, St Tamany, Tangipahoa and Terrebonne.

The revenue systems that will be effected include individual state and Federal income taxes (including social security), corporate state and Federal income taxes, workmen's and unemployment compensation, sales and use taxes, corporation franchise tax and property tax. The local revenues (e.g., property tax) generated by Waterford 3 will be used to support a variety of public services in St Charles Parish such as road construction and maintenance, education, police, and fire protection services. The state revenues (e.g., sales and use taxes) that will be derived from the operation of Waterford 3, will be used for activities such as education, community development, housing programs and the construction and maintenance of highways, etc. 2

For the purposes of this analysis, the discussion on the construction phase includes all benefits accrued as a result of Waterford 3 during the period 1975 to 1982, and the operational phase includes benefits accrued from 1983 to 2023. Furthermore, it should be noted that during the later years of construction, a portion of the work force will be operational workers in training. Therefore, the last years of the construction phase will include both construction and operational workers, and the income effects generated during this period will include workers from both groups.

The construction and operational phases of Waterford 3 will generate about \$2.347 billion in revenue for local, state and Federal governments. This estimate is considered to be conservatively low since it does not include property taxes due to the exemption allowed for industrial facilities, (which will continue until 1993), and the difficulty of forecasting a property tax rate and "fair market value" for Waterford 3 after 1993. The construction of Waterford 3 (1975 to 1982) will have generated about \$95.6 million in additional revenue for various governmental authorities, and during its operational phase (1983 to 2023) the facility will generate almost \$2.251 billion (discounted to 1983 dollars) in new revenues for local, state and Federal governments. 3

The construction and operation of Waterford 3 will also affect regional employment. To quantity this impact, regional employment multipliers are used.

The employment multipliers determine the level of non-basic (indirect and income-induced) job opportunities that would be generated by every new basic (construction and operational) job created by Waterford 3. The employment multiplier that was utilized for this analysis is a construction/operational phase employment multiplier of 0.65[3]. The multiplier assumes that the "leakage of volume" from the region during the construction will be very small.

During 1979, the construction of Waterford 3 created a total of 3,120 construction jobs and 131 operational jobs which in turn will have created an estimated 2,113 secondary job opportunities in the region's non-basic employment sectors. The total employment effect of Waterford 3 in 1979 will be the generation of an estimated 5,364 job opportunities. The operation of Waterford 3 will require a staff of about 357 operational workers. These operational workers will create an estimated additional 232 non-basic or secondary jobs for the region, resulting in a total employment impact of an estimated 589 job opportunities. 3

The construction and operation of Waterford 3 will generate about \$626.0 million in construction, operational and secondary worker income for the region. Of this total, about \$334.9 million will have been generated during the construction phase and about \$291.1 million (discounted to 1983 dollars) will be generated during the operational phase of Waterford 3.

LP&L will sponser several environmental research programs related to the operation of Waterford 3. These programs include aquatic biology and water quality surveillance, radiological sampling, meteorological monitoring, a hydrothermal survey, and terrestrial ecology surveys. These programs are described in detail in Chapter 6. The total estimated expenditure for these programs is approximately \$2.5 million for the period 1981 to 1984. The radiological sampling and meteorological monitoring will be continued throughout the remainder of the operation of Waterford 3 at an estimated annual cost of $40,000. These programs will contribute to an increase in knowledge of the environment and the plant's interaction with it in the vicinity of Waterford 3.

In order to enhance the appearance of Waterford 3, LP&L is restoring the land disturbed during construction and landscaping appropriate portions of the property. An estimated 150 acres have been disturbed during construction, and of this, approximately 50 acres are occupied by the Waterford 3 facilities. The environmental enhancement gained through restoration and landscaping of the remaining disturbed 100 acres is anticipated to have an initial cost to LP&L of approximately $250,000.

Additional environmental enhancement will be gained through the use of electricity by LP&L customers for pollution avoidance and abatement. An increasing number of commercial and industrial customers are changing to relatively clean electrical processes to avoid the releases of polluting by-products which result from the use of other fuels. Customers will also rely on electricity to abate pollution through the use of scrubbers, recycling systems, precipitators and similar control systems.

TABLE 8.1-1

ESTIMATED BENEFITS OF WATERFORD 3

Primary Benefits

Expected Average Annual Generation @ 75% Capacity	7.253×10^9 kWh
Capacity of Waterford 3	1,104,000 kW
Proportional Distribution of Electrical Energy (Expected Annual Delivery @ 75% Capacity)	
Industrial	4.458×10^9 kWh
Residential	1.797×10^9 kWh
Commercial	0.821×10^9 kWh
Governmental	0.140×10^9 kWh
Other	0.037×10^9 kWh
Expected Average Annual Revenues from Delivered Benefits	
Electrical Energy (Based upon a 75% Capacity Factor - in 1983 dollars)*	$388,050,480

3

Secondary Benefits

Taxes (local, state, Federal)	
Construction	$ 95,646,645
Operation**	$2,250,986,362
Employment at Waterford 3	
Construction (Basic and Non-Basic)	5,364 job opportunities at peak (1979)
Operation (Basic and Non-Basic)	589 job opportunities
Income	
Construction	$334,936,261
Operation**	$291,125,985

* Based upon anticipated overall revenue per kilowatt hour in 1983.
** Discounted to 1983 dollars.
Sources: Louisiana Power and Light Company and Ebasco Services Incorporated.

8.2 COSTS

The costs associated with the construction and operation of Waterford 3 include both internal and external costs. The internal costs are those directly related to construction and operation, and external costs refer to the potential adverse effects on the natural and social environments.

8.2.1 INTERNAL COSTS

The total estimated cost to LP&L for the construction of Waterford 3 is
approximately $1.575 billion (in 1983 dollars). The construction costs 3
are itemized in Table 8.2-1 in accordance with the format requested by NRC
Regulatory Guide 4.2 Revision 2. Construction of the transmission facilities directly associated with Waterford 3 as well as land costs will add about $2.3 million to the construction costs (in 1978 dollars).

The estimated costs of electrical energy generation by specific components for Waterford 3 during the initial year of operation are shown in Table 8.2-2 and are expressed in 1983 dollars. During the initial year of operation, the total cost of electrical generation will be about $357.3 million or 67.18 mills per kilowatt-hour (mills/kWh). This total cost for electrical generation consists of fixed charges, nuclear fuel cycle costs and operation and maintenance costs. Fixed charges are composed of the following items: cost of capital; depreciation; interim replacements; property insurance; income taxes, and state and local taxes. The fixed charges for Waterford 3, during its initial year of operation will be about $275.0
million (51.70 mills/kWh). The nuclear fuel cycle costs are the cost of 3
fuel material preparation and utilization. The nuclear fuel cycle costs for Waterford 3 during the initial year will be about $53.2 million (10.00 mills/kWh). The operation and maintenance costs include staff costs, operational costs, maintenance costs, insurance and fee costs and administration and general costs. The operation and maintenance costs for Waterford 3 during its initial year of operation will be about $29.2 million (5.48 mills/kWh). Table 8.2-2 presents a detailed breakdown for each category discussed above.

An estimate of the costs to decommission Waterford 3 is very difficult to make at this time. A recent study by the Atomic Industrial Forum[1] provides a basis for estimating the range of decommissioning costs for the three primary methods which have been used to date: mothballing, in-place entombment, and complete removal/dismantling. The decommissioning costs for a pressurized water reactor are estimated to range from $2.3 million (1975 dollars) for mothballing to $31.3 million (1975 dollars) for mothballing followed by complete removal and dismantling. These and other methods of decommissioning, as well as their relative costs, are discussed in more detail in Section 5.8.

8.2.2 EXTERNAL COSTS

External costs are the short-term and long-term effects of the operation of Waterford 3 on the natural and social environment. These effects are discussed in detail in Chapter 5.

No short-term adverse effects on the local community are anticipated from the influx of approximately 204 operations personnel. As described in 2
Section 2.1, Waterford 3 is within commuting distance of New Orleans, the region's major economic and population center, and within 10 miles of nine towns with populations ranging from 1,000 to 7,000 people. Even if all of the operations personnel are assumed to relocate to the Waterford 3 area from outside the region, these communities will be capable of assimilating 204 households without significant effects on their services or budgets.

This fact was confirmed by an investigation of existing and projected (1979 to 1982) public service levels in both St. Charles and St. John the Baptist Parishes and the induced demand for these services which could be expected from immigrant workers and their dependents. Immigrant workers are defined as those workers who have moved within ten miles of the site as a result of their involvement in the Waterford 3 project. The investigation included the following public service functions: the general control (parish administration, planning, legal and judicial functions), financial administration, sheriff, fire, water supply, sewer, sanitation, library and
hospitals. The investigation incorporated the results of a survey of both the construction and operational (in-training) work forces[2]. The investigation indicated that the induced service demand of the immigrant population would be absorbed by those public service functions which presently have excess capacities while, for those functions presently exhibiting deficits, the increase in the deficit from immigrant population would be marginal in comparison to the overall deficit. Thus, the estimated impact of the immigrant population upon the public services in these parishes is quite small. These impacts should be considered within the overall growth which is taking place within ten miles of Waterford 3. The area is the scene of a number of large construction projects in recent years and is growing at a projected annual population rate of 1.7 percent. Demands are, therefore, much more likely to evolve from general growth in the area rather than as a result of Waterford 3. 2

Most of the long-term external costs resulting from the operation of Waterford 3 cannot be realistically evaluated in quantitative terms. These costs have been analyzed and are described in Section 2.6 and Chapter 5. These costs are not considered to be significant when compared to the benefits provided by Waterford 3.

It is possible, however, to quantify two of the long-term external costs: the removal of land from agricultural productivity, and the value of commercial fish species killed by impingement on the intake screens of the Circulating Water System.

Approximately 150 acres of LP&L property are being utilized for the Waterford 3 facility or are being reseeded and landscaped following construction. This land has been typically used to grow sugar cane which, at the start of the construction period, was a declining industry throughout Louisiana[3]. As described in Section 2.1.3, the acreage of sugar cane declined by 75 percent in St Charles Parish alone between 1969 and 1974. The total land used for the Waterford 3 facility represents only about 1.5 percent in 1977 total cropland and pasture within five miles of

TABLE 8.2-1

COST INFORMATION FOR WATERFORD 3

1.	Interest during Construction	7.5%/year	5.	Escalation Rates	
				Site Labor	8.5%/yr
2.	Length of Construction Workweek	40 hours/wk		Materials	7.8%/yr
3.	Estimated Site Labor Requirement (Direct & Indirect)	16 man-hrs/kWe		Composite Escalation Rate	8.2%
4.	Average Site Labor Pay Rate (including Fringe Benefits) effective at Month and Year of NSSS Order	$8.33/hr			

3

Construction Costs*
(in millions)

a.	Structures and Site Facilities	$217.0	h.	Construction Facilities, Equipment, and Services	$200.0
b.	Reactor (boiler) Plant Equipment	212.0	i.	Engineering and Construction Management Services	209.0
c.	Turbine Plant Equipment not including Heat Rejection Systems	86.0	j.	Other Costs	211
			k.	Allowance for Funds used during Construction at 6.75% after 1977	286
d.	Electric Plant Equipment	80.0			
e.	Miscellaneous Equipment	5.0		Total Cost	
f.	Spare Parts Allowance	16.0		Total Station Cost, at start of Commercial Operation without Land Costs	$1,575
g.	Contigency Allowance	53.0		Total 1978 value of land and land rights:	$0.898

3

* All construction costs are expressed in 1983 dollars, initial year of operation, except when noted.

Sources: Louisiana Power and Light and Ebasco Services, Incorporated.

TABLE 8.2-2

ESTIMATED COST OF ELECTRICAL ENERGY GENERATION*

	Mills/Kilowatt-Hour
1. Fixed Charg +	51.70
2. Fuel Cycle Costs (Total)	
Waterford 3 (nuclear)	10.00
3. Operation and Maintenance Costs	5.48
4. Total	67.18

3

*The cost of electrical generation is for the first (initial) year of operation and is expressed in 1983 dollars. The operational characteristics of Waterford 3 are 1104 MW(e) at a 55% capacity factor.

+The fixed charge rate for Waterford 3 is a levelized rate of 17.46%. 3

Sources: Louisiana Power and Light and Ebasco Services Incorporated.

11.1 BENEFITS

The principal benefit of Waterford 3 is the distributed generation of approximately 7.253 billion kilowatt hours of electricity. This generation will result in a substantial cost savings to LP&L customers, along with a decreased reliance on more expensive fossil fuels and an enhancement of system reliability. |3

As described in Section 8.1.2, Waterford 3 will generate a total of \$2.347 billion in new revenues for local, state and Federal governments during the construction and operation phases. It is estimated that Waterford 3 will have created, during the peak construction year of 1979, a total of 5,364 job opportunities will have been created within the region. During its operational phase, Waterford 3 will create an estimated 589 job opportunities in the region. During the construction and operational phase of Waterford 3, about \$626.0 million of new income will be generated in the region's basic and non-basic employment sectors. |3

LP&L is maintaining environmental surveillance programs monitoring air and water quality, and terrestrial and aquatic ecology. These programs are increasing the knowledge and understanding of nuclear generating stations and their effects on the environment by providing information from which future advances in design and technology can evolve.

11.2 COST

The cost to LP&L to construct Waterford 3 will be about \$1.575 billion (in 1983 dollars). The operating cost of electrical generation during the initial year of operation (in 1983 dollars) will be \$357.3 million or 67.18 mills per kilowatt hour. |3

There is anticipated to be a small quantifiable external cost resulting from mortality of commercial fish species impinged on the Circulating Water System intake screens. This cost is estimated to range from approximately \$10,000 to \$19,000 annually.

In addition, there are other external costs due to the environmental impacts discussed in Section 2.6, and Chapters 4 and 5. These costs, while difficult to quantify, have been investigated, and are believed not to be significant when compared to the benefits derived from the project.

Decommissioning costs will probably fall within the range of \$2.3 million for mothballing to \$31.3 million for mothballing followed by complete removal/dismantling with security (See Table 5.8-1), depending upon the method selected. This cost will be borne by LP&L.

11.3 CONCLUSIONS

It is the judgment of Louisiana Power & Light Company that, given the nature of expensive and unreliable fossil fuel supplies, as well as the likely resultant environmental effects, Waterford 3 represents the optimum economic and environmental alternative available for providing electricity.

TABLE 12.1-1

(Sheet 1 of 2)

LICENSES, PERMITS AND OTHER APPROVALS RECUIRED FOR THE OPERATION OF WATERFORD 3

WATER

AGENCY	AUTHORIZATION REQUIRED	STATUTE OR AUTHORITY	STATUS	
United States Army Corps of Engineers	Permit to Construct on a navigable waterway	River and Harbors Act Sect. 10 33 CFR 209	Permit granted 7/72, Revised 4/77.	
	Permit to Discharge in waterway dredge and fill material	P.L. 92-500 Sect. 404	Permit granted 9/77.	3
Environmental Protection Agency	Approval of State Certification of Compliance with Effluent Limitations	P.L. 92-500 Sect. 401	Permit granted 9/73.	
	National Pollutant Discharge Elimination System Permit	P.L. 92-500 Sect. 402	Permit granted 7/80. Permit renewed 5/81.	3
	Approval of less stringent effluent limitation for thermal pollution	P.L. 92-500 Sect. 316(a)	Low Potential Impact Type III Demonstration submitted 4/79.	1
	Approval of intake structure technology	P.L. 92-500 Sect. 316(b)	Demonstration submitted 4/79.	
	Resource Conservation and Recovery Act		Notification of Hazardous Waste Activity Form submitted 8/80.	
Louisiana Stream Control Commission	Permit to Discharge to adhere to State Water Quality Standards	Louisiana Revised Statutes Acts 1975 No. 512 Section 1435, regulations	Permit granted 9/73.	
	State Certification that discharge complies with Sections 301, 302, 306 and 307 of P.L. 92-500	P.L. 92-500 Sect. 401	Permit granted 9/73.	
United States Coast Guard	Permit to establish private aid to navigation	14 U.S.C. 81; 33 CFR 66	Application approved 10/77 (annual).	

AIR

AGENCY	AUTHORIZATION REQUIRED	STATUTE OR AUTHORITY	STATUS	
Federal Aviation Administration	Federal Air Navigation Approval	80 Statute 932; 14 CFR 77	Request for approval to be submitted 11/78.	
Air Quality Division of the Department of Natural Resources	Approval for construction/ operation of emission source	Louisiana Air Control Law Acts 1964 No. 259 Section 1, Regulations Sect. 6.0	Permit for plant stack, auxiliary boiler, diesel generators, and fire pumps granted 9/79.	
			Permit for onsite oil storage tanks granted 1/80.	3

APPENDIX 2-2

LIST OF TABLES

TABLE A2.2.1-1

PLANT COVER RECORDED FOR SHRUB SPECIES
IN CYPRESS GUM SWAMP PLOTS, C-L DURING 1979

	Cover Class ***				
Plot:	L	K	J	I	H
Quercus nuttallii*	+				
Ulmus americana	+				
Cocculus carolinus	+				
Acer rubrum	1	3		1	2
Fraxinus pennsylvanica and tomentosa*		1	r		+
Berchemia scandens		+			
Nyssa aquatica					+

Plot:	G	F	E	D	C	
Sabal minor	2					3
Rubus argutis*	2					
Sambuccus canadensis	+					
Celtis laevigata	+		1			
Acer rubrum		1	1		+	
Cephalanthus occidentalis				3		
Rhus radicans				+		

---

* Identification based primarily on foliar features.

* Both species observed along transect, some individuals exhibited features intermediate between the two species.

*** Cover Class

r = solitary	3 = 26-50 percent
+ = less than 1 percent	4 = 51-75 percent
1 = 1-5 percent	5 = 76-100 percent
2 = 6-25 percent	

(Sheet 1 of 2)

TABLE A2.2.1-2

PLANT COVER RECORDED FOR SPECIES IN
HERBACEOUS STRATUM OF CYPRESS-GUM SWAMP PLOTS, C-L DURING 1979

	Cover Class*					
Plot:	L	K	J	I	H	
Thelypteris palustris	2					
Boehmeria cylindrica	1					
Family Cyperaceae	1					
Eupatorium rugosum	1					
Mikania scandens	1					
Sambuccus canadensis	1					
Ampelopsis arborea	+					
Aneilema sp	+					
Cocculus carolinus	+					
Ilex decidua	+					3
Lygodium japonicum	+					
Parthenocissus quinquefolia	+					
Rhus radicans	+					
Rubus argutis	+					
Viola sp	+					
Passiflora lutea	+					
Unidentified herb	+					
Unidentified vine - a	+					
Unidentified vine - b	r					
Campsis radicans	+	+				
Hydrocotyle verticillata	+	+				
Acer rubrum		1				
Saururus cernuus		1				
Justicia ovata		1				
Berchemia scandens		+				
Krigia virginica		+				
Lemna minima & Spirodela polyrhiza		4	5		5	
Eichlornia crassipes					r	
Bare ground	4	4		4		
Open water			5	3	5	
Soil drainage**	md	pm	15	15	15	

(Sheet 2 of 2)

TABLE A2.2.1-2

PLANT COVER RECORDED FOR SPECIES IN HERBACEOUS STRATUM CYPRESS-GUM SWAMP PLOTS, C-L DURING 1979

	Cover Class*				
Plot:	G	F	E	D	C
Rhus radicans	2				
Rubus sp	2				
Hydrocotyle verticillata	1				
Sabal minor	1				
Berchemia scandens	+				
Carex sp	+				
Desmodium paniculatum	+				
Parthenocissus quinquefolia	+				
Smilax bona-nox	+				
Unid herb	+				
Celtis laevigata	r				
Ilex decidua	r				
Ulmus americana	r				
Panicum gymnocarpon		1	+		
Lemna minima and Spirodela polyrhiza			4	4	5
Cephalanthus occidentalis				3	
Nymphoides cordata				+	
Family Cyperaceae				+	
Family Lamiaceae				r	
Eichhornia crassipes					+
Bare ground	4	5	2		
Open water			4	4	5
Soil moisture**	pd	pm	5	30	15

3

* Cover Class
r = solitary
+ = less than 1 percent
1 = 1-5 percent
2 = 6-25 percent(1)
3 = 26-50 percent
4 = 51-75 percent
5 = 76-100 percent

** md = moderately drained; pd = poorly drained, dry at time of sampling; pm = poorly drained, moist at time of sampling; numbers are depth of standing water, in cm.

TABLE A2.2.1-3

PLANT COVER RECORDED FOR SHRUB
SPECIES IN CYPRESS GUM SWAMP DURING 1980

Species	Cover*									
	Plot C	Plot D	Plot E	Plot F	Plot G	Plot H	Plot I	Plot J	Plot K	Plot L
Acer rubrum		3	2		2	4	2	1	4	+
Celtis laevigata	1									1
Cephalanthus occidentalis			4	3				+		
Fraxinus pennsylvanica									2	
*Quercus nuttallii***										1
Sabal minor	3									
Sambucus canadensis										1
Taxodium distichum								3		

* + = 1 percent

1 = 1-5 percent

2 = 6-25 percent

3 = 26-50 percent

4 = 51-75 percent

5 = 76-100 percent

** Identification based on foliage.

TABLE A2.2.1-4

PLANT COVER RECORDED FOR HERBACEOUS SPECIES IN THE CYPRESS GUM SWAMP DURING 1980

	Cover*										
Species	Plot C	Plot D	Plot E	Plot F	Plot G	Plot H	Plot I	Plot J	Plot K	Plot L	
Ampelopsis arborea										1	
Boehmeria cylindrica				1						1	
Campis radicans									2		
Commelina sp.										1	3
Desmodium sp.	r										
Eichhornia crassipes			2		5						
Hydrocotyle sp.	+										
Lemna minima			4	5		5	5	5			
Lygodium japonicum										1	
Panicum gymnocarpon			1	+							
Parthenocissus quinquefolia	1										
Passiflora lutea										+	
Rhus radicans	4										
Rubus sp.	2										
Sabal mincr	2										
Saururus cernuus									2		
Smilax bona-nox	+									r	
Thelypteris palustris										2	

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TABLE A2.2.1-4

PLANT COVER RECORDED FOR HERBACEOUS
SPECIES IN THE CYPRESS GUM SWAMP DURING 1980

Species	Cover*									
	Plot C	Plot D	Plot E	Plot F	Plot G	Plot H	Plot I	Plot J	Plot K	Plot L
Viola sp.										+
Leaf litter		2								
Open water		4								
Cypress knees							3			
Stump						2				

3

*+ = 1 percent
1 = 1-5 percent
2 = 6-25 percent
3 = 26-50 percent
4 = 51-75 percent
5 = 76-100 percent

TABLE A2.2.1-5

PLANT COVER RECORDED IN THE
WAX MYRTLE THICKET, PLOT M, DURING 1979

Shrub Stratum	Cover Class*
Myrica cerifera	5
Herbaceous Statum	
Boehmeria cylindrica	3
Acer rubrum	1
Rubus argutis	1
Eupatorium rugosum	1
Acer negundo	+
Cornus drummondii	+
Fraxinus pennsylvanica	+
Hydrocotyle verticillata	+
Lygodium japonicum	+
Rhus radicans	+
Sambuccus canadensis	+
Smilax bona-nox	r
Solidago sp	+
Ulmus pennsylvanica	r
Bare ground	4
Soil moisture	well-drained

3

* Cover Class
r = solitary
\+ = less than 1 percent
1 = 1-5 percent
2 = 6-25 percent(1)
3 = 26-50 percent
4 = 51-75 percent
5 = 76-100 percent

TABLE A2.2.1-6

PLANT COVER RECORDED IN BATTURE PLOTS DURING 1979 SURVEYS

	Cover Class*		
	Plot A (willow stand)	Plot B (bottomland hardwoods)	
Shrub Stratum			
Mikania scandens	+		
Salix nigra	+		
Fraxinus pennsylvanica	+		
Rhus radicans		+	
Celtis laevigata		+	
Herbaceous Stratum			
Unidentified forb	5	1	3
Aster sp.	3		
Stachys sp.	3		
Boehmeria cylindrica	3	+	
Mikania scandens	1		
Spilanthes americana	1		
Ampelopsis arborea	+	+	
Rhus redicans		2	
Rubus sp		+	
Cynodon dactylon		+	
Burnnichia cirrhosa		+	
Bare ground	1	3	
Soil moisture	Poorly drained Dry at time of sampling	Poorly drained Dry at time of sampling	

*Cover classes defined as:

+ = less than 1 percent
1 = 1-5 percent
2 = 6-25 percent
3 = 26-50 percent
4 = 51-75 percent
5 = 76-100 percent

TABLE A2.2.1-7

PLANT COVER RECORDED IN THE
WAX MYRTLE THICKET PLOT M DURING 1980

Species	Cover*
Shrub Stratum	
Myrica cerifera	5
Herbaceous Stratum	
Acer rubrum	1
Boehmeria cylindrica	2
Cornus drummondii	1
Eupatorium coelestinum	+
Fraxinus pennsylvanica	1
Lygodium japonicum	+
Rubus sp.	+
Sambuccus canadensis	2

3

* + = 1 percent
1 = 1-5 percent
2 = 6-25 percent
3 = 26-50 percent
4 = 51-75 percent
5 = 76-100 percent

TABLE A2.2.1-8

PLANT COVER RECORDED
IN BATTURE DURING 1980 SURVEYS

Species	Cover* Plot A (Willow Stand)	Cover* Plot B (Bottomland Hardwoods)
Shrub Stratum		
Salix nigra	4	
Sambucus canadensis	2	
Herbaceous Stratum		
Ampelopsis arborea	1	2
Boehmeria cylindrica		4
Mikania scandens	2	
Panicum sp.		1
Rubus sp.		3
Rhus radicans		3
Stachys sp.	5	3
Thelypteris palustis	1	
Unidentified	4	

3

*Cover Class

1 = 1-5 percent

2 = 6-25 percent

3 = 26-50 percent

4 = 51-75 percent

5 = 76-100 percent

3

TABLE A2.2.1-9 (Sheet 1 of 5)

PRESENCE OF PLANT SPECIES IN CYPRESS-GUM SWAMPS OF SOUTHEASTERN LOUISIANA*

SPECIES	COMMON NAME
Trees	
Fraxinus tomentosa	Pumpkin Ash
Liquidambar styraciflua	Sweetgum
Nyssa aquatica	Tupelo
Nyssa biflora	Sour Gum
Acer drummondii	Drummond Red Maple
Salix nigra	Black Willow
Persea palustris	Swamp Red Bay
Taxodium distichum	Bald Cypress
Shrubs and Vines	
Amorpha fruticosa	Leadplant
Ampelopsis arborea	Pepper-Vine
Baccharis halimifolia	Groundselbush
Berchemia scandens	Supplejack
Brunnichia cirrhosa	Ladies' Eardrops
Calystegia sepium	Marsh Bindweed
Cephalanthus occidentalis	Buttonbrush
Ipomoea sagittata	Marsh Morning Glory
Iva frutescens	March Elder
Mikania scandens	Hemp-Vine
Myrica cerifera	Wax Myrtle
Rubus louisianus	Swamp Blackberry

3

TABLE A2.2.1-9 (Sheet 2 of 5)

SPECIES	COMMON NAME
Shrubs and Vines	
Sabal minor	Palmetto
Sambucus canadensis	Elderberry
Styrax grandifolia	Bigleaf Snowbell
Herbs	
Alternanthera philoxeroides	Alligatorweed
Acnida cuspidata	Belle-dame
Ageratum conyzoides	Ageratum
Asplenium ebenoides	Scott's Spleenwort
Aster exilis	Slim Aster
Bacopa monnieri	Smooth Water-hyssop
Blechnum serrulatum	Swamp Fern
Carex comosa	Bristly Sedge
Carex crus-corvi	Cros-spur Sedge
Carex lupulina	Hop Sedge
Crinum americanum	Swamp Lily
Cyperus virens	Swamp Sedge
Echinochloa walteri	Walter's Millet
Echinodorus cordifolius	Creeping Bur-Head
Eleocharis albida	White Spike Rush
Eleocharis flavescens	Green Spike Rush
Erianthus giganteus	Giant Plume Grass
Micranthemum umbrosum	Dwarf Moneywort
Gratiola virginiana	Clammy Hedge-Hyssop
Hibiscus lasiocarpus	Marsh Mallow

3

TABLE A2.2.1-9 (Sheet 3of 5)

SPECIES	COMMON NAME
Herbs	
Hygrophila lacustris	Water Willow
Hymenocallis rotatum	Spider Lily
Iris virginica	Coastal Plain Iris
Juncus effusus	Common Rush
Justicia lanceolata	Water Willow
Kosteletskya virginica	Pink Hibiscus
Ludwigia elandulata (lanceolata) (glandulosa)	
Ludwigia palustris	Marsh Purslane
Myriophyllum pinnatum	Water Milfoil
Onoclea sensibilis	Bead Fern
Osmunda regalis	Royal Fern
Panicum anceps	Beaked Panic-Grass
Panicum agrostoides	Red-Top Panic-Grass
Panicum gymnocarpon	Broadleaf panicum
Panicum virgatum	Switch Grass
Pluchea camphorata	Camphorweed
Pluchea foetida	Viscid Marsh fleabane
Polygonum hydropiperoides	Smartweed
Polygonum densiflorum	Giant Knotweed
Polygonum punctatum	Dotted Smartweed
Pontederia cordata	Pickerel Weed
Proserpinace pectinata	Mermaid-Weed
Rhynchospora corniculata	Horned rush
Rumex verticillatus	Swamp Dock

TABLE A2.2.1-9 (Sheet 4 of 5) 3

SPECIES	COMMON NAME
Herbs	
Sabatia campanulata	Slender Marsh Pink
Sacciolepis striata	Baggy Pants
Sagittaria lancifolia	Delta Potato
Samolus parviflorus	Brookweed
Saururus cernuus	Lizard's Tail
Scirpus californicus	Giant Bulrush
Sesbania emerus	Coffee Bean
Setaria geniculata	Marsh Fox Tail
Setaria magna	Giant Fox Tail
Solidago sempervirens	Seaside Goldenrod
Spartina patens	Saltmeadow cordgrass
Spiranthes cernua	Ladies-Tresses
Thelypteris palustris	Marsh Fern
Thelypteris patens	Shield Fern
Tradescantia ohiensis	Spiderwort
Typha angustifolia	Narrowleaf Cattail
Typha latifolia	Broadleaf Cattail
Zizaniopsis miliacea	Giant Cutgrass
Herbs (on logs or stumps)	
Boehmeria cylindrica	False Nettle
Hydrocotyle verticillata	Whorled Pennywort
Hypericum walteri	St. John's-wort
Lycopus rubellus	Water Hoarhound

TABLE A2.2.1-9

SPECIES	COMMON NAME
Mosses (several species)	
Trisetum pennsylvanicum	False Oat
Aquatics	
Azolla caroliniana	Mosquito Fern
Ceratophyllum submersum	Coontail
Eichornia crassipes	Water Hyacinth
Lemna minor	Lesser Duckweed
Riccia fluitans	Dissected Liverwort
Ricciocarpos natans	Heart-shaped Liverwort
Spirodela polyrhiza	Greater Duckweed
Utricularia gibba	Humped Bladderwort
Utricularia vulgaris	Common Bladderwort
Vesiculina utricolaria	Purple Bladderwort

* Source: Penfound, W T and E S Hathaway, "Plant Communities in the Marshlands of Southeastern Louisiana." Ecological Monographs, 8(1): 1-56. 1938.

TABLE A2.2.1-10

AMPHIBIANS OF POTENTIAL OCCURRENCE IN THE VICINITY OF THE WATERFORD SITE

Species	Occurrence Verified
AMPHIBIANS	
Eastern Narrow-mouthed Toad	X
Eastern Spadefoot Toad	
Southern Toad	
Woodhouse's Toad	X
Gulf Coast Toad	X
Northern Cricket Frog	X
Southern Cricket Frog	
Northern Chorus Frog	
Southern Chorus Frog	
Ornate Chorus Frog	
Greater Gray Treefrog	
Peeper	X
Green Treefrog	X
Pine Woods Treefrog	
Squirrel Treefrog	
Barking Treefrog	
Pig Frog	
Bullfrog	X
Green Frog	X
River Frog	
Southern Leopard Frog	X
Pickerel Frog	
Gopher Frog	
Gulf Coast Waterdog	
Three-toed Amphiuma	
Lesser Siren	
Tiger Salamander	
Spotted Salamander	
Marbled Salamander	
Small-mouth Salamander	
Talpid Salamander	
Southern Dusky Salamander	
Two-lined Salamander	
Long-tailed Salamander	
Red Salamander	
Mud Salamander	
Slimy Salamander	
Dwarf Salamander	
Four-toed Salamander	
Eastern Newt	

X = Recorded during site surveys
R = Reported by local residents

3

TABLE A2.2.1-11

REPTILES OF POTENTIAL OCCURRENCE
IN THE VICINITY OF THE WATERFORD SITE

Species	Occurrence Verified	Species	Occurrence Verified
REPTILES			
American Alligator	X	Eastern Garter Snake	X
Alligator Snapping Turtle	X	Eastern Ribbon Snake	
Common Snapping Turtle		Rough Earth Snake	
Stinkpot		Smooth Earth Snake	
Razor-backed Musk Turtle		Red-bellied Snake	
Mississippi Mud Turtle	X	Marsh Brown Snake	
Quachita Map Turtle		Eastern Hognose Snake	
Mississippi Map Turtle		Worm Snake	
Diamondback Terrapin		Ring-necked Snake	
Southern Painted Turtle		Rough Green Snake	
Mobile Cooter		Rainbow Snake	
Missouri Slider		Western Mud Snake	
Red-eared Turtle	X	Black-masked Racer	X
Three-toed Box Turtle	X	Texas Rat Snake	X
Western Chicken Turtle		Corn Snake	
Midland Softshell Turtle		Northern Scarlet Snake	
Pallid Spiny Softshell Turtle		Louisiana Milk Snake	
Green Anole	X	Mole Snake	
Southern Fence Lizard		Speckled Kingsnake	
Ground Skink	X	Southeastern Crowned Snake	
Five-lined Skink	X	Western Cottonmouth	X
Broad-headed Skink		Southern Copperhead	
Southeastern five-lined Skink		Western Pigmy Rattlesnake	
Southern Coal Skink		Canebrake Rattlesnake	X
Six-lined Roadracer			
Eastern Glass Lizard			
Eastern Slender Glass Lizard			
Midland Water Snake			
Broad-banded Water Snake			
Yellow-bellied Water Snake	X		
Diamond-back Water Snake	X		
Green Water Snake	X		
Delta Water Snake			
Graham's Water Snake			

X = Recorded during site surveys

3

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TABLE A2.2.1-12

SUMMARY OF BIRD CHRISTMAS COUNT DATA (1969-1976)[a]
WATERFORD SITE REGION

SPECIES[c]	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Common Loon	2	3
Horned Grebe	(b)	1
Eared Grebe	(b)	1
Pied-billed Grebe	27	8
Double-crested Cormorant	22	8
Anhinga	1	2
Great Blue Heron	32	8
Green Heron	3	7
Little Blue Heron	863	8
Cattle Egret	86	8
Great Egret	1283	8
Snowy Egret	865	8
Lousiana Heron	600	8
Black-crowned Night Heron	3	2
Yellow-crowned Night Heron	1	3
American Bittern	3	5
Plegadis Ibis, species	1000	7
White Ibis	3356	8
Snow Goose	60	6
Mallard	300	8
Mottled Duck	2	1
Gadwall	200	7

(Sheet 2 Of 8) 3

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Pintail	210	8
Green-winged Teal	124	7
Blue-winged Teal	113	7
American Wigeon	202	7
Northern Shovelor	18	7
Wood Duck	318	8
Redhead	12	5
Ring-necked Duck	8	8
Canvasback	20	8
Greater Scaup	14	5
Lesser Scaup	1142	8
Unidentified Scaup	313	3
Common Goldeneye	8	4
Bufflehead	1	2
Ruddy Duck	4	4
Hooded Merganser	75	5
Red-breasted Merganser	3	4
Unidentified ducks	2000	4
Turkey Vulture	15	8
Black Vulture	7	6
Sharp-shinned Hawk	4	7
Cooper's Hawk	1	5
Red-tailed Hawk	9	8
Red-shouldered Hawk	89	8

(Sheet 3 Of 8) 3

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Broad-winged Hawk	1	2
Rough-legged Hawk	2	1
Marsh Hawk	4	6
American Kestrel	14	8
Bald Eagle	1	1
Bobwhite	36	6
King Rail	16	[illegible]
Clapper Rail	3	1
Virginia Rail	10	6
Sora Rail	27	6
Common Gallinule	28	6
American Coot	2600	8
Semipalmated Plover	6	3
Killdeer	1575	8
Golden Plover	1	1
Greater Yellowlegs	28	7
Lesser Yellowlegs	21	5
Spotted Sandpiper	11	8
American Woodcock	21	8
Common Snipe	103	8
Limnodromus sp.	7	2
Semipalmated Sandpiper	2	1
Western Sandpiper	12	6
Least Sandpiper	500	6

 3

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Dunlin	300	6
Unidentified Shorebirds	2500	5
Herring Gull	184	8
Ring-billed Gull	819	8
Laughing Gull	60	5
Bonaparte's Gull	15	3
Forster's Tern	48	8
Common Tern	2	3
Royal Tern	7	1
Caspian Tern	1	1
Black Skimmer	12	4
Rock Dove	20	3
Mourning Dove	167	8
Ground Dove	27	8
Unidentified Cuckoo	1	1
Groove-billed Ani	2	3
Barn Owl	1	4
Screech Owl	17	8
Great Horned Owl	3	8
Barred Owl	66	8
Chuck-wills Widow	1	2
Vaux's Swift	(b)	1
Ruby-throated Hummingbird	1	4
Allen's Hummingbird	1	1

(Sheet 5 of 8) | 3

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Rufous Hummingbird	8	6
Belted Kingfisher	23	8
Common Flicker	61	8
Pileated Woodpecker	28	8
Red-bellied Woodpecker	43	8
Yellow-bellied Sapsucker	70	8
Hairy Woodpecker	24	8
Downy Woodpecker	39	8
Myiarchus sp.	(b)	1
Scissor-tailed Flycatcher	1	1
Eastern Phoebe	64	8
Emipidonax sp.	1	2
Tree Swallow	10,000	8
Rough-winged Swallow	40	4
Barn Swallow	1	2
Blue Jay	67	8
Common Crow	749	8
Fish Crow	2170	8
Carolina Chickadee	159	8
Tufted Titmouse	32	8
Brown Creeper	1	3
House Wren	23	8
Winter Wren	15	8
Carolina Wren	220	8

(Sheet 6 of 8) 3

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Unidentified Wren	59	8
Mockingbird	86	8
Gray Catbird	24	8
Brown Thrasher	74	8
American Robin	2227	8
Wood Thrush	1	1
Hermit Thrush	28	8
Eastern Bluebird	52	8
Blue-gray Gnatcatcher	67	8
Golden-crowned Kinglet	63	7
Ruby-crowned Kinglet	615	8
Water Pipit	686	8
Sprague's Pipit	6	2
Cedar Waxwing	1250	8
Loggerhead Shrike	32	8
Starling	838	8
White-eyed Vireo	74	8
Solitary Vireo	12	8
Black & White Warbler	1	4
Orange-crowned Warbler	67	8
Parula Warbler	(b)	1
Pine Warbler	3	6
Magnolia Warbler	1	1
Yellow-rumped Warbler	1210	8

Sheet 7 Of 8) | 3

TABLE A2.2.1-12 (Cont'd)

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Recorded
Palm Warbler	26	8
Ovenbird	1	2
Northern Waterthrush	1	3
Common Yellowthroat	128	8
Wilson's Warbler	5	4
Yellow-breasted Chat	1	1
House Sparrow	355	8
Eastern Meadowlark	112	8
Western Meadowlark	1	1
Northern Oriole	1	4
Redwinged Blackbird	3770	8
Rusty Blackbird	530	8
Brewer's Blackbird	3	3
Boat-tailed Grackle	630	8
Common Crackle	4491	8
Brown-headed Cowbird	1031	8
Summer Tanager	1	2
Cardinal	387	8
Black-headed Grosbeak	1	3
Blue-headed Grosbeak	(b)	1
Indigo Bunting	2	3
Evening Grosbeak	15	2
Purple Finch	153	8
American Goldfinch	196	8

TABLE A2.2.1-12

Species	Maximum Number Recorded During Any Single Winter Survey	Number of Years Re[illegible]rded
Rufous-sided Towhee	97	8
Savannah Sparrow	235	8
LeConte's Sparrow	2	3
Seaside Sparrow	1	1
Vesper Sparrow	30	7
Lark Sparrow	1	2
Dark-eyed Junco	129	8
Chipping Sparrow	60	8
Field Sparrow	17	7
White-crowned Sparrow	8	5
White-throated Sparrow	1092	[illegible]
Fox Sparrow	23	8
Lincoln's Sparrow	1	3
Swamp Sparrow	568	8
Song Sparrow	89	8
Total Species 178		

a) Christmas Count Data (provided by R.J. Stein, Reserve, La.) Area Covered: 15 mile diameter circle centered 1.4 miles northeast of junction of Highways 51 and 61 to include Reserve, Laplace, Frenier, Norco, La Branche and Edgard and Bonnet Carre Spillway. Habitats include Cypress Tupelo Swamp, 35 percent; Marsh, 25 percent; Lakes and Rivers, 25 percent; Willow-cottonwood forest, 12 percent; Residential, 3 percent.

b) Seen on census area but not during count.

c) Scientific names may be found in the 1957 AOU check list and subsequent amendments.

TABLE A2.2.1-13 (Sheet 1 of 2)

STATUS OF BIRDS OF POTENTIAL OCCURRENCE
IN THE VICINITY OF THE WATERFORD SITE

Species	Presence on Site	Status in Region	Species	Presence on Site	Status in Region
Common Loon		RW	Black-bellied Plover		RM
Horned Grebe		RW	Upland Sandpiper		CM
Pied-billed Grebe		CW, RS	Greater Yellowlegs		[illegible]
White Pelican		UW	Lesser Yellowlegs		UM
Double-crested Cormorant	W	RW	Solitary Sandpiper		CM
Anhinga		US	Spotted Sandpiper	M	CM, RW
Great Blue Heron	YB	UY	American Woodcock	W	CW, RS
Green Heron	YB	CS	Common Snipe	W	CW
Little Blue Heron	YB	CS	Semipalmated Sandpiper		UM
Cattle Egret	SB	CS, UW	Western Sandpiper		CM, UW
Great Egret	YB	CS, UW	Least Sandpiper		CW
Snowy Egret	YB	CS	Pectoral Sandpiper		CM
Louisiana Heron	YB	RS	Stilt Sandpiper		UM
Black-crowned Night Heron	YB	CS, USw	Buff-breasted Sandpiper		UM
Yellow-crowned Night Heron	SB	US	Herring Gull	W	UW
Least Bittern		CS	Ring-billed Gull	W	CW
American Bittern		UW	Bonaparte's Gull		UW
Wood Stork		CS	Forster's Tern	M	UW
White Ibis	YB	CS	Least Tern	M	CS
Snow Goose		CM	Caspian Tern		UW
Mallard	W	UW	Black Tern		CM
Mottled Duck	SB	UY	Rock Dove	YB	CY
Gadwall	W	UW	Mourning Dove	YB	CY
Pintail		UW	Common Ground Dove	S	RM
Green-winged Teal	W	UW	Yellow-billed Cuckoo	SB	CS
Blue-winged Teal		UW	Black-billed Cuckoo		UM
Northern Shoveler	W	UW	Barn Owl		CY
American Wigeon	W	UW	Screech Owl		CY
Wood Duck	YB	UY	Great Horned Owl		CY 3
Redhead		UW	Burrowing Owl		RW
Ring-necked Duck		CW	Barred Owl	YB	CY
Canvasback		UW	Short-eared Owl		RW
Greater Scaup		RW	Chuck-will's Widow		CS
Lesser Scaup	W	CW	Whip-poor-will		CM
Common Goldeneye		UW	Common Nighthawk		CS
Bufflehead		UW	Chimney Swift	S	CS
Oldsquaw		RW	Vaux's Swift		RW
Ruddy Duck		CW	Ruby-throated Hummingbird	SB	CS
Hooded Merganser		RW	Rufous Hummingbird		RW
Red-breasted Merganser		RW	Belted Kingfisher	W	CW, US
Turkey Vulture	Y	CY	Common Flicker	W, W	CW, US
Black Vulture		CY	Pileated Woodpecker		CY
Swallow-tailed Kite		RS	Red-bellied Woodpecker	YB	CY
Mississippi Kite	SB	CS	Red-headed Woodpecker		CY
Sharp-shinned Hawk		UW	Yellow-bellied Sapsucker	W	CW
Cooper's Hawk		RY	Hairy Woodpecker	YB	UY
Red-tailed Hawk	Y	CW	Downy Woodpecker	YB	CY
Red-shouldered Hawk	YB	CY	Red-cockaded Woodpecker		UY
Broad-winged Hawk		CS	Eastern Kingbird	SB	CS
Rough-legged Hawk		RW	Western Kingbird		UM
Bald Eagle		RW	Scissor-tailed Flycatcher		RM
Marsh Hawk	W	CW	Great Crested Flycatcher	SB	CS
Peregrine Falcon		AW	Eastern Phoebe	W	CW
American Kestrel	W	CW, RS	Yellow-bellied Flycatcher		UM
Bobwhite	YB	CY	Acadian Flycatcher	SB	CS
Wild Turkey		UY	Willow Flycatcher		CM
King Rail	YB	CY	Alder Flycatcher		CM
Virginia Rail		RW	Least Flycatcher		CM
Sora		UW	Eastern Wood Pewee	SB	CS
Purple Gallinule		CS	Vermilion Flycatcher		RW
Common Gallinule		RW, US	Tree Swallow	M, W	CW
American Coot		CW, RS	Bank Swallow		UM
American Avocet		RM	Rough-winged Swallow	M	CS, RW
Semipalmated Plover		RM	Barn Swallow	M	CM
Killdeer	YB	CW, US	Cliff Swallow		UM
Piping Plover		RM	Purple Martin		CS
American Golden Plover		RM	Blue Jay	W	CY

TABLE A2.2.1-13 (Sheet 2 of 2)

STATUS OF BIRDS OF POTENTIAL OCCURRENCE
IN THE VICINITY OF THE WATERFORD SITE

Species	Presence on Site	Status in Region
Common Crow	YB	CY
Fish Crow	YB	CY
Carolina Chickadee	YB	CY
Tufted Titmouse	YB	CY
White-breasted Nuthatch		UY
Red-breasted Nuthatch		RW
Brown-headed Nuthatch		UY
Brown Creeper	W	UW
House Wren	W	CW
Winter Wren	W	CW
Bewick's Wren		UW
Carolina Wren	YB	CY
Long-billed Marsh Wren		UW
Short-billed Marsh Wren		UW
Northern Mockingbird	YB	CY
Gray Catbird	M, W	RY, CM
Brown Thrasher	YB	CY
American Robin	M, W	CY
Wood Thrush		CS
Hermit Thrush	W	CW
Swainson's Thrush	M	CM
Gray-checked Thrush	M	CM
Veery	M	UY
Eastern Bluebird		UY
Blue-gray Gnatcatcher	YB	UW, CS
Golden-crowned Kinglet	W	UW
Ruby-crowned Kinglet	M, W	CW
Water Pipit	W	CW
Sprague's Pipit		RW
Cedar Waxwing	W	CW
Loggerhead Shrike	YB	CY
European Starling	YB	CY
White-eyed Vireo	YB	CS, RW
Yellow-throated Vireo	SB	CS
Solitary Vireo	M, W	UM
Red-eyed Vireo	M, SB	CS
Philadelphia Vireo		CM
Warbling Vireo		CS
Black-and-white Warbler		CM
Swainson's Warbler	SB	CS
Worm-eating Warbler		CS
Prothonotary Warbler	SB	CS
Golden-winged Warbler		CM
Blue-winged Warbler		CM
Tennessee Warbler		CM
Orange-crowned Warbler	M, W	CW
Nashville Warbler		UM
Northern Parula	S.	CS
Yellow Warbler		CM
Chestnut-sided Warbler		UM
Cerulean Warbler		UM
Black-throated Blue Warbler		RM
Pine Warbler	W	XY
Yellow-throated Warbler		CS
Black-throated Green Warbler		CM
Prairie Warbler	W	CS
Blackburnian Warbler		UM
Magnolia Warbler	M	CM
Yellow-rumped Warbler	M, W	CW
Palm Warbler	W	UW
Blackpoll Warbler		CM
Bay-breasted Warbler		UM
Ovenbird	M	UM
Northern Waterthrush	[illegible]	CM
Louisiana Waterthrush		CS
Common Yellowthroat	YB	CS, UW
Kentucky Warbler		CS
Mourning Warbler		UM
Hooded Warbler	SB	CS
Wilson's Warbler		UM
Canada Warbler		CM
Yellow-breasted Chat	SB	CS
American Redstart	M	CS
House Sparrow	YB	CS
Bobolink		CM
Eastern Meadowlark	YB	CY
Boat-tailed Grackle	YB	CY
Red-winged Blackbird	YB	CY
Orchard Oriole	SB	CS
Northern Oriole		CW
Rusty Blackbird	W	CW
Brewer's Blackbird		CW
Common Grackle	YB	CY
Brown-headed Cowbird	M	CM
Scarlet Tanager		UM
Summer Tanager	SB	CS
Cardinal	YB	CY
Rose-breasted Grosbeak	M	UM
Blue Grosbeak	M	CM
Indigo Bunting	SB	CS
Painted Bunting	SB	CS
Dickcissel		CS
Purple Finch	W	UW
Pike Siskin		UW
American Goldfinch	W	CW
Rufous-sided Towhee	YB	CY
Savannah Sparrow	W	CW
Grasshopper Sparrow		UW
Henslow's Sparrow		CW
LeConte's Sparrow		CW
Vesper Sparrow		UW
Lark Sparrow		UM
Backman's Sparrow		UY
Dark-eyed Junco		UW
Chipping Sparrow		CY
Field Sparrow	W	CY
White-crowned Sparrow		UW
White-throated Sparrow	W	CW
Fox Sparrow	W	RW
Lincoln's Sparrow		RW
Swamp Sparrow	W	CW
Song Sparrow	W	CW

3

Legend:

Season of Occurrence
S = Summer Resident
W = Winter Resident
Y = Yearround Resident
M = Migration Periods (Spring and/or Fall)

Relative Abundance
C = Common
U = Uncommon
R = Rare

Site Status
B = Known or believed to have bred on or near the Waterford Site

Source: Lowery, G H Jr,
1974 Louisiana Birds. Louisiana State University Press, Baton Rouge, Louisiana

TABLE A2.2.1-14 (Sheet 1 of 2)

RELATIVE ABUNDANCE BY HABITAT TYPE
OF BIRDS OBSERVED ON THE WATERFORD SITE DURING FEBRUARY 1979

Habitat Type	Relative Abundance (Percent of Total Observations)					
	Swamp Forest		Bottomland Forest	Agriculture	River	
Species	Ground	Boat	(Batture Area)			
Great Blue Heron	0.5	7.3				
Green Heron		1.6				
Little Blue Heron		4.1				
Cattle Egret				0.7		
Great Egret	1.0	9.7				
Snowy Egret		4.8				
Louisiana heron		1.6				
White Ibis	0.5	47.1				
Mallard	4.0	13.8				3
Wood Duck	2.0		1.6			
Red-tailed Hawk		0.8		0.7		
Red-shouldered Hawk	2.5	5.7	0.4			
Marsh Hawk				0.7		
American Kestrel				2.8		
Killdeer				9.6		
Common Snipe			0.2			
Ring-billed Gull					100.0	
Rock Dove						
Mourning Dove				1.4		
Barred Owl	4.5	2.4				
Belted Kingfisher		0.8				
Common Flicker	0.5		0.4			
Red-bellied Woodpecker	0.5		1.1			
Yellow-bellied Sapsucker			1.1			
Hairy Woodpecker	3.0					
Downy Woodpecker	0.5		1.8			
Eastern Phoebe	0.5					
Tree Shallow				6.7		
Blue Jay			1.6			
Common Crow	5.5		0.2			
Fish Crow	*					
Carolina Chickadee	22.2		5.4			

TABLE A2.2.1-14 (Sheet 2 of 2)

RELATIVE ABUNDANCE BY HABITAT TYPE
OF BIRDS OBSERVED ON THE WATERFORD SITE DURING FEBRUARY 1979

Habitat Type Species	Relative Abundance (Percent of Total Observations) Swamp Forest Ground	Swamp Forest Boat	Bottomland Forest (Batture Area)	Agriculture	River	
Tufted Titmouse	1.0		0.4			
Carolina Wren	4.5		7.9			
Northern Mockingbird				2.1		
American Robin	9.1		11.2	11.0		
Hermit Thrush			0.9			
Blue-gray Gnatcatcher	0.5		0.9			
Ruby-crowned Kinglet	0.5		0.7			
Water Pipit				27.5		3
Cedar Waxwing			*			
Loggerhead Shrike				1.4		
Starling			2.2			
White-eyed Vireo	0.5		0.4			
Solitary Vireo	0.5					
Orange-crowned Warbler	0.5		0.4			
Yellow-rumped Warbler	22.7		15.7			
Common Yellowthroat				1.4		
House Sparrow				*		
Eastern Meadowlark				2.1		
Red-winged Blackbird			25.8	21.4		
Rusty Blackbird			0.4			
Boat-tailed Grackle				11.0		
Common Grackle			2.9			
Cardinal	12.6		12.3			
Rufous-sided Towhee	*					
White-throated Sparrow			2.7			
Swamp Sparrow			0.4			
Song Sparrow			0.2			

Footnote a * Species heard, number unknown.

TABLE A2.2.1-15

RELATIVE ABUNDANCE WITHIN HABITAT TYPES OF BIRDS OBSERVED ON THE WATERFORD SITE DURING MAY 1979

Species	Relative Abundance (Percentage of Total Observations)				
	Swamp Forest				
	Ground	Boat	Wax Myrtle	Agriculture	
Great Blue Heron		11			
Green Heron		6	4		
Little Blue Heron	3	38			
Cattle Egret				1	
Common Egret	1	15		2	
Snowy Egret	1	2		1	
Louisiana Heron		5			
Yellow-crowned Night Heron	1	9			
White Ibis	3	1			
Mottled Duck	1				
Red-shouldered Hawk	1	4			
Bobwhite				1	
*Forster's Tern		1			
*Least Tern		1			
Rock Dove				1	
Mourning Dove			4	5	3
Yellow-billed Cuckoo	1				
Barred Owl	3	5			
Pileated Woodpecker	1				
Red-bellied Woodpecker	1				
Downy Woodpecker	1				
Eastern Kingbird			1		
Great-crested Flycatcher	1				
Common Crow	2			3	
Carolina Chickadee	9				
Tufted Titmouse	3				
Carolina Wren	1				
Northern Mockingbird				4	
Brown Thrasher			4	1	
Blue-gray Gnatcatcher	1				
Loggerhead Shrike				3	
White-eyed Vireo	3		20		
Yellow-throated Vireo	1				
Red-eyed Vireo	3				
Prothonotary Warbler	30				
Northern Parula	14				
Common Yellowthroat			12	3	
Yellow-breasted Chat	1		12	1	
Eastern Meadowlark				1	
Red-winged Blackbird			20	60	
Orchard Oriole				2	
Boat-tailed Grackle				10	
Common Grackle	6				
Cardinal	5		24	2	
Rufous-sided Towhee	1				

* Lacks breeding habitat on site and is presumed transient.

TABLE A2.2.1-16 (Sheet 1 of 2)

RELATIVE ABUNDANCE BY HABITAT TYPE
OF BIRDS OBSERVED ON THE WATERFORD SITE DURING FEBRUARY 1980

Habitat Type	Relative Abundance (Percent of Total Observations)					
	Swamp Forest		Wax Myrtle	Batture Area	Agriculture	River
Species	Ground	Boat				
Anhinga				0.3		
Great Blue Heron		1.0		0.1		
Little Blue Heron		3.4				
Great Egret	1.4	5.0		0.1		10.2
Snowy Egret		1.3			0.2	
Louisiana Heron	0.1					
White Ibis	1.4	1.6				
Mallard	19.2	5.8				
Gadwall	1.0					
American Wigeon	0.9					
Wood Duck	1.6	0.5		0.6		
Red-tailed Hawk	0.1	0.1			0.5	
Red-shouldered Hawk	1.3	2.2				
Marsh Hawk			0.8		0.4	
American Kestrel					0.5	
King Rail					0.2	
Killdeer				0.3	17.9	
Spotted Sandpiper				0.1		
Herring Gull						*
Ring-billed Gull						86.4
Rock Dove					0.7	
Mourning Dove					1.1	
Barred Owl	1.3	1.2				
Belted Kingfisher		0.2				
Common Flicker	0.3			0.5		
Pileated Woodpecker	0.2	0.7				
Red-bellied Woodpecker	1.0	0.2		0.3		
Yellow-bellied Sapsucker	0.2			1.0		
Downy Woodpecker	2.0	0.6		1.2		
Eastern Phoebe	0.3	0.6		0.1	0.2	
Tree Swallow						*
Blue Jay				0.3		
Common Crow	1.7	1.0		1.3	0.7	
Fish Crow	*			*		
Carolina Chickadee	9.6	10.5		2.1		

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TABLE A2.2.1-16

RELATIVE ABUNDANCE BY HABITAT TYPE
OF BIRDS OBSERVED ON THE WATERFORD SITE DURING FEBRUARY 1980

Habitat Type	Relative Abundance (Percent of Total Observations)					
	Swamp Forest		Wax Myrtle	Batture Area	Agriculture	River
Species	Ground	Boat				
Tufted Titmouse	2.1	3.8		0.1		
Carolina Wren	1.2	2.1	2.5	1.9		
House Wren				0.1	0.2	
Mockingbird					0.5	
Gray Catbird					0.2	
American Robin	3.7	3.6	0.8	10.7	4.8	
Hermit Thrush	0.2					
Blue-gray Gnatcatcher	0.3	2.1		0.6		
Ruby-crowned Kinglet	2.1	1.9	1.6	2.6		
Water Pipit					0.5	
Loggerhead Shrike					1.1	
Starling				0.4	4.8	
White-eyed Vireo		3.6	0.8			
Solitary Vireo	0.2					
Black-and-White Warbler	0.1					
Orange-crowed Warbler	0.7	0.1		0.4		
Yellow-rumped Warbler	13.3	9.9	34.4	35.7		
Palm Warbler			0.8		0.2	
Common Yellowthroat			3.3		4.6	
Eastern Meadowlark					3.7	
Red-winged Blackbird	13.0	5.6		29.2	43.2	
Rusty Blackbird	3.6	2.7				
Boat-tailed Grackle						3.4
Common Grackle	8.5	2.6		4.1	5.0	
Cardinal	3.3	14.0	14.8	3.9	0.4	
Purple Finch	0.1					
American Goldfinch	4.0					
Rufous-sided Towhee			1.6		1.6	
White-throated Sparrow	0.1	11.9	28.7	1.7		
Swamp Sparrow			9.8	0.4	4.1	
Song Sparrow					0.2	

3

* Observed in habitat but not during survey.

TABLE A2.2.1- 17

RELATIVE ABUNDANCE BY HABITAT TYPE
OF BIRDS OBSERVED ON THE WATERFORD SITE DURING MAY 1980

Habitat Type	Relative Abundance (Percent of Total Observations)					
	Swamp Forest		Wax Myrtle	Batture Area	Agriculture	River
Species	Ground	Boat				
Anhinga				0.6		
Great Blue Heron		5.9				
Green Heron	0.9	3.9		4.5	1.3	
Little Blue Heron	3.8	25.0		2.8		
Cattle Egret					1.3	
Great Egret	0.5	17.1		2.2		
Snowy Egret	0.2	7.9		0.6	0.6	8.2
Louisiana Heron	0.9	3.9				
Black-crowned Night Heron		1.3		6.1		
Yellow-crowned Night Heron	1.6	32.2		0.6		
Wood Duck		0.7		1.7		
Red-shouldered Hawk	1.8	1.3				
Mississippi Kite		0.7				
King Rail					3.8	
Killdeer				0.6	2.5	
Spotted Sandpiper					0.6	
Laughing Gull						22.4
Least Tern						65.3
Black Tern						4.1
Rock Dove					1.3	
Mourning Dove					0.6	
Yellow-bellied Cuckoo			3.2	3.9		
Barred Owl	3.2		1.6	0.6		
Chimney Swift					0.6	
Ruby-throated Hummingbird			3.2			
Red-bellied Woodpecker	0.5			2.8		
Pileated Woodpecker	*					
Downy Woodpecker	1.1		3.2	3.4		
Barn Swallow					0.6	

3

TABLE A2.2.1-17 (Sheet 2 of 2)

RELATIVE ABUNDANCE BY HABITAT TYPE OF BIRDS OBSERVED ON THE WATERFORD SITE DURING MAY 1980

Habitat Type / Species	Relative Abundance (Percent of Total Observations)					
	Swamp Forest		Wax Myrtle	Batture Area	Agriculture	River
	Ground	Boat				
Blue Jay				2.8		
Common Crow	2.5		6.5			
Fish Crow				1.7		
Carolina Chickadee	5.4			5.6		
Tufted Titmouse	1.4			0.6		
Carolina Wren	2.7		3.2	6.1		
Mockingbird			1.6		1.9	
Brown Thrasher				*		
Wood Thrush				*		
Blue-gray Gnatcatcher			6.5			
Loggerhead Shrike					0.6	
Starling					3.1	
White-eyed Vireo	3.6		11.3	0.6		
Red-eyed Vireo	6.1			0.6		
Promonotary Warbler	40.6			9.5		
Northern Parula	16.5					
Common Yellowthroat			14.5	0.6	6.3	
Yellow-breasted Chat			*			
Hooded Warbler	0.5		1.6			
House Sparrow					*	
Eastern Meadowlark					2.5	
Red-winged Blackbird			4.8	4.5	51.9	
Orchard Oriole					1.3	
Boat-tailed Grackle				3.4	8.1	
Common Grackle	2.5		3.2	16.2	6.9	
Summer Tanager				1.1		
Cardinal	3.8		32.3	15.1	2.5	
Indigo Bunting			1.6	0.6		
Painted Bunting			1.6	1.1		
Rufous-sided Towhee					1.5	

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* Observed in habitat type but not during survey.

TABLE A2.2.1-18

MAMMALS OF POTENTIAL OCCURRENCE IN THE VICINITY OF THE WATERFORD SITE*

Common name	Scientific name	Site Verification
Virginia opossum	Didelphis virginiana	X
Short-tailed shrew	Blarina brevicauda	
Least shrew	Cryptotis parva	
Southeastern myotis	Myotis austroriparius	
Eastern pipistrelle	Pipistrellus subflavus	
Big brown bat	Eptesicus fuscus	
Red bat	Lasiurus seminolus	
Northern yellow bat	Lasiurus intermedius	
Evening bat	Nycticeius humeralis	
Rafinesque's big-eared bat	Plectotus rafinesquii	
Brazilian free-tailed bat	Tadarida brasiliensis	
Nine-banded armadillo	Dasypus novemcinctus	X
Eastern cottontail	Sylvilagus floridanus	X
Swamp rabbit	Sylvilagus aquaticus	X
Gray squirrel	Sciurus carolinensis	
Fox squirrel	Sciurus niger	X
Southern flying squirrel	Glaucomys volans	
Marsh rice rat	Oryzomys palustris	
Fulvous harvest mouse	Reithrodontomys fulvescens	
White-footed mouse	Peromyscus leucopus	
Cotton mouse	Peromyscus gossypinus	
Hispid cotton rat	Sigmodon hispidus	
Eastern wood rat	Neotoma floridan	
Common muskrat	Ondatra zibethicus	
Roof rat	Rattus rattus	
Norway rat	Rattus norvegicus	
House mouse	Mus musculus	X
Nutria	Myocastor coypus	X
Red fox	Vulpes fulva	
Gray fox	Urocyon cinereoargenteus	
American black bear	Eurarctos americanus	
Northern raccoon	Procyon lotor	X
Long-tailed weasel	Mustela frenata	
North American mink	Mustela vision	X
Spotted skunk	Spilogale putorius	
River otter	Lutra canadensis	
Bobcat	Lynx rufus	
White-tailed deer	Odocoileus virginianus	X

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*Determined from distribution maps in:
Lowery, G H, Jr
1974 The Mammals of Louisiana and Its Adjacent Waters, Louisiana State University Press, Baton Rouge, Louisiana.

X = Recorded during site surveys

APPENDIX 2-7

TABLE A2-7-1 (Sheet 1 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
77 AUG 12	ANABAENA	984,043.	464,000.	368,000.	728,000.	307,856.	2,851,898.	
	ANKISTRODESMUS CONVOLUTUS	0	0	24,000.	0	0	24,000.	
	CHARACIUM	0	8,000.	0	0	0	8,000.	
	CHLAMYDOMONAS	0	0	0	32,000.	0	32,000.	
	CHLAMYDOMONAS GLOBOSA	13,298.	0	8,000.	0	0	21,298.	
	CHROOCOCCUS DISPERSUS B	119,681.	104,000.	136,000.	32,000.	63,694.	455,375.	
	CHROOCOCCUS MINOR	146,277.	104,000.	56,000.	56,000.	10,616.	372,892.	
	CLOSTERIUM	0	0	8,000.	0	0	8,000.	
	COSCINODISCUS	33,858.	9,822.	5,937.	13,536.	17,031.	80,184.	
	COSCIODISCUS ROTHII	50,788.	19,644.	11,874.	33,841.	46,834.	162,980.	
	CRUCIGENIA QUADRATA	0	0	0	64,000.	0	64,000.	
	CRUCIGENIA TETRAPEDIA	0	0	32,000.	64,000.	0	96,000.	
	CRYPTOMONAS EROSA	0	0	8,000.	72,000.	0	80,000.	
	CYCLOTELLA BODANICA B	0	0	0	0	17,031.	17,031.	
	CYCLOTELLA BODANICA C	50,788.	4,911.	94,991.	54,146.	8,515.	213,350.	
	CYCLOTELLA GLOMERATA	76,181.	44,199.	11,874.	40,609.	0	172,863.	
	CYCLOTELLA MENEGHINIANA	338,584.	196,440.	124,675.	270,728.	170,306.	1,100,732.	
	CYMBELLA TUMIDA	0	0	11,197.	0	0	11,197.	
	DIPLONEIS SMITHII	18,997.	115,385.	22,393.	64,988.	7,601.	229,363.	
	GLENODINIUM	0	16,000.	0	0	0	16,000.	
	GYROSIGMA	0	0	22,393.	0	0	22,393.	
	KIRCHNERIELLA LUNARIS	53,191.	0	0	0	0	53,191.	
	MELOSIRA DISTANS	93,111.	49,110.	53,432.	74,450.	59,607.	329,710.	
	MELOSIRA GRANULATA A	42,323.	157,152.	148,423.	101,523.	85,153.	534,573.	3
	MELOSIRA GRANULATA ANG	118,504.	157,152.	89,054.	142,132.	42,576.	549,418.	
	MELOSIRA ITALICA	1,125,791.	392,879.	771,800.	825,719.	510,917.	3,627,106.	
	MERISMOPEDIA TENUISSIMA	212,766.	0	320,000.	64,000.	0	596,766.	
	NAVICULA	18,997.	0	11,197.	0	0	30,194.	
	NITZSCHIA FILIFORMIS	0	0	0	0	7,601.	7,601.	
	NITZSCHIA HOLSATICA	56,991.	38,462.	33,590.	12,998.	22,802.	164,842.	
	NITZSCHIA TRYBLIONELLA	18,997.	0	0	12,998.	11,401.	43,396.	
	OOCYSTIS	39,894.	0	0	40,000.	0	79,894.	
	OOCYSTIS ELLIPTICA	0	0	0	0	21,231.	21,231.	
	OOCYSTIS PUSILLA	106,383.	96,000.	0	32,000.	0	234,383.	
	OSCILLATORIA	0	0	80,000.	416,000.	10,616.	506,616.	
	OSCILLATORIA LIMNETICA	279,255.	488,000.	232,000.	192,000.	175,159.	1,366,415.	
	PEDIASTRUM DUPLEX	0	0	104,000.	0	37,155.	141,155.	
	PEDIASTRUM SIMPLEX B	0	0	128,000.	136,000.	0	264,000.	
	PHACUS	0	0	0	0	5,308.	5,308.	
	PLANKTOSPHERIA GELATINOSA	0	0	0	0	127,389.	127,389.	
	SCENEDESMUS ACUMINATUS	0	0	0	0	21,231.	21,231.	
	SCENEDESMUS BIJUGA	26,596.	16,000.	16,000.	32,000.	0	90,596.	
	SCENEDESMUS OBLIQUUS	0	0	0	16,000.	0	16,000.	
	SCENEDESMUS QUADRICAUDA	39,894.	32,000.	0	16,000.	21,231.	109,125.	

. NO SAMPLE

TABLE A2-7-1

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
77 AUG 12	SELENASTRUM	0	40,000.	40,000.	16,000.	5,308.	101,308.
	SPHAEROCYSTIS SCHROETERI	132,979.	104,000.	128,000.	0	26,539.	391,518.
	SPIRULINA LAXA	0	32,000.	0	0	0	32,000.
	SPIRULINA MAJOR	39,894.	0	16,000.	0	0	55,894.
	STEPHANODISCUS ASTREA A	25,394.	24,555.	23,748.	27,073.	17,031.	117,800.
	SYNEDRA ACUS	18,997.	38,462.	11,197.	12,998.	3,800.	85,453.
	TETRAEDRON MINIMUM	13,298.	8,000.	8,000.	8,000.	0	37,298.
	TETRASTRUM STAUROGENIAEFORME	0	0	0	32,000.	0	32,000.
	TRACHELOMONAS	13,298.	0	0	0	0	13,298.
	WESTELLA BOTRYOIDES	0	0	32,000.	48,000.	21,231.	101,231.
*TOTAL 77 AUG 12		4,309,044.	2,760,170.	3,191,774.	3,783,737.	1,882,769.	15,927,495.
77 SEP 25	ACNANTHES LANCEOLATA A	11,599.	0	0	.	0	11,599.
	ACNANTHES LANCEOLATA C	0	12,727.	0	.	0	12,727.
	AMPHORA	0	0	0	.	12,731.	12,731.
	AMPHORA OVALIS	0	12,727.	0	.	0	12,727.
	ANABAENA	280,000.	0	240,000.	.	0	520,000.
	ASTERIONELLA FORMOSA	0	12,727.	0	.	0	12,727.
	CALONEIS VENTRICOSA	0	0	0	.	12,731.	12,731.
	CHARACIUM	40,000.	20,000.	0	.	0	60,000.
	CHLAMYDOMONAS GLOBOSA	0	0	0	.	0	0.
	CHROOCOCCUS DISPERSUS A	160,000.	0	0	.	0	160,000.
	CHROOCOCCUS DISPERSUS B	0	0	0	.	0	0. 3
	CHROOCOCCUS LIMNETICUS	160,000.	0	0	.	0	160,000.
	COCCONEIS DIMUNATA	0	0	0	.	0	0.
	COSCINODISCUS	0	0	0	.	14,898.	14,898.
	COSCIODISCUS ROTHII	25,173.	28,179.	0	.	59,590.	112,942.
	CRUCIGENIA TETRAPEDIA	0	0	80,000.	.	0	80,000.
	CYCLOTELLA BODANICA A	0	0	0	.	14,898.	14,898.
	CYCLOTELLA BODANICA C	12,[illegible]87.	0	29,907.	.	59,590.	102,083.
	CYCLOTELLA GLOMERATA	138,452.	281,789.	104,673.	.	44,693.	569,607.
	CYCLOTELLA MENEGHINIANA	276,904.	300,575.	299,065.	.	297,952.	1,174,496.
	CYCLOTELLA MICHIGANIANA	125,865.	112,716.	119,626.	.	74,488.	432,695.
	CYMBELLA MINUTA B	0	0	0	.	0	0.
	DIATOMA VULGARE	0	12,727.	0	.	0	12,727.
	DIPLONEIS SMITHII	104,393.	292,714.	203,710.	.	203,692.	804,510.
	FRAGILARIA CAPUCINA	23,198.	0	0	.	0	23,198.
	FRAGILARIA CONSTRUENS	0	101,814.	0	.	114,577.	216,390.
	GOMPHONEMA OLIVACEUM	0	12,727.	0	.	0	12,727.
	GYROSIGMA	0	0	14,551.	.	0	14,551.
	HANTZSCHIA AMPHIOXUS	0	0	14,551.	.	0	14,551.
	MELOSIRA AMBIGUA	163,625.	479,042.	239,252.	.	551,210.	1,433,130.
	MELOSIRA DISTANS	465,702.	244,217.	448,598.	.	14,898.	1,173,415.

. NO SAMPLE

TABLE A2-7-1

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
77 SEP 25	MELOSIRA GRANULATA A	100,692.	112,716.	89,720.	.	134,078.	437,206.
	MELOSIRA GRANULATA ANG	0	122,109.	179,439.	.	148,976.	450,524.
	MELOSIRA ITALICA	113,279.	0	164,486.	.	0	277,765.
	MERISMOPEDIA TENUISSIMA	0	280,000.	0	.	0	280,000.
	NAVICULA	0	0	29,101.	.	12,731.	41,832.
	NAVICULA CRYPTOCEPHALA A	0	25,453.	0	.	0	25,453.
	NAVICULA CRYPTOCEPHALA B	0	0	0	.	0	0.
	NAVICULA EXIGA	11,599.	12,727.	0	.	0	24,326.
	NAVICULA PEREGRINA	11,599.	0	0	.	0	11,599.
	NAVICULA RADIOSA	0	0	14,551.	.	12,731.	27,281
	NITZSCHIA	0	0	0	.	12,731.	12,731.
	NITZSCHIA ACICULARIS	0	0	0	.	0	0.
	NITZSCHIA FILIFORMIS	11,599.	0	0	.	0	11,599.
	NITZSCHIA LINEARIS	0	25,453.	0	.	0	25,453.
	NITZSCHIA PALEA	0	25,453.	0	.	0	25,453.
	NITZSCHIA PARVULA	11,599.	0	0	.	25,461.	37,061.
	NITZSCHIA TRYBLIONELLA	23,198.	0	0	.	12,731.	35,929.
	OOCYSTIS	40,000.	40,000.	0	.	40,000.	120,000.
	OSCILLATORIA	100,000.	20,000.	460,000.	.	0	580,000.
	PEDIASTRUM BORYANUM	0	0	0	.	0	0.
	PEDIASTRUM SIMPLEX A	320,000.	0	0	.	0	320,000.
	PLEUROSIGMA	0	0	0	.	0	0.
	SCENEDESMUS ACUMINATUS	0	0	0	.	0	0.
	SCENEDESMUS BIJUGA	40,000.	0	0	.	0	40,000.
	SCENEDESMUS QUADRICAUDA	260,000.	0	80,000.	.	80,000.	420,000.
	SPIRULINA MAJOR	0	80,000.	0	.	0	80,000.
	STEPHANODISCUS ASTREA A	12,587.	18,786.	0	.	104,283.	135,656.
	STEPHANODISCUS ASTREA B	25,173.	0	44,860.	.	0	70,033.
	STEPHANODISCUS HANTZSCHII	0	0	0	.	0	0.
	SURIRELLA OVATA	11,599.	0	14,551.	.	0	26,150.
	SYNEDRA ULNA A	0	12,727.	29,101.	.	12,731.	54,559.
	TETRASTRUM STAUROGENIAEFORME	0	0	0	.	80,000.	80,000.
*TOTAL 77 SEP 25		3,080,424.	2,700,104.	2,899,743.	.	2,152,399.	10,832,669.
78 JAN 19	ACNANTHES	0	2,500.	0	4,150.	2,745.	9,395.
	ACNANTHES LANCEOLATA B	0	0	0	2,075.	0	2,075.
	ACNANTHES MINUTISSIMA	7,500.	0	0	0	0	7,500.
	ANABAENA	56,000	13,333.	0	0	320,000.	389,333.
	ANKISTRODESMUS FALCATUS	8,000.	26,667.	0	0	0	34,667.
	ASTERIONELLA FORMOSA	0	2,500.	5,520.	16,600.	15,100.	39,720.
	ASTERIONELLA GRACILLIMA	0	0	1,380.	0	2,745.	4,125.
	CHLAMYDOMONAS	0	0	0	13,333.	0	13,333.
	COCCONEIS DIMUNATA	3,750.	0	0	0	0	3,750.

. NO SAMPLE

3

TABLE A2-7-1 (Sheet 4 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
78 JAN 19	COCCONEIS PLACENTULA A	0	0	0	2,075.	2,745.	4,820.
	COCCONEIS PLACENTULA B	3,750.	0	0	0	0	3,750.
	COSCIODISCUS ROTHII	1,853.	13,941.	7,217.	6,812.	0	29,823.
	CYCLOTELLA BODANICA C	0	0	2,406.	0	21,81[illegible]	24,219.
	CYCLOTELLA GLOMERATA	12,974.	33,457.	21,652.	10,218.	59,207.	137,508.
	CYCLOTELLA MENEGHINIANA	37,070.	64,127.	38,492.	61,306.	59,207.	260,200.
	CYCLOTELLA MICHIGANIANA	7,414.	13,941.	12,029.	17,029.	34,278.	84,690.
	CYCLOTELLA STELLIGERA	18,535.	13,941.	14,434.	13,624.	15,581.	76,114.
	CYMBELL VENTRICOSA	0	5,000.	0	0	0	5,000.
	CYMBELLA AFFINIS	0	0	0	2,075.	0	2,075.
	CYMBELLA MINUTA A	0	0	1,380.	0	0	1,380.
	CYMBELLA SINUATA	7,500.	0	0	0	2,745.	10,245.
	DIATOMA HIEMALE	3,750.	0	0	0	0	3,750.
	DIATOMA VULGARE	0	5,000.	0	0	0	5,000.
	DINOKONTAE	0	13,333.	16,000.	0	0	29,333.
	DIPLONEIS SMITHII	0	0	0	0	1,373.	1,373.
	EPITHEMIA TURGIDA	0	0	1,380.	0	0	1,380.
	FRAGILARIA CAPUCINA	0	0	2,760.	0	4,118.	6,878.
	FRAGILARIA CONSTRUENS	7,500.	12,500.	0	0	8,236.	28,236.
	FRUSTULIA RHOMBOIDES A	0	2,500.	0	0	0	2,500.
	FRUSTULIA RHOMBOIDES B	3,750.	0	0	0	0	3,750.
	FRUSTULIA VULGARIS	0	0	0	2,075.	0	2,075.
	GOMPHONEMA OLIVACEUM	0	0	2,760.	0	0	2,760.
	GOMPHONEMA TARGESTINUM	0	0	0	0	1,373.	1,373.
	GYROSIGMA	3,750.	2,500.	0	0	0	6,250.
	GYROSIGMA SCALPROIDES	0	0	0	0	1,373.	1,373.
	MELOSIRA AMBIGUA	51,898.	61,339.	96,229.	166,888.	62,323.	438,676.
	MELOSIRA DISTANS	159,400.	186,804.	168,401.	173,700.	211,897.	900,202.
	MELOSIRA GRANULATA A	7,414.	36,246.	7,217.	51,088.	18,697.	120,662.
	MELOSIRA GRANULATA ANG	0	25,093.	0	23,841.	12,465.	61,399.
	MELOSIRA VARIANS	0	0	2,406.	10,218.	18,697.	31,320.
	MICROCYSTIS INCERTA	208,000.	0	0	0	0	208,000.
	NAVICULA	3,750.	2,500.	0	4,150.	4,118.	14,518.
	NAVICULA CONTENTA	3,750.	0	1,380.	2,142.	0	7,271.
	NAVICULA CRYPTOCEPHALA A	7,500.	0	2,760.	0	1,373.	11,632.
	NAVICULA CRYPTOCEPHALA B	0	0	2,760.	6,225.	0	8,985.
	NAVICULA CUSPIDATA	3,750.	0	0	0	0	3,750.
	NAVICULA RHYNCHOCEPHALA	7,500.	5,000.	0	2,075.	5,491.	20,066.
	NAVICULA TRIPUNCTATA	0	0	0	0	1,373.	1,373.
	NAVICULA VIRIDULA	3,750.	0	0	0	0	3,750.
	NITZSCHIA ACICULARIS	0	0	2,760.	4,150.	0	6,910.
	NITZSCHIA AMPHIBIA	0	2,500.	2,760.	0	0	5,260.
	NITZSCHIA COMMUTATA	0	0	1,380.	2,075.	1,373.	4,828.
	NITZSCHIA DISSIPATA	0	0	1,380.	2,075.	0	3,455.

. NO SAMPLE

TABLE A2-7-1 (Sheet 5 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
78 JAN 19	NITZSCHIA FILIFORMIS	0	7,500.	0	0	1,373.	8,873.
	NITZSCHIA LINEARIS	3,750.	5,000.	4,140.	0	1,373.	14,263.
	NITZSCHIA OBTUSA	0	0	1,380.	2,075.	0	3,455.
	NITZSCHIA PALEA	15,000.	10,000.	6,900.	8,300.	6,864.	47,063.
	NITZSCHIA PARVULA	0	0	0	0	2,745.	2,745.
	NITZSCHIA TRYBLIONELLA	3,750.	0	0	0	1,373.	5,123.
	NITZSCHIA VERMICULARIS	0	0	0	2,075.	0	2,075.
	OSCILLATORIA	0	240,000.	160,000.	0	133,333.	533,333.
	PINNULARIA	0	0	0	0	2,745.	2,745.
	PINNULARIA ABAUJENSIS	0	0	0	2,075.	0	2,075.
	PINNULARIA ACUMINATA	0	0	1,380.	0	0	1,380.
	PINNULARIA BRAUNII	0	0	0	0	1,373.	1,373.
	SCENEDESMUS	0	0	0	0	26,667.	26,667.
	SCENEDESMUS DIMORPHUS	0	0	32,000.	0	0	32,000.
	SCENEDESMUS QUADRICAUDA	0	53,333.	0	53,333.	0	106,667.
	SPIRULINA LAXISSIMA	0	0	0	0	66,667.	66,667.
	SPIRULINA MAJOR	0	26,667.	0	0	0	26,667.
	STEPHANODISCUS ASTREA A	9,267.	13,941.	19,246.	10,218.	31,161.	83,833.
	STEPHANODISCUS HANTZSCHII	22,242.	2,788.	2,406.	13,624.	52,974.	94,034.
	SURIRELLA ANGUSTATA	7,500.	2,500.	2,760.	0	0	12,760.
	SURIRELLA LINEARIS	0	2,500.	0	0	0	2,500.
	SURIRELLA OVATA	0	5,000.	0	0	1,373.	6,373.
	SYNEDRA	3,750.	0	0	0	0	3,750.
	SYNEDRA ULNA A	15,000.	5,000.	0	0	1,373.	21,372.
	SYNEDRA ULNA B	0	0	0	0	1,373.	1,373.
*TOTAL 78 JAN 19		720,063.	918,951.	647,053.	691,697.	1,223,211.	4,200,975.
78 APR 20	ACNANTHES LANCEOLATA B	0	0	0	2,862.	0	2,862.
	ANABAENA	39,267.	0	0	0	0	39,267.
	ASTERIONELLA FORMOSA	16,100.	27,503.	3,740.	8,587.	18,097.	74,027.
	ASTERIONELLA GRACILLIMA	0	27,503.	0	0	0	27,503.
	CHLAMYDOMONAS	6,545.	19,582.	13,089.	19,481.	6,494.	65,190.
	COSCINODISCUS LACUSTRIS	2,741.	4,796.	0	0	0	7,537.
	COSCIODISCUS ROTHII	0	4,796.	0	3,389.	3,721.	11,907.
	CRYPTOMONAS OVATA	13,089.	6,527.	0	19,481.	0	39,097.
	CYCLOTELLA BODANICA C	13,707.	11,990.	0	9,038.	6,202.	40,936.
	CYCLOTELLA GLOMERATA	0	26,378.	5,610.	10,168.	24,809.	66,965.
	CYCLOTELLA MENECHINIANA	54,829.	50,358.	20,296.	16,946.	21,088.	163,517.
	CYCLOTELLA MICHIGANIANA	8,224.	9,592.	5,074.	3,389.	6,202.	32,482.
	CYCLOTELLA STELLIGERA	0	4,796.	0	0	0	4,796.
	DIATOMA ELONGATUM	0	9,168.	0	0	0	9,168.
	DIATOMA HIEMALE	0	0	0	2,862.	0	2,862.
	EUGLENA	0	6,527.	0	0	0	6,527.

. NO SAMPLE

3

TABLE A2-7-1 (Sheet 6 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1977-1978

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
78 APR 20	FRAGILARIA CONSTRUENS	32,199.	0	0	11,450.	4,524.	48,173.	
	GOMPHONEMA OLIVACEUM	0	9,168.	0	0	2,262.	11,430.	
	GYROSIGMA	0	0	935.	0	0	935.	
	MELOSIRA AMBIGUA	71,277.	45,562.	36,786.	24,854.	52,099.	230,580.	
	MELOSIRA DISTANS	167,228.	122,299.	68,499.	73,434.	48,378.	479.838.	
	MELOSIRA GRANULATA A	30,156.	26,378.	19,027.	5,649.	3,721.	84,932.	
	MELOSIRA ITALICA	101,433.	93,523.	68,499.	42,930.	35,973.	342,359.	
	MELOSIRA VARIANS	2,741.	0	3,805.	0	0	6,547.	
	MERIDION CIRCULARE	0	0	935.	0	2,262.	3,197.	
	NAVICULA	2,683.	9,168.	0	0	2,262.	14,113.	
	NAVICULA EXIGA	0	9,168.	0	0	0	9,168.	
	NITZSCHIA ACICULARIS	0	0	0	0	6,786.	6,786.	
	NITZSCHIA AMPHIBIA	0	9,168.	0	0	2,262.	11,430.	
	NITZSCHIA COMMUTATA	0	0	0	5,725.	0	5,725.	
	NITZSCHIA DISSIPATA	0	9,168.	0	2,862.	2,262.	14,292.	
	NITZSCHIA FILIFORMIS	2,683.	0	0	0	0	2,683.	
	NITZSCHIA LINEARIS	0	0	0	2,862.	2[illegible]	5,125.	
	NITZSCHIA PALEA	2,683.	0	1,870.	5,725.	11,3[illegible]	21,589.	
	NITZSCHIA SIGMOIDEA	0	0	0	2,862.	2,262.	5,125.	
	NITZSCHIA TRYBLIONELLA	0	9,168.	0	0	0	9,168.	
	OPEPHORA MARTYI	0	9,168.	0	0	0	9,168.	
	OSCILLATORIA	189,791.	91,384.	130,890.	25,974.	0	438,038.	
	SCENEDESMUS QUADRICAUDA	13,089.	0	0	0	0	13,089.	
	SPIRULINA MAJOR	58,901.	39,164.	39,267.	58,442.	0	195,774.	3
	STEPHANODISCUS ASTREA A	19,190.	38,368.	12,685.	16,946.	7,443.	94,632.	
	SURIRELLA OVATA	0	0	0	2,862.	2,262.	5,125.	
	SYNEDRA ACUS	0	0	935.	2,862.	0	3,797.	
	SYNEDRA ULNA A	2,683.	9,168.	2,805.	0	6,786.	21,442.	
	TABELLARIA FENESTRATA	0	0	1,870.	0	0	1,870.	
*TOTAL 78 APR 20		851,240.	739,539.	436,617.	381,645.	281,734.	2,690,775.	
TOTAL		8,960,771.	7,118,765.	7,175,186.	4,857,079.	5,540,113.	33,651,915.	

. NO SAMPLE

TABLE A2-7-1 (Sheet 7 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
78 JUL 22	ACNANTHES	16,361.	3,490.	4,363.	0	0	24,215.	
	ACNANTHES EXIGUA	0	0	4,363.	0	0	4,363.	
	ASTERIONELLA FORMOSA	0	0	0	9,234.	0	9,234.	
	CALONEIS VENTRICOSA TRUN	0	0	4,363.	9,234.	0	13,597.	
	CLOSTERIUM	0	13,089.	0	0	0	13,089.	
	COCCONEIS PLACENTULA A	0	3,490.	0	0	0	3,490.	
	CYCLOTELLA BODANICA A	18,012.	0	0	3,316.	0	21,328.	
	CYCLOTELLA BODANICA B	0	0	2,592.	0	0	2,592.	
	CYCLOTELLA BODANICA C	6,004.	41,794.	15,551.	6,632.	21,601.	91,582.	
	CYCLOTELLA GLOMERATA	12,008.	11,398.	15,551.	0	5,400.	44,[illegible]358.	
	CYCLOTELLA MENEGHINIANA	72,050.	37,994.	72,573.	59,684.	27,002.	269,302.	
	CYCLOTELLA MICHIGANIANA	12,008.	45,593.	12,959.	36,473.	18,901.	125,935.	
	CYCLOTELLA STELLIGERA	0	15,198.	5,184.	6,632.	5,400.	32,413.	
	DIPLONEIS SMITHII	16,361.	0	0	0	0	16,361.	
	FRAGILARIA CAPUCINA	0	6,981.	0	0	53,975.	60,956.	
	FRAGILARIA CONSTRUENS	0	31,414.	0	0	0	31,414.	
	FRAGILARIA CROTONENSIS	0	0	0	27,702.	0	27,702.	
	FRUSTULIA RHOMBOIDES B	0	0	4,363.	0	0	4,363.	
	GOMPHONEMA ANGUSTATUM	0	3,490.	0	9,234.	0	12,724.	
	GOMPHONEMA OLIVACEUM	16,361.	0	0	9,234.	14,721.	40,316.	
	GYROSIGMA OBTUSATUS	0	0	0	0	4,907.	4,907.	
	GYROSIGMA SCALPROIDES	0	3,490.	0	0	0	3,490.	
	MELOSIRA AMBIGUA	36,025.	26,596.	49,246.	132,631.	78,305.	322,[illegible]2.	
	MELOSIRA DISTANS	450,310.	402,739.	235,861.	368,051.	313,218.	1,77[illegible]79.	3
	MELOSIRA GRANULATA A	156,107.	94,986.	72,573.	33,158.	56,703.	413,527.	
	MELOSIRA GRANULATA ANG	12,008.	18,997.	0	0	18,901.	49,906.	
	MELOSIRA ITALICA	0	98,785.	41,470.	69,631.	43,202.	253,089.	
	MELOSIRA VARIANS	0	0	0	0	2,700.	2,700.	
	NAVICULA	0	3,490.	4,363.	9,234.	0	17,087.	
	NAVICULA CUSPIDATA AMB	0	0	0	9,234.	0	9,234.	
	NAVICULA EXIGA	0	0	4,363.	9,234.	0	13,597.	
	NAVICULA RHYNCHOCEPHALA	16,361.	0	0	0	0	16,361.	
	NITZSCHIA ACICULARIS	0	0	0	9,234.	0	9,234.	
	NITZSCHIA IGNORATA	0	0	0	9,234.	0	9,234.	
	NITZSCHIA LINEARIS	0	3,490.	0	9,234.	0	12,724.	
	NITZSCHIA PALEA	16,361.	10,471.	8,726.	9,234.	0	44,792.	
	NITZSCHIA PARADOXA	0	0	8,726.	0	0	8,726.	
	NITZSCHIA SIGMOIDEA	0	3,490.	0	0	0	3,490.	
	NITZSCHIA TRYBLIONELLA	0	0	4,363.	9,234.	0	13,597.	
	OOCYSTIS	0	52,356.	0	0	0	52,356.	
	SCENEDESMUS QUADRICAUDA	0	0	0	0	52,356.	52,356.	
	STEPHANODISCUS ASTREA A	24,017.	18,997.	10,368.	13,263.	2,700.	69,344.	
	STEPHANODISCUS ASTREA B	0	7,599.	0	0	0	7,599.	
	STEPHANODISCUS HANTZSCHII	0	3,799.	2,592.	3,316.	8,100.	17,808.	

. NO SAMPLE

TABLE A2-7-1 (Sheet 8 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
78 JUL 22	SURIRELLA	0	0	0	9,234.	0	9,234.
	SURIRELLA OVALIS	0	3,490.	0	0	0	3,490.
	SYNEDRA ACUS	16,361.	17,452.	8,726.	9,234.	9,814.	61,587.
	SYNEDRA ULNA A	32,723.	6,981.	34,904.	0	14,721.	89,328.
	SYNEDRA ULNA B	0	3,490.	0	0	19,627.	23,118.
*TOTAL 78 JUL 22		929,440.	994,631.	628,143.	889,761.	772,255.	4,214,230.
78 SEP 28	AMPHORA OVALIS	20,776.	0	0	0	0	20,776.
	ANABAENA	0	0	0	279,232.	143,979.	423,211
	CHROOCOCCUS DISPERSUS A	0	0	26,178.	0	0	26,178.
	COELASTRUM	0	0	65,445.	0	0	65,445.
	COSCIODISCUS ROTHII	47,535.	81,949.	43,630.	57,916.	22,509.	253,538.
	CRUCIGENIA QUADRATA	69,808	0	52,356.	0	52,356.	174,520.
	CRUCIGENIA TETRAPEDIA	0	69,808.	52,356.	0	0	122,164.
	CRYPTOMONAS EROSA	0	0	0	0	26,178.	26,178.
	CYCLOTELLA BODANICA A	0	0	8,726.	34,750.	4,502.	47,977.
	CYCLOTELLA BODANICA C	135,813.	81,949.	17,452.	277,997.	58,524.	571,734.
	CYCLOTELLA MENEGHINIANA	88,279.	100,159.	95,986.	138,998.	45,018.	468,440.
	CYCLOTELLA MICHIGANIANA	6,791.	0	17,452.	11,583.	0	35,826.
	CYCLOTELLA STELLIGERA	0	18,211.	8,726.	0	0	26,937.
	CYMBELLA VENTRICOSA	0	0	0	22,185.	0	22,185.
	CYMBELLA TUMIDA	20,776.	0	0	0	0	20,776.
	DINOKONTAE	0	0	0	66,554.	0	66,554. 3
	DIPLONEIS SMITHII	20,776.	45,792.	10,471.	44,370.	37,397.	158,807.
	EUASTRUM	0	0	0	34,904.	0	34,904.
	FRAGILARIA	20,776.	0	0	0	0	20,776.
	FRAGILARIA CONSTRUENS	62,329.	0	0	0	0	62,329.
	GLENODINIUM	17,452.	0	0	0	0	17,452.
	GOMPHONEMA OLIVACEUM	20,776.	0	0	0	0	20,776.
	GYROSIGMA	0	0	0	22,185.	0	22,185.
	GYROSIGMA OBTUSATUS	0	30,528.	10,471.	44,370.	0	85,369.
	MELOSIRA AMBIGUA	434,603.	309,583.	113,438.	34,750.	139,556.	1,031,930.
	MELOSIRA DISTANS	183,348.	655,588.	410,122.	706,575.	382,654.	2,338,287.
	MELOSIRA GRANULATA A	285,208.	418,848.	628,272.	347,496.	90,036.	1,769,860.
	MELOSIRA GRANULATA ANG	203,720.	154,792.	218,150.	0	81,033.	657,694.
	MELOSIRA ITALICA	54,325.	373,321.	279,232.	961,405.	283,614.	1,951,898.
	NAVICULA	0	0	0	0	9,349.	9,349.
	NAVICULA CRYPTOCEPHALA A	83,105.	0	31,414.	0	0	114,518.
	NAVICULA RHYNCHOCEPHALA	41,552.	30,528.	31,414.	44,370.	9,349.	157,213.
	NITZSCHIA ACICULARIS	0	0	0	22,185.	0	22,185.
	NITZSCHIA LINEARIS	0	0	10,471.	0	0	10,471.
	NITZSCHIA PALEA	20,776.	0	0	0	0	20,776.
	NITZSCHIA PARADOXA	83,105.	0	0	0	0	83,105.

. NO SAMPLE

TABLE A2-7-1 (Sheet 9 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
78 SEP 28	NITZSCHIA SIGMA	0	0	0	0	9,349.	9,349.
	NITZSCHIA SIGMOIDEA	0	0	0	22,185.	0	22,185.
	OOCYSTIS	0	0	0	104,712.	0	104,712.
	OSCILLATORIA	0	226,876.	366,492.	0	510,471.	1,103,839.
	PEDIASTRUM SIMPLEX A	0	0	26,178.	0	0	26,178.
	PLANKTOSPHERIA GELATINOSA	349,040.	122,164.	65,445.	0	0	536,649.
	PROTOCOCCUS VIRIDIS	34,904.	104,712.	65,445.	52,356.	0	257,417.
	SCENEDESMUS ANOMALUS	0	0	0	0	91,623.	91,623.
	SCENEDESMUS BIJUGA	69,808.	0	0	0	0	69,808.
	SCENEDESMUS QUADRICAUDA	0	139,616.	52,356.	69,808.	0	261,780.
	SPIRULINA LAXA	0	52,356.	104,712.	52,356.	39,267.	248,691.
	STEPHANODISCUS ASTREA A	13,581.	9,105.	17,452.	34,750.	9,004.	83,892.
	STEPHANODISCUS ASTREA B	47,535.	27,316.	26,178.	46,333.	13,505.	160,867.
	STEPHANODISCUS HANTZSCHII	0	54,632.	26,178.	34,750.	9,004.	124,564.
	SURIRELLA OVALIS	0	0	10,471.	0	0	10,471.
	SYNEDRA ACUS	41,552.	15,264.	0	22,185.	0	79,001.
	TETRADESMUS WISCONSINENSE	0	69,808.	0	69,808.	0	139,616.
	TRACHELOMONAS GRANULOSA	0	17,452.	0	0	0	17,452.
*TOTAL 78 SEP 28		2,478,050.	3,210,360.	2,892,670.	3,661,064.	2,068,277.	14,310,420.
79 JAN 13	ACNANTHES	0	7,855.	0	3,708.	0	11,563.
	ACNANTHES LANCEOLATA A	0	3,928.	0	0	0	3,928.
	ACNANTHES LANCEOLATA B	0	0	3,091.	0	0	3,091. 3
	ACNANTHES MINUTISSIMA	0	7,855.	6,181.	7,416.	0	21,453.
	AMPHORA COFFEIFORMIS	0	0	0	3,708.	0	3,708.
	ANKISTRODESMUS CONVOLUTUS	13,089.	26,178.	0	13,089.	16,340.	68,696.
	ASTERIONELLA FORMOSA	30,541.	86,409.	101,992.	77,867.	65,009.	361,818.
	ASTERIONELLA GRACILLIMA	8,726.	11,783.	3,091.	0	0	23,600.
	COCCONEIS PLACENTULA B	0	0	3,091.	0	10,001.	13,092.
	COSCINODISCUS DENARIUS	0	5,636.	9,417.	0	0	15,052.
	COSCIODISCUS ROTHII	7,993.	11,271.	9,417.	7,328.	13,574.	49,583.
	CYCLOTELLA BODANICA A	0	0	9,417.	3,664.	0	13,080.
	CYCLOTELLA BODANICA C	27,977.	0	[illegible]3,582.	29,311.	61,084.	221,953.
	CYCLOTELLA GLOMERATA	7,993.	0	0	14,655.	27,148.	49,797.
	CYCLOTELLA MENEGHINIANA	51,956.	112,715.	150,665.	65,949.	61,084.	442,368.
	CYCLOTELLA MICHIGANIANA	31,973.	16,907.	47,083.	40,302.	27,148.	163,413.
	CYCLOTELLA STELLIGERA	0	11,271.	0	7,328.	0	18,599.
	CYMATOPLEURA SOLEA	0	0	6,181.	0	0	6,181.
	CYMBELL VENTRICOSA	0	3,928.	0	0	0	3,928.
	CYMBELLA MINUTA A	0	3,928.	0	7,416.	0	11,344.
	CYMBELLA TUMIDA	0	0	0	7,416.	0	7,416.
	DIATOMA HIEMALE	0	3,928.	0	0	0	3,928.
	DIATOMA VULGARE	4,363.	0	3,091.	3,708.	5,001.	16,162.

. NO SAMPLE

TABLE A2-7-1 (Sheet 10 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
79 JAN 13	DIPLONEIS ELLIPTICA	0	0	0	0	5,001.	5,001.
	DIPLONEIS SMITHII	0	0	0	3,708.	0	3,708.
	EUNOTIA	0	3,928.	0	0	0	3,928.
	FALCATUS MIRABILES	0	13,089.	13,089.	0	0	26,178.
	FRAGILARIA CONSTRUENS	17,452.	0	0	0	10,001.	27,453.
	FRUSTULIA RHOMBOIDES A	8,726.	3,928.	0	3,708.	5,001.	21,362.
	FRUSTULIA RHOMBOIDES AMPH	0	0	3,091.	0	0	3,091.
	GOMPHONEMA	0	0	0	0	5,001.	5,001.
	GOMPHONEMA OLIVACEUM	13,089.	15,711.	9,272.	11,124.	5,001.	54,196.
	GOMPHONEMA PARVULUM	4,363.	0	0	7,416.	5,001.	16,780.
	GOMPHONEMA SUBCLAVATUM	4,363.	0	0	0	0	4,363.
	GYROSIGMA OBTUSATUS	0	3,928.	0	3,708.	0	7,636.
	HANTZSCHIA AMPHIOXUS	0	0	3,091.	0	0	3,091.
	MASTOGLIA BRAUNII	4,363.	0	0	0	0	4,363.
	MELOSIRA AMBIGUA	43,963.	140,893.	197,748.	51,294.	135,741.	569,639.
	MELOSIRA BINDERANA	0	39,450.	0	0	0	39,450.
	MELOSIRA DISTANS	103,913.	242,337.	273,080.	109,915.	230,760.	960,005.
	MELOSIRA GRANULATA A	35,970.	5,636.	0	21,983.	20,361.	83,950.
	MELOSIRA GRANULATA ANG	0	11,271.	47,083.	7,328.	13,574.	79,256.
	MELOSIRA ITALICA	11,990.	16,907.	0	7,328.	6,787.	43,012.
	MELOSIRA VARIANS	7,993.	5,636.	0	3,664.	0	17,293.
	MERIDION CIRCULARE	0	3,928.	0	0	15,002.	18,930.
	NAVICULA	4,363.	3,928.	3,091.	0	0	11,381. 3
	NAVICULA BACILLUM	0	3,928.	0	0	0	3,928.
	NAVICULA CANALIS	0	0	6,181.	0	0	6,181.
	NAVICULA CAPITATA	0	7,855.	0	7,416.	5,001.	20,272.
	NAVICULA CONTENTA PAR	0	0	0	0	5,001.	5,001.
	NAVICULA CRYPTOCEPHALA A	4,363.	0	3,091.	3,708.	0	11,162.
	NAVICULA CUSPIDATA	0	0	0	0	5,001.	5,001.
	NAVICULA DICEPHALA	4,363.	0	0	0	5,001.	9,364.
	NAVICULA EXIGA	4,363.	3,928.	3,091.	0	5,001.	16,382.
	NAVICULA RADIOAPSA TENU	0	0	6,181.	3,708.	0	9,889.
	NAVICULA RADIOSA	4,363.	0	6,181.	7,416.	10,001.	27,962.
	NAVICULA RHYNCHOCEPHALA	0	0	0	11,124.	5,001.	16,125.
	NITZSCHIA ACICULARIS	4,363.	3,928.	0	3,708.	10,001.	22,000.
	NITZSCHIA AMPHIBIA	0	0	0	3,708.	0	3,708.
	NITZSCHIA DISSIPATA	0	3,928.	0	0	0	3,928.
	NITZSCHIA FILIFORMIS	0	3,928.	3,091.	0	0	7,018.
	NITZSCHIA LINEARIS	4,363.	7,855.	6,181.	0	5,001.	23,400.
	NITZSCHIA PALEA	17,452.	11,783.	6,181.	0	30,004.	65,421.
	NITZSCHIA PARADOXA	0	3,928.	3,091.	3,708.	0	10,726.
	NITZSCHIA PARVULA	4,363.	0	3,091.	0	5,001.	12,454.
	NITZSCHIA SIGMA	0	0	6,181.	0	0	6,181.
	NITZSCHIA SIGMOIDEA	0	0	3,091.	0	0	3,091.

. NO SAMPLE

TABLE A2-7-1 (Sheet 11 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
79 JAN 13	NITZSCHIA TRYBLIONELLA	0	0	6,181.	3,708.	0	9,889.
	OSCILLATORIA	91,623.	0	0	117,801.	163,399.	372,823.
	PINNULARIA	4,363.	0	0	0	5,001.	9,364.
	PINNULARIA DIVERGENTISSIMA	0	3,928.	0	0	0	3,928.
	PINNULARIA GIBBA	4,363.	0	0	3,708.	0	8,071.
	PINNULARIA MESOLEPTA	0	3,928.	0	0	0	3,928.
	RHICOSPHENIA CURVATA	0	7,855.	0	11,124.	5,001.	23,980.
	SCENEDESMUS ACUMINATUS	0	0	0	52,356.	0	52,356.
	SPHAEROCYSTIS SCHROETERI	0	0	314,136.	0	0	314,136.
	STEPHANODISCUS ASTREA A	15,987.	28,179.	47,083.	18,319.	40,722.	150,290.
	STEPHANODISCUS ASTREA B	31,973.	84,536.	84,749.	69,613.	156,103.	426,973.
	STEPHANODISCUS ASTREA VM	0	0	28,250.	0	0	28,250.
	STEPHANODISCUS HANTZSCHII	0	0	0	0	6,787.	6,787.
	SURIRELLA ANGUSTATA	0	0	6,181.	0	5,001.	11,182.
	SURIRELLA LINEARIS	4,363.	0	0	0	0	4,363.
	SURIRELLA OVALIS SALINA	0	3,928.	0	3,708.	0	7,636.
	SURIRELLA OVATA	0	0	3,091.	0	10,001.	13,092.
	SYNEDRA	4,363.	0	0	0	0	4,363.
	SYNEDRA ACUS	0	0	0	7,416.	0	7,416.
	SYNEDRA ULNA A	4,363.	0	6,181.	3,708.	0	14,252.
	TABELLARIA FENESTRATA	0	0	0	3,708.	0	3,708.
	WESTELLA BOTRYOIDES	0	0	0	0	65,359.	65,359.
*TOTAL 79 JAN 13		654,550.	1,007,574.	1,557,325.	863,700.	1,291,008.	5,374,157. 3
79 APR 17	ACNANTHES	0	0	9,972.	0	0	9,972.
	ACNANTHES LANCEOLATA D	0	0	0	3,810.	0	3,810.
	ACNANTHES MINUTISSIMA	0	0	0	3,810.	0	3,810.
	ANKISTRODESMUS CONVOLUTUS	0	13,966.	0	0	0	13,966.
	ASTERIONELLA FORMOSA	0	9,716.	9,972.	0	0	19,688.
	COCCONEIS PLACENTULA LIN	0	0	0	0	1,995.	1,995.
	COSCINODISCUS DENARIUS	0	0	0	2,518.	0	2,518.
	COSCIODISCUS ROTHII	7,469.	7,255.	21,848.	7,555.	2,775.	46,902.
	CRYPTOMONAS EROSA	22,989.	13,966.	0	11,429.	0	48,384.
	CYCLOTELLA BODANICA A	3,734.	21,766.	21,848.	2,518.	5,549.	55,416.
	CYCLOTELLA GLOMERATA	7,469.	0	38,235.	5,037.	5,549.	56,289.
	CYCLOTELLA MENEGHINIANA	59,749.	159,617.	60,083.	25,184.	41,618.	346,252.
	CYCLOTELLA MICHIGANIANA	7,469.	58,043.	16,386.	17,629.	16,647.	116,174.
	CYMBELL VENTRICOSA	2,463.	0	9,972.	0	0	12,435.
	CYMBELLA TUMIDA	2,463.	0	9,972.	0	0	12,435.
	CYMBELLA TURGIDA	0	0	0	3,810.	0	3,810.
	FRAGILARIA CONSTRUENS	0	0	0	0	17,951.	17,951.
	GOMPHONEMA OLIVACEUM	4,927.	0	19,944.	3,810.	0	28,680.
	GOMPHONEMA PARVULUM	0	0	9,972.	0	0	9,972.

. NO SAMPLE

TABLE A2-7-1 (Sheet 12 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
79 APR 17	GYROSIGMA	2,463.	0	0	0	0	2,463.
	GYROSIGMA WORMLEYI	0	0	0	0	1,995.	1,995.
	MELOSIRA AMBIGUA	44,812.	123,340.	71,007.	62,960.	63,815.	365,935.
	MELOSIRA DISTANS	74,687.	94,319.	92,856.	75,553.	113,757.	451,171.
	MELOSIRA GRANULATA A	0	7,255.	43,697.	5,037.	0	55,989.
	MELOSIRA GRANULATA ANG	3,734.	0	0	0	0	3,734.
	MELOSIRA ITALICA	0	0	16,386.	0	5,549.	21,935.
	MELOSIRA VARIANS	156,842.	130,596.	98,318.	27,703.	22,197.	435,654.
	MERIDION CIRCULARE	0	4,858.	9,972.	0	0	14,830.
	NAVICULA	0	4,858.	0	0	0	4,858.
	NAVICULA CAPITATA	2,463.	0	0	3,810.	0	6,273.
	NAVICULA CRYPTOCEPHALA A	0	4,858.	0	0	0	4,858.
	NAVICULA CRYPTOCEPHALA B	0	0	0	0	3,989.	3,989.
	NAVICULA RADIOSA	2,463.	4,858.	9,972.	0	0	17,293.
	NAVICULA RHYNCHOCEPHALA	2,463.	9,716.	19,944.	0	0	32,123.
	NITZSCHIA	2,463.	0	0	0	0	2,463.
	NITZSCHIA ACICULARIS	2,463.	4,858.	9,972.	0	1,995.	19,288.
	NITZSCHIA BREVISSIMA	0	0	0	3,810.	0	3,810.
	NITZSCHIA GRACILIS	0	0	0	3,810.	0	3,810.
	NITZSCHIA LINEARIS	0	4,858.	0	0	0	4,858.
	NITZSCHIA OBTUSA	0	0	9,972.	0	0	9,972.
	NITZSCHIA PALEA	2,463.	19,432.	9,972.	11,429.	1,995.	45,290.
	NITZSCHIA PARADOXA	0	0	0	0	1,995.	1,995.
	NITZSCHIA PARVULA	2,463.	0	0	7,619.	0	10,082.
	NITZSCHIA SIGMOIDEA	0	4,858.	9,972.	0	0	14,830.
	PINNULARIA	0	4,858.	0	3,810.	0	8,667.
	PINNULARIA BRAUNII AMP	0	4,858.	0	0	0	4,858.
	PINNULARIA INTERUPTA	0	0	0	0	1,995.	1,995.
	RHICOSPHENIA CURVATA	0	0	0	0	1,995.	1,995.
	STEPHANODISCUS ASTREA A	70,952.	152,362.	103,780.	65,479.	47,168.	439,740.
	SURIRELLA	2,463.	4,858.	0	0	0	7,321.
	SURIRELLA ANGUSTATA	2,463.	0	0	3,810.	0	6,273.
	SURIRELLA OVATA	0	4,858.	0	0	1,995.	6,852.
	SYNEDRA ULNA A	0	14,574.	0	3,810.	1,995.	20,378.
	SYNEDRA ULNA B	0	4,858.	0	0	1,995.	6,852.
*TOTAL 79 APR 17		494,392.	894,218.	734,025.	365,745.	366,509.	2,854,889.
79 JUL 28	ACNANTHES HUNGARCIA	10,641.	0	0	0	0	10,641.
	ACNANTHES MINUTISSIMA	0	0	0	0	873.	873.
	ACNANTHES PINNATA	0	4,504.	0	0	873.	5,376.
	AMPHORA OVALIS	10,641.	0	0	1,454.	0	12,096.
	AMPHORA VENETA	0	0	0	0	873.	873.
	ANABAENA	541,012.	0	0	157,068.	0	698,080.

. NO SAMPLE

TABLE A2-7-1 (Sheet 13 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
79 JUL 28	ANKISTRODESMUS CONVOLUTUS	34,904.	0	13,089.	0	0	47,993.	
	ASTERIONELLA FORMOSA	0	2,252.	0	0	0	2,252.	
	CHLAMYDOMONAS	0	17,452.	0	0	0	17,452.	
	CHROOCOCCUS DISPERSUS B	0	0	0	0	26,178.	26,178.	
	COCCONEIS PLACENTULA A	10,641.	2,252.	0	1,454.	0	14,348.	
	COELASTRUM	0	0	0	0	69,808.	69,808.	
	COSCIODISCUS ROTHII	0	5,792.	0	6,081.	0	11,872.	
	CRUCIGENIA QUADRATA	0	0	0	0	34,904.	34,904.	
	CRUCIGENIA TETRAPEDIA	0	0	0	0	130,890.	130,890.	
	CYCLOTELLA BODANICA C	41,997.	40,541.	31,111.	30,404.	50,149.	194,203.	
	CYCLOTELLA GLOMERATA	181,986.	428,578.	240,002.	431,740.	165,493.	1,447,799.	
	CYCLOTELLA MENEGHINIANA	216,984.	104,249.	71,112.	188,506.	95,284.	676,134.	
	CYCLOTELLA MICHIGANIANA	13,999.	0	0	0	5,015.	19,014.	
	CYCLOTELLA STELLIGERA	0	0	0	6,081.	5,015.	11,096.	
	CYMBELLA SINUATA	0	0	0	0	873.	873.	
	DIATOMA VULGARE	0	0	0	1,454.	873.	2,327.	
	DINOKONTAE	0	0	0	13,089.	0	13,089.	
	DIPLONEIS SMITHII	10,641.	2,252.	0	0	0	12,893.	
	EUGLENA	0	0	0	13,089.	0	13,089.	
	FRAGILARIA CONSTRUENS	478,866.	243,202.	89,753.	143,979.	22,688.	978,488.	
	GOMPHONEMA OLIVACEUM	10,641.	0	1,995.	2,909.	873.	16,417.	
	GOMPHONEMA SPHAEROPHORUM	10,641.	0	997.	0	0	11,639.	
	GYROSIGMA ACUMINATUM	0	0	997.	0	0	997.	
	GYROSIGMA SCALPROIDES	10,641.	0	0	0	0	10,641.	3
	GYROSIGMA WORMLEYI	0	2,252.	2,992.	0	0	5,244.	
	MASTOGLIA BRAUNII	0	2,252.	0	0	0	2,252.	
	MELOSIRA AMBIGUA	251,981.	127,415.	124,446.	91,213.	150,448.	745,50[illegible]	
	MELOSIRA DISTANS	244,981.	133,207.	146,668.	127,698.	245,732.	898,286.	
	MELOSIRA GRANULATA A	370,972.	289,580.	226,669.	304,042.	240,717.	1,431,980.	
	MELOSIRA GRANULATA ANG	83,994.	28,958.	44,445.	24,323.	80,239.	261,959.	
	MELOSIRA VARIANS	0	0	26,667.	12,162.	5,015.	43,844.	
	NAVICULA	10,641.	2,252.	0	1,454.	873.	15,220.	
	NAVICULA CRYPTOCEPHALA A	0	0	997.	0	1,745.	2,742.	
	NAVICULA EXIGA	0	0	0	0	873.	873.	
	NAVICULA RADIOSA	0	0	0	0	873.	873.	
	NAVICULA RHYNCHOCEPHALA	21,283.	2,252.	997.	0	0	24,532.	
	NAVICULA VIRIDULA	0	0	0	0	873.	873.	
	NITZSCHIA	0	0	997.	0	0	997.	
	NITZSCHIA FONTICOLA	10,641.	0	0	0	0	10,641.	
	NITZSCHIA LEVIDENSIS	10,641.	0	0	0	0	10,641.	
	NITZSCHIA OBTUSA	10,641.	0	0	0	0	10,641.	
	NITZSCHIA PALEA	0	0	0	1,454.	0	1,454.	
	NITZSCHIA TRYBLIONELLA	31,924.	2,252.	2,992.	0	1,745.	38,913.	
	OOCYSTIS	0	69,808.	0	0	0	69,808.	

. NO SAMPLE

TABLE A2-7-1 (Sheet 14 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER 1978-1979

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL
79 JUL 28	OPEPHORA MARTYI	0	0	0	1,454.	0	1,454.
	OSCILLATORIA	0	837,696.	39,267.	65,445.	69,808.	1,012,216.
	PEDIASTRUM DUPLEX	558,464.	0	0	0	0	558,464.
	PEDIASTRUM TETRAS	0	0	0	104,712.	0	104,712.
	PINNULARIA	0	2,252.	0	0	0	2,252.
	PINNULARIA APPENDICULATA	0	0	997.	0	0	997.
	PROCTOCOCCUS SP	0	0	0	0	8,726.	8,726.
	RHICOSPHENIA CURVATA	10,641.	0	0	0	0	10,641.
	RHOPALODIA GIBBA	10,641.	2,252.	0	0	0	12,893.
	SC[illegible]MUS ACUMINATUS	0	0	104,712.	0	17,452.	122,164.
	SCENEDESMUS BIJUGA	0	0	52,356.	0	0	52,356.
	SCENEDESMUS INCRASSATULUS	0	0	0	65,445.	0	65,4[illegible].
	SCENEDESMUS QUADRICAUDA	34,904.	0	143,979.	26,178.	52,356.	257,417.
	SETIGERA	17,452.	0	0	0	0	17,452.
	STEPHANODISCUS ASTREA A	41,997.	98,457.	57,778.	60,808.	65,194.	324,235.
	SURIRELLA OVALIS SALINA	10,641.	0	0	0	0	10,641.
	SYNEDRA ACUS	0	0	997.	0	0	997.
	SYNEDRA ULNA A	0	4,504.	0	0	0	4,504.
	SYNEDRA ULNA [illegible]	0	0	0	1,454.	0	1,454.
	TABELLARIA FENESTRATA	0	4,504.	0	0	0	4,504.
	TETRADESMUS WISCONSINENSE	69,808.	0	0	52,356.	0	122,164.
	TRACHELOMONAS	17,452.	0	13,089.	13,089.	0	43,630.
	TRACHELOMONAS SCHAUINSLANDII	34,904.	0	0	0	0	34,904.
*TOTAL 79 JUL 28		3,438,845.	2,460,965.	1,440,102.	1,950,596.	1,553,329.	10,843,837.
TOTAL		7,995,276.	8,567,748.	7,252,265.	7,730,866.	6,[illegible]51,378.	37,597,533.

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TABLE A2-7-1 (Sheet 15 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER CDM 1979-1980

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
79 OCT 01	ACTINASTRUM	0	0	0	0	66,184.	66,184.	
	APHANOCAPSA	0	0	0	2,946,218.	0	2,946,218.	
	CENTRALES	37,199.	46,443.	90,395.	58,924.	8,273.	241,234.	
	CHLOROCOCCALES	55,798.	15,481.	18,079.	0	8,273.	97,631.	
	CHLOROMONADOPHYTA	37,199.	0	0	0	0	37,199.	
	CHROOCOCCALES	18,599.	0	0	0	0	18,599.	
	CHROOCOCCUS	18,599.	0	18,079.	14,731.	33,092.	84,501.	
	CILIOPHORA	0	0	0	0	8,273.	8,273.	
	CLOSTERIOPIS	18,599.	0	0	0	0	18,599.	
	COELASTRUM	0	0	18,079.	0	132,368.	150,447.	
	COSCINODISCUS	0	0	18,079.	44,193.	41,365.	103,637.	
	CRYPTOPHYTA	55,798.	15,481.	0	29,462.	8,273.	109,014.	
	CRYSOPHYCEAE	0	0	0	0	16,546.	16,546.	
	CYCLOTELLA	185,993.	108,366.	162,712.	265,160.	57,911.	780,141.	
	DACTYLOCOCCOPSIS	18,5[illegible]	15,481.	0	0	0	34,080.	
	DICTYOSPHAERIUM	0	0	90,395.	0	0	90,395.	
	EUGLENA	0	0	0	0	33,092.	33,092.	
	EUGLENOPHYTA	0	15,481.	0	29,462.	16,546.	61,489.	
	GLOEOCYSTIS	0	46,443.	36,158.	58,924.	16,546.	158,071.	
	GOLENLEINIA	18,599.	0	0	0	0	18,599.	
	GYMNODINIUM	18,599.	0	0	0	8,273.	26,872.	
	KIRCHNERIELLA	0	61,923.	0	0	0	61,923.	
	LAGERHEINIA	0	0	36,158.	29,[illegible]62.	41,365.	106,985.	
	MELOSIRA	92,997.	294,137.	198,870.	250,429.	140,641.	977,072.	3
	MICRACTINUM	0	0	0	44,193.	16,546.	60,739.	
	MICROSIPHONA	185,993.	154,809.	36,158.	73,655.	91,003.	541,618.	
	NAVICULA	0	0	18,079.	0	8,273.	26,352.	
	NITZSCHIA	111,596.	15,481.	36,1[illegible]8.	44,193.	8,273.	215,701.	
	OOCYSTIS	111,596.	0	0	14,731.	49,638.	175,965.	
	OSCILLATORIA	1,859,932.	2,476,940.	2,350,278.	2,519,016.	1,158,217.	10,364,384.	
	PANDORINA	0	0	289,265.	0	0	289,265.	
	PYRRHOPHYTA	0	15,481.	0	0	0	15,481.	
	SCENEDESMUS	148,795.	61,923.	108,474.	220,966.	115,822.	655,981.	
	STEPHANODISCUS	0	0	18,079.	0	0	18,079.	
	TETRASTUM	0	0	72,316.	294,622.	0	366,938.	
	5-10 MICRONS	111,596.	0	90,395.	58,924.	41,365.	302,281.	
*TOTAL 79 OCT 01		3,106,087.	3,343,869.	3,706,208.	6,997,267.	2,126,156.	19,279,587.	
80 JAN 21	ACNANTHES	0	0	0	0	26,930.	26,930.	
	ANKISTRODESMUS	61,263.	57,934.	44,247.	22,514.	8,977.	194,935.	
	APHANOCAPSA	0	0	0	0	987,443.	987,443.	
	ASTERIONELLA	98,021.	123,110.	246,521.	67,541.	89,768.	624,960.	
	CENTRALES	0	21,725.	0	0	0	21,725.	

. NO SAMPLE

TABLE A2-7-1 (Sheet 16 of 16)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER CDM 1979-1980

DATE	TAXA	STATION AC	AT	BC	BT	BT1	TOTAL	
80 JAN 21	CHLAMYDOMONAS	0	14,484.	12,642.	0	17,954.	45,079.	
	CHLOROCOCCALES	12,253.	0	0	0	0	12,253.	
	CHLOROPHYTA	0	0	44,247.	0	8,977.	53,224.	
	CILIOPHORA	24,505.	0	0	0	0	24,505.	
	CRYPTOMONAS	24,505.	14,484.	18,963.	0	44,884.	102,836.	
	CRYPTOPHYTA	61,263.	43,451.	50,568.	60,036.	26,930.	242,248.	
	CRYSOPHYCEAE	0	0	0	30,018.	0	30,018.	
	CYCLOTELLA	0	0	12,642.	0	8,977.	21,619.	
	DICTYOSPHAERIUM	0	0	25,284.	127,577.	0	152,861.	
	EUGLENA	12,253.	0	6,321.	0	8,977.	27,550.	
	EUGLENOPHYTA	36,758.	0	6,321.	30,018.	0	73,097.	
	GREATER THAN 10 MICRONS	12,253.	0	0	7,505.	0	19,757.	
	GYMNODINIUM	12,253.	0	0	0	0	12,253.	
	LAGERHEINIA	0	0	6,321.	0	0	6,321.	
	LEPOCINCLIS	232,800.	173,802.	189,631.	240,145.	161,582.	997,960.	
	MELOSIRA	122,526.	159,319.	347,657.	105,063.	170,558.	905,124.	
	MICROCYSTIS	980,211.	0	0	0	0	980,211.	
	MICROSIPHONA	0	28,967.	0	30,018.	0	58,985.	
	NAVICULA	49,011.	0	0	0	0	49,011.	
	NITZSCHIA	36,758.	7,242.	0	7,505.	8,977.	60,481.	
	OSCILLATORIA	0	94,143.	63,210.	262,658.	0	420,011.	3
	PANDORINA	49,011.	0	0	0	0	49,011.	
	PENNALES	0	14,484.	6,321.	0	0	20,805.	
	PYRRHOPHYTA	0	0	0	0	8,977.	8,977.	
	RHOICOSPHENIA	12,253.	0	0	0	0	12,253.	
	SCENEDESMUS	73,516.	57,934.	120,100.	150,090.	0	401,640.	
	STELEXOMONAS	122,526.	21,725.	88,495.	97,559.	98,744.	429,049.	
	STEPHANODISCUS	294,063.	152,077.	82,174.	90,054.	206,465.	824,833.	
	SYNEDRA	0	7,242.	0	0	8,977.	16,219.	
	TETRASTUM	147,032.	0	0	0	0	147,032.	
	TINTINNIDA	0	0	0	15,009.	0	15,009.	
	TRACHELOMONAS	0	0	0	0	26,930.	26,930.	
	5-10 MICRONS	73,516.	14,484.	6,321.	37,523.	26,930.	158,773.	
*TOTAL 80 JAN 21		2,548,548.	1,006,604.	1,377,987.	1,380,831.	1,947,956.	8,261,927.	
TOTAL		5,654,635.	4,350,473.	5,084,195.	8,378,098.	4,074,112.	27,541,514.	

* NO SAMPLE

TABLE A2-7-2 (Sheet 1 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1978-1979

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT'	TOTAL	
78 JUL 22 CHLOROPHYTA GREEN ALGAE	CHLOROCOCCALES	0	52,356.	0	0	52,356.	104,712.	
	DESMIDIACEAE	0	13,089.	0	0	0	13,089.	
*TOTAL GROUP CHLOROPHYTA [illegible]EN ALGAE		0.	65,445.	0.	0.	52,356.	117,801.	
DIATOMACEAE DIATOMS	CENTRALES	798,549.	824,474.	536,5[illegible].	732,785.	602,135.	3,494,464.	
	PENNALES	130,890.	104,712.	91,623.	156,976.	117,764.	601,965.	
*TOTAL GROUP DIATOMACEAE DIATOMS		929,440.	929,186.	628,143.	889,761.	719,899.	4,096,429.	
*TOTAL DATE 78 JUL 22		929,440.	994,631.	628,143.	889,761.	772,255.	4,214,230.	
78 SEP 28 CHLOROPHYTA GREEN ALGAE	CHLOROCOCCALES	488,656.	401,396.	314,136.	244,328.	143,979.	1,592,496.	
	CHAETOPHORALES	34,904.	104,712.	65,445.	52,356.	0	257,417.	
	DESMIDIACEAE	0	0	0	34,904.	0	34,904.	
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		523,560.	506,108.	379,581.	331,588.	143,979.	1,884,817.	
CRYPTOPHYTA BROWN FLAGELLA	CRYPTOMONADACEAE	0	0	0	0	26,178.	26,178.	
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		0.	0.	0.	0.	26,178.	26,178.	3
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	0	0	26,178.	0	0	26,178.	
	OSCILLIATORIALES	0	279,232.	471,204.	52,356.	549,738.	1,352,531.	
	NOSTOCALES	0	0	0	279,232.	143,979.	423,211.	
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		0.	279,232.	497,382.	331,588.	693,717.	1,801,920.	
DIATOMACEAE DIATOMS	CENTRALES	1,500,737.	2,285,454.	1,910,995.	2,687,301.	1,138,957.	9,523,444.	
	PENNALES	436,300.	122,113.	104,712.	244,032.	65,445.	972,603.	
*TOTAL GROUP DIATOMACEAE DIATOMS		1,937,037.	2,407,567.	2,015,707.	2,931,333.	1,204,402.	10,496,047.	
EUGLENOPHYTA PROTOZOAN LIKE	EUGLENALES	0	17,452.	0	0	0	17,452.	
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		0.	17,452.	0.	0.	0.	17,452.	
PYRROPHYTA DINOFLAGELLATES	DINOKONTAE	17,452.	0	0	66,554.	0	84,006.	

TABLE A2-7-2 (Sheet 2 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1978-1979

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		17,452.	0.	0.	66 554.	0.	84,006.
*TOTAL DATE 78 SEP 28		2,478,050.	3,210,360.	2,892,670.	3,661,064.	2,068,277.	14,310,420.
79 JAN 13 CHLOROPHYTA GREEN ALGAE	CHLOROCOCCALES	13,089.	39,267.	327,225.	65,445.	81,699.	526,726.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		13,089.	39,267.	327,225.	65,445.	81,699.	526,726.
CYANOPHYTA BLUE-GREEN ALGAE	OSCILLIATORIALES	91,623.	0	0	117,801.	163,399.	372,823.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		91,623.	0.	0.	117,801.	163,399.	372,823.
DIATOMACEAE DIATOMS	CENTRALES	379,681.	732,646.	1,007,571.	457,978.	800,874.	3,378,750.
	PENNALES	170,157.	235,661.	222,529.	222,476.	245,036.	1,095,858.
*TOTAL GROUP DIATOMACEAE DIATOMS		549,838.	968,307.	1,230,100.	680,454.	1,045,910.	4,474,609.
*TOTAL DATE 79 JAN 13		654,550.	1,007,574.	1,557,325.	863,700.	1,291,008.	5,374,157.
79 APR 17 CHLOROPHYTA GREEN ALGAE	CHLOROCOCCALES	0	13,966.	0	0	0	13,966.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		0.	13,966.	0.	0.	0.	13,966.
CRYPTOPHYTA BROWN FLAGELLA	CRYPTOMONADACEAE	22,989.	13,966.	0	11,429.	0	48,384.
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		22,989.	13,966.	0.	11,429.	0.	48,384.
DIATOMACEAE DIATOMS	CENTRALES	436,916.	754,553.	584,444.	297,173.	324,624.	2,397,710.
	PENNALES	34,488.	111,732.	149,581.	57,143.	41,885.	394,828.
*TOTAL GROUP DIATOMACEAE DIATOMS		471,404.	866,285.	734,025.	354,316.	366,509.	2,792,539.
*TOTAL DATE 79 APR 17		494,392.	894,218.	734,025.	365,7[illegible].	366,509.	2,854,889.
79 JUL 28 CHLOROPHYTA GREEN ALGAE	VOLVOCALES	0	17,452.	0	0	0	17,452.
	CHLOROCOCCALES	715,532.	69,808.	314,136.	248,691.	314,136.	1,662,304.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		715,532.	87,260.	314,136.	248,691.	314,136.	1,679,756.

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TABLE A2-7-2 (Sheet 3 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1978-1979

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
79 JUL 28 CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	0	0	0	0	26,178.	26,178.
	OSCILLIATORIALES	0	837,696.	39,267.	65,445.	69,808.	1,012,216.
	NOSTOCALES	541,012.	0	0	157,068.	0	698,080.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		541,012.	837,696.	39,267.	222,513.	95,986.	1,736,475.
DIATOMACEAE DIATOMS	CENTRALES	1,448,890.	1,256,776.	968,898.	1,283,057.	1,108,303.	6,065,924.
	PENNALES	681,054.	279,232.	104,712.	157,068.	34,904.	1,256,970.
*TOTAL GROUP DIATOMACEAE DIATOMS		2,129,944.	1,536,008.	1,073,610.	1,440,125.	1,143,207.	7,322,894.
EUGLENOPHYTA PROTOZOAN LIKE	EUGLENALES	52,356.	0	13,089.	26,178.	0	91,623.
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		52,356.	0.	13,089.	26,178.	0.	91,623.
PYRROPHYTA DINOFLAGELLATES	DINOKONTAE	0	0	0	13,089.	0	13,089.
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		0.	0.	0.	13,089.	0.	13,089.
*TOTAL DATE 79 JUL 28		3,438,845.	2,460,965.	1,440,10[illegible].	1,950,596.	1,553,329.	10,843,837.
TOTAL		7,995,276.	8,567,748.	7,252,265.	7,730,866.	6,051,378.	37,597,533.

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TABLE A2-7-2 (Sheet 4 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1979-1980

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
79 OCT 01 CHLOROMONADOPHYTA NON-FIL.	CHLOROMONADOPHYTA	37,199.	0	0	0	0	37,199.
*TOTAL GROUP CHLOROMONADOPHYTA NON-FIL.		37,199.	0.	0.	0.	0.	37,199.
CHLOROPHYTA GREEN ALGAE	VOLVOCALES	0	0	289,265.	0	0	289,265.
	TETRASPORALES	0	46,443.	36,158.	58,924.	16,546.	158,071.
	CHLOROCOCCALES	353,387.	139,328.	343,502.	603,975.	430,195.	1,870,387.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		353,387.	185,770.	668,925.	662,899.	446,741.	2,317,723.
CRYPTOPHYTA BROWN FLAGELLA	CRYPTOPHYTA	55,798.	15,481.	0	29,462.	8,273.	109,014.
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		55,798.	15,481.	0.	29,462.	8,273.	109,014.
CRYSOPHYCEAE YELLOWGREEN	CRYSOPHYCEAE	0	0	0	0	16,546.	16,546.
*TOTAL GROUP CRYSOPHYCEAE YELLOWGREEN		0.	0.	0.	0.	16,546.	16,546.
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	55,798.	15,481.	18,079.	2,960,949.	33,092.	3,083,399.
	OSCILLIATORIALES	1,859,932.	2,476,940.	2,350,278.	2,519,016.	1,158,217.	10,364,384.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		1,915,730.	2,492,421.	2,368,357.	5,479,965.	1,191,309.	13,447,783.
DIATOMACEAE DIATOMS	CENTRALES	502,182.	603,754.	524,293.	692,361.	339,192.	2,661,782.
	PENNALES	111,596.	15,481.	54,237.	44,193.	16,546.	242,053.
*TOTAL GROUP DIATOMACEAE DIATOMS		613,778.	619,235.	578,530.	736,554.	355,738.	2,903,835.
EUGLENOPHYTA PROTOZOAN LIKE	EUGLENOPHYTA	0	15,481.	0	29,462.	16,546.	61,489.
	EUGLENALES	0	0	0	0	33,092.	33,092.
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		0.	15,481.	0.	29,462.	49,638.	94,581.
PROTOZOA	CILIOPHORA	0	0	0	0	8,273.	8,273.
*TOTAL GROUP PROTOZOA		0.	0.	0.	0.	8,273.	8,273.

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TABLE A2-7-2 (Sheet 5 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1979-1980

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
79 OCT 01 PYRROPHYTA DINOFLAGELLATES	PYRROPHYTA	0	15,481.	0	0	0	15,481.
	DINOKONTAE	18,599.	0	0	0	8,273.	26,872.
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		18,599.	15,481.	0.	0.	8,273.	42,353.
UNIDENTIFIED	FLAGELLATED	55,798.	0	54,237.	0	16,546.	126,581.
	UNICELLULAR	55,798.	0	36,158.	58,924.	24,819.	175,699.
*TOTAL GROUP UNIDENTIFIED		111,596.	0.	90,395.	58,924.	41,365.	302,281.
*TOTAL DATE 79 OCT 01		3,106,087.	3,343,869.	3,706,208.	6,997,267.	2,126,156.	19,279,587.
80 JAN 21 CHLOROPHYTA GREEN ALGAE	CHLOROPHYTA	0	0	44,247.	0	8,977.	53,224.
	VOLVOCALES	49,011.	14,484.	12,642.	0	17,954.	94,090.
	CHLOROCOCCALES	294,063.	115,868.	195,952.	300,181.	8,977.	915,041.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		343,074.	130,352.	252,842.	300,181.	35,907.	1,062,355. 3
CRYPTOPHYTA BROWN FLAGELLA	CRYPTOPHYTA	61,263.	43,451.	50,568.	60,036.	26,930.	242,248.
	CRYPTOMONADACEAE	24,505.	14,484.	18,963.	0	44,884.	102,836.
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		85,768.	57,934.	69,531.	60,036.	71,814.	345,084.
CRYSOPHYCEAE YELLOWGREEN	CRYSOPHYCEAE	0	0	0	30,018.	0	30,018.
	MONOSIGALES	122,526.	21,725.	88,495.	97,559.	98,744.	429,049.
*TOTAL GROUP CRYSOPHYCEAE YELLOWGREEN		122,526.	21,725.	88,495.	127,577.	98,744.	459,067.
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	980,211.	0	0	0	987,443.	1,967,654.
	OSCILLIATORIALES	0	94,143.	63,210.	262,658.	0	420,011.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		980,211.	94,143.	63,210.	262,658.	987,443.	2,387,665.
DIATOMACEAE DIATOMS	CENTRALES	416,590.	362,088.	442,473.	225,136.	386,001.	1,832,286.
	PENNALES	196,042.	152,077.	252,842.	75,045.	134,651.	810,657.
*TOTAL GROUP DIATOMACEAE DIATOMS		612,632.	514,165.	695,315.	300,181.	520,652.	2,642,944.

TABLE A2-7-2 (Sheet 6 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1979-1980

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
80 JAN 21 EUGLENOPHYTA PROTOZOAN LIKE	EUGLENOPHYTA	36,758.	0	6,321.	30,018.	0	73,097.
	EUGLENALES	245,053.	173,802.	195,952.	240,145.	197,489.	1,052,440.
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		281,811.	173,802.	202,273.	270,163.	197,489.	1,125,537.
PROTOZOA	CILIOPHORA	24,505.	0	0	15,009.	0	39,514.
*TOTAL GROUP PROTOZOA		24,505.	0.	0.	15,009.	0.	39,514.
PYRROPHYTA DINOFLAGELLATES	PYRROPHYTA	0	0	0	0	8,977.	8,977.
	DINOKONTAE	12,253.	0	0	0	0	12,253.
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		12,253.	0.	0.	0.	8,977.	21,229.
UNIDENTIFIED	FLAGELLATED	12,253.	0	6,321.	15,009.	26,930.	60,513.
	UNICELLULAR	73,516.	14,484.	0	30,018.	0	118,017.
*TOTAL GROUP UNIDENTIFIED		85,768.	14,484.	6,321.	45,027.	26,930.	178,530.
*TOTAL DATE 80 JAN 21		2,548,548.	1,006,504.	1,377,987.	1,380,831.	1,947,956.	8,261,927.
TOTAL		5,654,635.	4,350,473.	5,084,195.	8,378,098.	4,074,112.	27,541,514.

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TABLE A2-7-2 (Sheet 7 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1977-1978

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL	
77 AUG 12 CHLOROPHYTA GREEN ALGAE	VOLVOCALES	13,298.	0	8,000.	32,000.	0	53,298.	
	CHLOROCOCCALES	412,234.	304,000.	512,000.	504,000.	281,316.	2,013,550.	
	DESMIDIACEAE	0	0	8,000.	0	0	8,000.	
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		425,532.	304,000.	528,000.	536,000.	281,316.	2,074,848.	
CRYPTOPHYTA BROWN FLAGELLA	CRYPTOMONADACEAE	0	0	8,000.	72,000.	0	80,000.	
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		0.	0.	8,000.	72,000.	0.	80,000.	
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	478,723.	208,000.	512,000.	152,000.	74,310.	1,425,033.	
	OSCILLIATORIALES	319,149.	520,000.	328,000.	608,000.	185,775.	1,960,924.	
	NOSTOCALES	984,043.	464,000.	368,000.	728,000.	307,856.	2,851,898.	
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		1,781,915.	1,192,000.	1,208,000.	1,488,000.	567,941.	6,237,856.	
DIATOMACEAE DIATOMS	CENTRALES	1,955,321.	1,055,863.	1,335,807.	1,583,757.	974,999.	6,905,747.	
	PENNALES	132,979.	192,308.	111,966.	103,981.	53,205.	594,439.	3
*TOTAL GROUP DIATOMACEAE DIATOMS		2,088,300.	1,248,170.	1,447,774.	1,687,737.	1,028,205.	7,500,186.	
EUGLENOPHYTA PROTOZOAN LIKE	EUGLENALES	13,298.	0	0	0	5,308.	18,606.	
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		13,298.	0.	0.	0.	5,308.	18,606.	
PYRROPHYTA DINOFLAGELLATES	DINOPONTAE	0	16,000.	0	0	0	16,000.	
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		0.	16,000.	0.	0.	0.	16,000.	
*TOTAL DATE 77 AUG 12		4,309,044.	2,760,170.	3,191,774.	3,783,737.	1,882,769.	15,927,495.	
77 SEP 25 CHLOROPHYTA GREEN ALGAE	VOLVOCALES	0	0	0	0.	0	0.	
	CHLOROCOCCALES	700,000.	60,000.	160,000.	0.	200,000.	1,120,000.	
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		700,000.	60,000.	160,000.	0.	200,000.	1,120,000.	
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	320,000.	280,000.	0	0.	0	600,000.	

TABLE A2-7-2 (Sheet 8 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1977-1978

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
77 SEP 25 CYANOPHYTA BLUE-GREEN ALGAE	OSCILLIATORIALES	100,000.	100,000.	460,000.	0	0	660,000.
	NOSTOCALES	280,000.	0	240,000.	0.	0	520,000.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		700,000.	380,000.	700,000.	0.	0.	1,780,000.
DIATOMACEAE DIATOMS	CENTRALES	1,460,038.	1,700,129.	1,719,626.	0.	1,519,553.	6,399,347.
	PENNALES	220,386.	559,975.	320,116.	0.	432,845.	1,533,322.
*TOTAL GROUP DIATOMACEAE DIATOMS		1,680,424.	2,260,104.	2,039,743.	0.	1,952,399.	7,932,669.
*TOTAL DATE 77 SEP 25		3,080,424.	2,700,104.	2,899,743.	0.	2,152,399.	10,832,669.
78 JAN 19 CHLOROPHYTA GREEN ALGAE	VOLVOCALES	0	0	0	13,333.	0	13,333.
	CHLOROCOCCALES	8,000.	80,000.	32,000.	53,333.	26,667.	200,000.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		8,000.	80,000.	32,000.	66,667.	26,667.	213,333.
CYANOPHYTA BLUE-GREEN ALGAE	CHROOCOCCALES	208,000.	0	0	0	0	208,000.
	OSCILLIATORIALES	0	266,667.	160,000.	0	200,000.	626,667.
	NOSTOCALES	56,000.	13,333.	0	0	320,000.	389,333.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		264,000.	280,000.	160,000.	0.	520,000.	1,224,000.
DIATOMACEAE DIATOMS	CENTRALES	328,066.	465,616.	392,133.	558,564.	598,299.	2,342,679.
	PENNALES	119,996.	80,002.	46,919.	66,466.	78,246.	391,629.
*TOTAL GROUP DIATOMACEAE DIATOMS		448,063.	545,618.	439,053.	625,030.	676,544.	2,734,308.
PYRROPHYTA DINOFLAGELLATES	DINOKONTAE	0	13,333.	16,000.	0	0	29,333.
*TOTAL GROUP PYRROPHYTA DINOFLAGELLATES		0.	13,333.	16,000.	0.	0.	29,333.
*TOTAL DATE 78 JAN 19		720,063.	918,951.	647,053.	691,697.	1,223,211.	4,200,975.
78 APR 20 CHLOROPHYTA GREEN ALGAE	VOLVOCALES	6,545.	19,582.	13,089.	19,481.	6,494.	65,190.
	CHLOROCOCCALES	13,089.	0	0	0	0	13,089.
*TOTAL GROUP CHLOROPHYTA GREEN ALGAE		19,634.	19,582.	13,089.	19,481.	6,494.	78,279.

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TABLE A2-7-2 (Sheet 9 of 9)

PHYTOPLANKTON DENSITIES IN THE VICINITY OF WATERFORD 3
NO./LITER BY MAJOR GROUP 1977-1978

DATE GROUP	DIVISION	STATION AC	AT	BC	BT	BT1	TOTAL
78 APR 20 CRYPTOPHYTA BROWN FLAGELLA	CRYPTOMONADACEAE	13,089.	6,527.	0	19,481.	0	39,097.
*TOTAL GROUP CRYPTOPHYTA BROWN FLAGELLA		13,089.	6,527.	0.	19,481.	0.	39,097.
CYANOPHYTA BLUE-GREEN ALGAE	OSCILLIATORIALES	248,691.	130,548.	170,157.	84,416.	0	633,812.
	NOSTOCALES	39,267.	0	0	0	0	39,267.
*TOTAL GROUP CYANOPHYTA BLUE-GREEN ALGAE		287,958.	130,548.	170,157.	84,416.	0.	673,079. 3
DIATOMACEAE DIATOMS	CENTRALES	471,528.	438,838.	240,282.	206,744.	209,638.	1,567,030.
	PENNALES	59,032.	137,516.	13,089.	51,524.	65,602.	326,764.
*TOTAL GROUP DIATOMACEAE DIATOMS		530,560.	576,354.	253,371.	258,268.	275,240.	1,893,793.
EUGLENOPHYTA PROTOZOAN LIKE	EUGLENALES	0	6,527.	0	0	0	6,527.
*TOTAL GROUP EUGLENOPHYTA PROTOZOAN LIKE		0.	6,527.	0.	0.	0.	6,527.
*TOTAL DATE 78 APR 20		851,240.	739,539.	436,617.	381,645.	281,734.	2,690,775.
TOTAL		8,960,771.	7,118,765.	7,175,186.	4,857,079.	5,540,113.	33,651,915.

TABLE A2-7-3 (Sheet 1 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1977-1978

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
77 AUG	1	BOSMINA	.35	0	.37	.22	.34	1.28
		CERIODAPHNIA	0	.17	.37	.44	0	.98
		DAPHNIA	1.04	0	.56	.22	0	1.82
		DECAPODA	.52	0	.37	0	.17	1.06
		DIAPHANOSOMA	3.12	0	.93	1.43	.17	5.66
		MOINA	14.89	1.75	14.67	20.41	18.64	70.37
		OTHER	1.73	.92	2.90	.11	.86	6.51
		ROTIFERA	.17	0	.09	.22	.17	.66
		SUBORDER CALANOIDA	2.42	1.84	.84	.66	2.22	7.99
		SUBORDER CYCLOPOIDA	36.88	20.54	73.93	69.17	56.43	256.95
	2	BOSMINA	7.91	4.35	14.78	8.14	2.84	38.04
		CERIODAPHNIA	0	2.72	8.45	6.11	1.42	18.70
		DAPHNIA	2.97	2.72	10.56	4.07	2.84	23.16
		DECAPODA	11.87	0	21.12	34.61	28.44	96.04
		DIAPHANOSOMA	199.83	29.93	156.25	220.57	164.93	771.52
		MOINA	412.51	184.50	443.42	390.92	369.68	1,801.03
		OTHER	5.94	136.60	8.45	5.43	4.27	160.68
		SUBORDER CALANOIDA	57.38	11.97	19.00	12.22	21.33	121.90
		SUBORDER CYCLOPOIDA	208.73	7.63	238.60	190.03	255.93	900.92
	3	BOSMINA	.	.	.69	29.20	0	29.89
		CERIODAPHNIA	.	.	0	14.60	2.11	16.71
		DAPHNIA	.	.	11.79	43.80	10.55	66.14
		DECAPODA	.	.	1.39	36.50	10.55	48.44
		DIAPHANOSOMA	.	.	40.22	250.65	65.44	356.30
		MOINA	.	.	278.05	876.05	329.29	1,483.38
		OTHER	.	.	12.48	60.84	10.55	83.87
		SUBORDER CALANOIDA	.	.	13.17	46.24	33.77	93.18
		SUBORDER CYCLOPOIDA	.	.	210.10	352.85	232.19	795.14
*TOTAL MONTH 77 AUG			968.26	405.64	1,583.56	2,675.72	1,625.15	7,258.33
77 SEP	1	BOSMINA	.26	0	.09	0	0	.35
		CERIODAPHNIA	.17	0	.02	0	0	.20
		DAPHNIA	.60	0	.33	0	0	.94
		DECAPODA	.43	.27	.22	.22	.24	1.38
		DIAPHANOSOMA	1.99	.09	.36	1.09	.24	3.76
		MOINA	4.41	0	.78	.22	.16	5.56
		OTHER	.95	.18	.22	1.09	.87	3.31
		SUBORDER CALANOIDA	9.59	19.60	7.97	36.96	33.31	107.42
		SUBORDER CYCLOPOIDA	4.67	3.04	1.67	5.65	4.02	19.05
	2	BOSMINA	0	0	0	.05	0	.05

. NO SAMPLE

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TABLE A2-7-3 (Sheet 2 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1977-1978

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
77 SEP	2	DECAPODA	.11	0	.06	0	.10	.28
		DIAPHANOSOMA	.34	.15	.63	1.08	.37	2.58
		MOINA	.15	0	.19	.30	.24	.87
		OTHER	.49	.09	1.96	1.03	.17	3.74
		SUBORDER CALANOIDA	14.19	2.32	9.62	14.93	4.30	45.36
		SUBORDER CYCLOPOIDA	2.80	.40	4.05	7.93	1.73	16.91
	3	CERIODAPHNIA	.	.	.02	0	0	.02
		DAPHNIA	.	.	.03	0	.02	.06
		DECAPODA	.	.	0	.10	.07	.17
		DIAPHANOSOMA	.	.	.44	.62	.07	1.13
		MOINA	.	.	.24	.10	.02	.36
		OTHER	.	.	.30	1.34	.02	1.67
		SUBORDER CALANOIDA	.	.	4.63	4.82	2.17	11.63
		SUBORDER CYCLOPOIDA	.	.	3.35	2.10	.60	6.05
*TOTAL MONTH 77 SEP			41.14	26.14	37.20	79.61	48.72	232.82
78 JAN	1	BOSMINA	2.08	2.61	1.22	3.67	.48	10.06
		CERIODAPHNIA	0	1.74	1.22	0	.56	3.52
		DAPHNIA	11.22	27.87	16.29	24.22	4.11	83.71
		DIAPHANOSOMA	0	0	.24	.37	0	.61
		MOINA	1.25	0	0	0	0	1.25
		OTHER	8.31	48.77	7.78	9.17	4.99	79.04
		ROTIFERA	0	0	.24	0	.08	.32
		SUBORDER CALANOIDA	32.00	65.32	61.76	71.93	27.47	258.48
		SUBORDER CYCLOPOIDA	13.71	28.74	32.83	52.48	24.41	152.17
	2	BOSMINA	2.18	3.04	.73	1.21	3.28	10.44
		CERIODAPHNIA	2.18	3.04	.29	.17	.39	6.07
		DAPHNIA	14.18	24.31	8.03	9.35	12.16	68.03
		OTHER	34.55	25.61	9.49	6.23	13.51	89.39
		ROTIFERA	0	.43	0	0	.19	.63
		SUBORDER CALANOIDA	52.00	49.49	26.72	35.15	38.21	201.57
		SUBORDER CYCLOPOIDA	32.00	19.53	6.28	27.71	28.37	113.89
	3	BOSMINA	.	.	0	.68	1.29	1.97
		CERIODAPHNIA	.	.	0	.23	.50	.72
		DAPHNIA	.	.	1.96	4.40	10.31	16.67
		OTHER	.	.	4.10	5.64	12.19	21.93
		ROTIFERA	.	.	0	.11	0	.11
		SUBORDER CALANOIDA	.	.	33.67	22.79	30.32	86.79
		SUBORDER CYCLOPOIDA	.	.	22.45	6.66	17.94	47.04
*TOTAL MONTH 78 JAN			205.66	300.51	235.30	282.17	230.77	1,254.41

. NO SAMPLE

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TABLE A2-7-3 (Sheet 3 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1977-1978

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
78 APR	1	BOSMINA	20.80	70.31	24.71	13.84	34.11	163.76
		CERIODAPHNIA	62.40	33.09	18.30	27.67	72.23	213.69
		DAPHNIA	344.15	599.67	273.61	76.86	238.75	1,533.05
		MOINA	7.56	28.95	0	0	6.02	42.53
		OTHER	88.87	264.68	268.12	133.74	114.36	869.78
		ROTIFERA	0	12.41	0	0	0	12.41
		SUBORDER CALANOIDA	136.15	165.43	106.15	53.80	142.45	603.98
		SUBORDER CYCLOPOIDA	527.57	661.70	412.71	182.93	499.58	2,284.49
	2	BOSMINA	3.30	46.76	32.51	28.42	26.49	137.49
		CERIODAPHNIA	7.71	116.90	65.02	78.69	80.63	348.96
		DAPHNIA	30.84	568.93	451.05	347.56	649.66	2,048.06
		DIAPHANOSOMA	0	15.59	0	2.19	2.30	20.08
		MOINA	1.10	7.79	0	4.37	0	13.27
		OTHER	91.42	646.87	160.51	135.53	196.97	1,231.30
		ROTIFERA	0	0	0	8.74	2.30	11.05
		SUBORDER CALANOIDA	47.36	109.11	113.78	146.46	141.68	558.39
		SUBORDER CYCLOPOIDA	210.37	576.73	566.87	535.55	434.26	2,323.78
	3	BOSMINA	.	.	23.49	23.97	35.24	82.71
		CERIODAPHNIA	.	.	63.77	21.89	68.05	153.71
		DAPHNIA	.	.	411.13	184.49	420.46	1,016.08
		DIAPHANOSOMA	.	.	3.36	0	2.43	5.79
		MOINA	.	.	15.10	2.08	3.65	20.83
		OTHER	.	.	78.87	115.70	114.23	308.80
		SUBORDER CALANOIDA	.	.	151.03	64.62	75.34	290.99
		SUBORDER CYCLOPOIDA	.	.	639.35	259.54	387.65	1,286.54
*TOTAL MONTH 78 APR			1,579.61	3,924.92	3,879.44	2,448.65	3,748.88	15,581.49
TOTAL			2,794.67	4,657.21	5,735.50	5,486.15	5,653.52	24,327.05

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. NO SAMPLE

TABLE A2-7-3 (Sheet 4 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1978-1979

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL	
78 JUL	1	BOSMINA	.08	.06	0	0	.06	.20	
		DAPHNIA	0	1.62	.05	0	.06	1.72	
		DECAPODA	2.03	12.01	2.72	3.85	5.76	26.37	
		DIAPHANOSOMA	0	.06	0	.12	0	.18	
		MOINA	1.06	1.80	.23	.30	.61	4.00	
		OTHER	.08	1.24	.09	.30	.22	1.94	
		SUBORDER CALANOIDA	1.38	1.56	1.31	1.20	.61	6.06	
		SUBORDER CYCLOPOIDA	3.90	8.77	5.10	3.73	2.44	23.94	
	2	BOSMINA	0	0	0	0	.12	.12	
		DAPHNIA	.43	.15	0	0	.12	.71	
		DECAPODA	7.47	15.65	4.06	19.74	7.24	54.1[illegible]	
		DIAPHANOSOMA	0	0	0	.19	.36	.55	
		MOINA	1.73	1.52	2.46	1.13	.36	7.21	
		OTHER	.65	1.37	.72	2.63	.61	5.98	
		SUBORDER CALANOIDA	1.62	.91	1.88	1.32	1.09	6.83	
		SUBORDER CYCLOPOIDA	5.30	6.84	10.00	7.89	3.89	33.93	
	3	DAPHNIA	.	.	.08	0	.07	.15	
		DECAPODA	.	.	3.27	6.48	10.78	20.53	
		DIAPHANOSOMA	.	.	0	0	.07	.07	3
		MOINA	.	.	.48	.48	.99	1.96	
		OTHER	.	.	.64	.30	.35	1.30	
		SUBORDER CALANOIDA	.	.	.40	.73	.78	1.91	
		SUBORDER CYCLOPOIDA	.	.	4.71	2.48	3.90	11.09	
*TOTAL MONTH 78 JUL			25.73	53.57	38.22	52.88	40.51	210.90	
78 OCT	1	BOSMINA	14.56	1.65	11.98	5.03	20.75	53.96	
		CERIODAPHNIA	3.64	1.65	9.65	4.26	16.86	36.05	
		DAPHNIA	31.30	2.64	15.64	10.19	27.23	86.99	
		DIAPHANOSOMA	9.46	1.10	10.32	2.71	12.32	35.90	
		MOINA	73.51	3.74	30.95	17.54	36.30	162.04	
		OTHER	2.91	.44	2.00	.64	.65	5.64	
		SUBORDER CALANOIDA	37.12	5.84	30.95	13.28	29.17	116.36	
		SUBORDER CYCLOPOIDA	179.04	8.48	154.74	68.47	239.87	650.60	
	2	BOSMINA	31.53	25.70	19.45	17.62	19.77	114.08	
		CERIODAPHNIA	14.41	10.44	12.16	14.56	2.28	53.85	
		DAPHNIA	95.50	110.84	112.46	90.42	85.93	495.15	
		DECAPODA	0	0	0	0	.76	.76	
		DIAPHANOSOMA	35.14	34.54	31.00	25.29	20.53	146.50	
		MOINA	155.86	146.18	109.42	123.37	158.17	693.01	
		OTHER	3.60	4.02	7.29	5.36	0	20.28	

. NO SAMPLE
* SAMPLED WITH 76U NET

TABLE A2-7-3 (Sheet 5 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1978-1979

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
78 OCT	2	SUBORDER CALANOIDA	54.95	66.67	61.40	44.44	53.99	281.46
		SUBORDER CYCLOPOIDA	346.85	151.00	310.03	298.85	313.31	1,420.04
	3	BOSMINA	.	.	7.27	17.46	9.32	34.05
		CERIODAPHNIA	.	.	18.91	0	0	18.91
		DAPHNIA	.	.	76.36	94.44	40.99	211.80
		DECAPODA	.	.	0	.79	0	.79
		DIAPHANOSOMA	.	.	21.09	23.81	8.07	52.97
		MOINA	.	.	78.55	95.24	65.22	239.00
		OTHER	.	.	3.64	6.35	.31	10.30
		SUBORDER CALANOIDA	.	.	53.09	38.10	28.57	119.76
		SUBORDER CYCLOPOIDA	.	.	358.55	272.22	242.86	873.62
*TOTAL MONTH 78 OCT			1,089.37	574.95	1,546.90	1,290.45	1,433.24	5,934.90
79 JAN	1	BOSMINA	3.77	0	2.29	.96	2.00	9.02
		CERIODAPHNIA	0	.41	0	0	0	.41
		DAPHNIA	6.73	7.76	2.00	3.47	2.54	22.50
		MOINA	.81	.41	0	.77	0	1.99
		OTHER	6.20	7.35	1.00	.96	1.27	16.78
		SUBORDER CALANOIDA	38.25	68.16	21.57	18.71	19.78	166.47
		SUBORDER CYCLOPOIDA	40.40	61.63	17.00	19.10	14.88	153.01
	2	BOSMINA	5.37	6.90	.94	.43	3.11	16.75
		DAPHNIA	4.70	8.83	0	.22	5.19	18.93
		DIAPHANOSOMA	0	.28	0	0	0	.28
		MOINA	0	0	0	1.29	0	1.29
		OTHER	2.01	1.66	1.42	1.08	1.82	7.97
		ROTIFERA	0	1.10	0	0	0	1.10
		SUBORDER CALANOIDA	53.00	40.83	36.58	14.63	20.75	165.78
		SUBORDER CYCLOPOIDA	42.60	35.03	37.05	11.83	17.38	143.89
		SUBORDER HARPACTICOIDA	.34	0	0	0	0	.34
	3	BOSMINA	.	.	0	1.22	1.49	2.72
		DAPHNIA	.	.	.96	3.97	2.49	7.42
		MOINA	.	.	0	.31	0	.31
		OTHER	.	.	5.78	.61	1.25	7.64
		SUBORDER CALANOIDA	.	.	19.28	18.32	17.18	54.77
		SUBORDER CYCLOPOIDA	.	.	3.86	18.01	13.94	35.81
*TOTAL MONTH 79 JAN			204.17	240.34	149.72	115.89	125.05	835.16
79 APR	1	BOSMINA	8.37	5.94	9.77	13.26	8.22	45.57
		CERIODAPHNIA	0	1.08	1.20	2.90	2.88	8.06

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. NO SAMPLE
* SAMPLED WITH 76U NET

TABLE A2-7-3 (Sheet 6 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1978-1979

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
79 APR	1	DAPHNIA	13.94	11.62	12.77	24.03	23.03	85.38
		MOINA	2.39	0	0	0	0	2.39
		OTHER	15.54	24.32	20.95	31.90	26.73	119.4[illegible]
		SUBORDER CALANOIDA	21.12	14.32	21.15	29.00	29.19	114.77
		SUBORDER CYCLOPOIDA	74.90	34.32	58.45	111.02	82.24	360.92
	2	BOSMINA	22.35	2.38	10.00	9.77	6.33	50.85
		CERIODAPHNIA	4.97	3.58	2.65	1.18	1.95	14.33
		DAPHNIA	21.36	11.92	24.42	16.59	16.08	90.37
		MOINA	.50	0	0	0	0	.50
		OTHER	53.64	34.57	36.49	28.43	21.43	174.57
		SUBORDER CALANOIDA	15.40	33.38	21.19	21.92	18.27	110.15
		SUBORDER CYCLOPOIDA	71.03	70.34	48.26	62.79	42.62	295.04
	3	BOSMINA	.	.	3.83	9.56	54.01	67.41
		CERIODAPHNIA	.	.	0	11.48	23.15	34.62
		DAPHNIA	.	.	7.67	59.30	135.03	202.00
		OTHER	.	.	26.84	95.64	250.77	373.25
		SUBORDER CALANOIDA	.	.	11.50	63.12	162.04	236.66
		SUBORDER CYCLOPOIDA	.	.	95.86	164.50	493.83	754.18
*TOTAL MONTH 79 APR			325.50	247.78	412.99	756.38	1,397.80	3,140.44
79 JUL	1	DAPHNIA	.39	0	.28	.13	.05	.85
		DECAPODA	3.93	1.43	2.35	4.29	2.68	14.69
		DIAPHANOSOMA	.52	0	.08	.51	.26	1.37
		MOINA	1.16	.50	.24	2.53	.37	4.80
		OTHER	.32	.17	.12	.63	.16	1.40
		SUBORDER CALANOIDA	14.32	10.16	7.63	21.59	7.89	61.59
		SUBORDER CYCLOPOIDA	5.03	2.44	2.76	5.43	2.32	17.9[illegible]
	2	DAPHNIA	.12	1.21	0	.72	.08	2.14
		DECAPODA	0	18.17	6.63	14.75	4.22	43.78
		DIAPHANOSOMA	0	5.45	.25	1.45	.08	7.23
		MOINA	0	4.85	.37	2.17	.08	7.47
		OTHER	.72	3.63	.49	1.01	.04	5.90
		SUBORDER CALANOIDA	.60	24.83	7.12	21.55	2.45	56.56
		SUBORDER CYCLOPOIDA	2.65	15.75	4.54	7.37	1.52	31.84
	3	DAPHNIA	.	.	.33	.59	.63	1.55
		DECAPODA	.	.	7.20	15.90	15.86	38.96
		DIAPHANOSOMA	.	.	.33	.82	0	1.15
		MOINA	.	.	.65	4.47	0	5.13
		OTHER	.	.	1.31	.35	.32	1.98
		SUBORDER CALANOIDA	.	.	9.00	19.31	3.49	31.80

. NO SAMPLE
* SAMPLED WITH 76U NET

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TABLE A2-7-3 (Sheet 7 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1978-1979

MONTH	SAMPLE	ZOOPLANKTON GROUP	STATION AC	AT	BC	BT	BT1	TOTAL
79 JUL	3	SUBORDER CYCLOPOIDA	.	.	8.18	7.54	4.44	20.16
	4	DAPHNIA	.	.	.	.65	.	.65
		DECAPODA	.	.	.	4.54	.	4.54
		DIAPHANOSOMA	.	.	.	1.51	.	1.51
		MOINA	.	.	.	.43	.	.43
		OTHER	.	.	.	.43	.	.43
		SUBORDER CALANOIDA	.	.	.	18.06	.	18.06
		SUBORDER CYCLOPOIDA	.	.	.	5.08	.	5.08
	5	DAPHNIA	.	.	.	.86	.	.86
		DECAPODA	.	.	.	9.54	.	9.54
		DIAPHANOSOMA	.	.	.	1.47	.	1.47
		MOINA	.	.	.	1.22	.	1.22
		OTHER	.	.	.	.37	.	.37
		SUBORDER CALANOIDA	.	.	.	17.37	.	17.37
		SUBORDER CYCLOPOIDA	.	.	.	6.24	.	6.24
	6	DAPHNIA	.	.	.	.79	.	.79
		DECAPODA	.	.	.	17.58	.	17.58
		DIAPHANOSOMA	.	.	.	1.31	.	1.31
		MOINA	.	.	.	3.94	.	3.94
		OTHER	.	.	.	.79	.	.79
		SUBORDER CALANOIDA	.	.	.	22.70	.	22.70
		SUBORDER CYCLOPOIDA	.	.	.	9.45	.	9.45
	7	BOSMINA	.	.	.	.40*	.	.40
		DAPHNIA	.	.	.	1.20*	.	1.20
		DIAPHANOSOMA	.	.	.	1.00*	.	1.00
		OTHER	.	.	.	.40*	.	.40
		SUBORDER CALANOIDA	.	.	.	8.41*	.	8.41
		SUBORDER CYCLOPOIDA	.	.	.	32.42*	.	32.42
*TOTAL MONTH 79 JUL			29.76	88.59	59.87	301.25	46.97	526.45
TOTAL			1,674.53	1,205.22	2,207.71	2,516.85	3,043.57	10,647.87

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. NO SAMPLE
* SAMPLED WITH 76U NET

TABLE A2-7-3 (Sheet 8 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1979-1980

MONTH	DEPTH	SAMPLE	ZOOGROUP	STATION AC	AT	BC	BT	BT1	TOTAL
79 OCT	.5	1	BOSMINA	3.23	6.85	5.04	3.34	5.99	24.45
			CERIODAPHNIA	1.08	.76	.72	0	0	2.56
			DAPHNIA	2.15	3.80	5.04	5.89	5.56	22.45
			DIAPHANOSOMA	4.04	3.20	4.32	2.16	6.42	20.13
			MOINA	10.09	10.80	9.60	7.85	6.85	45.20
			OTHER	27	.61	.96	.20	0	2.03
			SUBORDER CALANOIDA	29.73	42.61	54.48	28.87	71.89	227.58
			SUBORDER CYCLOPOIDA	25.03	33.94	38.16	29.85	49.64	176.61
			SUBORDER HARPACTICOIDA	.13	0	0	0	0	.13
		2	BOSMINA	.	.	.	4.11	.	4.11
			CERIODAPHNIA	.	.	.	.62	.	.62
			DAPHNIA	.	.	.	4.11	.	4.11
			DIAPHANOSOMA	.	.	.	6.57	.	6.57
			MOINA	.	.	.	9.04	.	9.04
			SUBORDER CALANOIDA	.	.	.	41.90	.	41.90
			SUBORDER CYCLOPOIDA	.	.	.	33.27	.	33.27
		3	BOSMINA	.	.	.	339.05*	.	339.05
			DAPHNIA	.	.	.	24.47*	.	24.47
			DIAPHANOSOMA	.	.	.	10.49*	.	10.49
			MOINA	.	.	.	31.46*	.	31.46
			OTHER	.	.	.	248.17*	.	248.17
			ROTIFERA	.	.	.	384.49*	.	384.49
			SUBORDER CALANOIDA	.	.	.	90.88*	.	90.88
			SUBORDER CYCLOPOIDA	.	.	.	318.08*	.	318.08
	4.5	1	BOSMINA	3.12	5.45	9.80	7.83	10.61	36.82
			CERIODAPHNIA	.48	.56	.18	1.26	1.14	3.62
			DAPHNIA	4.56	5.64	9.27	4.80	4.17	28.44
			DIAPHANOSOMA	2.40	4.51	4.99	3.79	5.69	21.38
			MOINA	7.32	8.83	11.76	8.59	12.51	49.02
			OTHER	.12	.19	0	.51	0	.81
			SUBORDER CALANOIDA	43.58	42.86	46.17	29.04	51.93	213.58
			SUBORDER CYCLOPOIDA	29.65	35.90	36.19	34.35	48.14	184.23
		2	BOSMINA	.	.	.	1.74	.	1.74
			CERIODAPHNIA	.	.	.	.65	.	.65
			DAPHNIA	.	.	.	2.61	.	2.61
			DIAPHANOSOMA	.	.	.	1.74	.	1.74
			MOINA	.	.	.	6.30	.	6.30
			OTHER	.	.	.	.65	.	.65
			SUBORDER CALANOIDA	.	.	.	27.58	.	27.58
			SUBORDER CYCLOPOIDA	.	.	.	28.45	.	28.45
		3	BOSMINA	.	.	.	409.60*	.	409.60

. NO SAMPLE
* SAMPLED WITH 76U NET
** SAMPLED WITH 76U NET THEN RE-SIEVED WITH 239U NET

TABLE A2-7-3 (Sheet 9 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1979-1980

MONTH	DEPTH	SAMPLE	ZOOGROUP	STATION AC	AT	BC	BT	BT1	TOTAL	
79 OCT	4.5	3	DAPHNIA	.	.	.	12.80*	.	12.80	
			MOINA	.	.	.	55.47*	.	55.47	
			OTHER	.	.	.	332.80*	.	332.80	
			ROTIFERA	.	.	.	290.13*	.	290.13	
			SUBORDER CALANOIDA	.	.	.	115.20*	.	115.20	
			SUBORDER CYCLOPOIDA	.	.	.	375.47*	.	375.47	
			SUBORDER HARPACTICOIDA	.	.	.	4.27*	.	4.27	
	10.5	1	BOSMINA	.	.	.	5.58	.	5.58	
			CERIODAPHNIA	.	.	.	1.08	.	1.08	
			DAPHNIA	.	.	.	4.14	.	4.14	
			DIAPHANOSOMA	.	.	.	6.48	.	6.48	
			MOINA	.	.	.	7.02	.	7.02	
			OTHER	.	.	.	.18	.	.18	
			SUBORDER CALANOIDA	.	.	.	33.84	.	33.84	
			SUBORDER CYCLOPOIDA	.	.	.	38.16	.	38.16	
		2	BOSMINA	.	.	.	4.74	.	4.74	
			CERIODAPHNIA	.	.	.	.34	.	.34	
			DAPHNIA	.	.	.	5.41	.	5.41	
			DIAPHANOSOMA	.	.	.	2.03	.	2.03	
			MOINA	.	.	.	8.12	.	8.12	3
			SUBORDER CALANOIDA	.	.	.	25.71	.	25.71	
			SUBORDER CYCLOPOIDA	.	.	.	35.86	.	35.86	
		3	BOSMINA	.	.	.	228.14*	.	228.14	
			CERIODAPHNIA	.	.	.	3.04*	.	3.04	
			DAPHNIA	.	.	.	15.21*	.	15.21	
			DIAPHANOSOMA	.	.	.	9.13*	.	9.13	
			MOINA	.	.	.	21.29*	.	21.29	
			OTHER	.	.	.	252.47*	.	252.47	
			ROTIFERA	.	.	.	231.18*	.	231.18	
			SUBORDER CALANOIDA	.	.	.	63.88*	.	63.88	
			SUBORDER CYCLOPOIDA	.	.	.	237.26*	.	237.26	
	10.7	1	BOSMINA	.	.	6.47	.	6.25	12.72	
			CERIODAPHNIA	.	.	.36	.	1.25	1.61	
			DAPHNIA	.	.	8.27	.	5.63	13.90	
			DIAPHANOSOMA	.	.	3.59	.	5.32	8.91	
			MOINA	.	.	11.50	.	11.26	22.76	
			OTHER	.	.	.72	.	0	.72	
			SUBORDER CALANOIDA	.	.	35.94	.	46.59	82.54	
			SUBORDER CYCLOPOIDA	.	.	32.71	.	27.83	60.54	
80 JAN	.5	1	BOSMINA	58.15	42.20	40.73	118.[illegible]0	36.42**	295.89	
			CERIODAPHNIA	5.51	1.35	2.29	19.73	0**	28.89	

. NO SAMPLE
* SAMPLED WITH 76U NET
** SAMPLED WITH 76U NET THEN RE-SIEVED WITH 239U NET

TABLE A2-7-3 (Sheet 10 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1979-1980

MONTH	DEPTH	SAMPLE	ZOOGROUP	STATION AC	AT	BC	BT	BT1	TOTAL
80 JAN	.5	1	DAPHNIA	32.08	21.27	26.96	78.93	54.62**	213.87
			OTHER	8.52	4.05	2.29	78.93	27.31**	121.11
			ROTIFERA	7.52	1.35	5.74	1,677.29	801.14**	2,493.03
			SUBORDER CALANOIDA	86.72	69.55	59.66	171.02	54.62**	441.57
			SUBORDER CYCLOPOIDA	132.83	98.92	98.67	467.01	245.80**	1,043.24
		2	BOSMINA	.	.	.	360.28	.	360.28
			CERIODAPHNIA	.	.	.	20.02	.	20.02
			DAPHNIA	.	.	.	80.06	.	80.06
			OTHER	.	.	.	20.02	.	20.02
			ROTIFERA	.	.	.	4,883.82	.	4,883.82
			SUBORDER CALANOIDA	.	.	.	180.14	.	180.14
			SUBORDER CYCLOPOIDA	.	.	.	280.22	.	280.22
		3	BOSMINA	.	.	.	112.08*	.	112.08
			OTHER	.	.	.	1,277.76*	.	1,277.76
			ROTIFERA	.	.	.	4,348.86*	.	4,348.86
			SUBORDER CALANOIDA	.	.	.	67.25*	.	67.25
			SUBORDER CYCLOPOIDA	.	.	.	538.00*	.	538.00 3
		4	BOSMINA	.	.	.	30.38*	.	30.38
			DAPHNIA	.	.	.	50.63*	.	50.63
			OTHER	.	.	.	1,053.16*	.	1,053.16
			ROTIFERA	.	.	.	2,400.00*	.	2,400.00
			SUBORDER CALANOIDA	.	.	.	60.76*	.	60.76
			SUBORDER CYCLOPOIDA	.	.	.	384.81*	.	384.81
	4.5	1	BOSMINA	139.32	97.49**	56.05	72.01**	40.63**	405.50
			CERIODAPHNIA	6.53	2.44**	3.35	0**	0**	12.31
			DAPHNIA	89.25	24.37**	66.93	27.00**	25.40**	232.95
			OTHER	15.24	65.80**	8.37	27.00**	7.62**	124.03
			ROTIFERA	6.53	1,428.18**	5.02	891.14**	424.13**	2,755.00
			SUBORDER CALANOIDA	99.05	97.49**	137.20	99.02**	58.41**	491.17
			SUBORDER CYCLOPOIDA	153.47	343.64**	201.62	153.02**	124.44**	976.20
			SUBORDER HARPACTICOIDA	0	2.44**	0	0**	0	2.44
		2	BOSMINA	.	.	.	125.71**	.	125.71
			CERIODAPHNIA	.	.	.	22.86**	.	22.86
			DAPHNIA	.	.	.	34.29**	.	34.29
			OTHER	.	.	.	34.29**	.	34.29
			ROTIFERA	.	.	.	1,394.29**	.	1,394.29
			SUBORDER CALANOIDA	.	.	.	91.43**	.	91.43
			SUBORDER CYCLOPOIDA	.	.	.	365.71**	.	365.71
		3	BOSMINA	.	.	.	225.72*	.	225.72
			DAPHNIA	.	.	.	37.62*	.	37.62
			OTHER	.	.	.	827.63*	.	827.63

. NO SAMPLE
* SAMPLED WITH 76U NET
** SAMPLED WITH 76U NET THEN RE-SIEVED WITH 239U NET

TABLE A2-7-3 (Sheet 11 of 11)

AVERAGE ZOOPLANKTON DENSITIES, NUMBER PER M3 BY STATION BY DATE
IN SAMPLES COLLECTED IN THE VICINITY OF WATERFORD 3 FOR 1979-1980

MONTH	DEPTH	SAMPLE	ZOOGROUP	STATION AC	AT	BC	BT	BT1	TOTAL
80 JAN	4.5	3	ROTIFERA	.	.	.	7,298.16*	.	7,298.16
			SUBORDER CALANOIDA	.	.	.	150.48*	.	150.48
			SUBORDER CYCLOPOIDA	.	.	.	376.19*	.	376.19
		4	BOSMINA	.	.	.	189.81*	.	189.81
			DAPHNIA	.	.	.	118.63*	.	118.63
			OTHER	.	.	.	1,115.11*	.	1,115.11
			ROTIFERA	.	.	.	4,982.39*	.	4,982.39
			SUBORDER CALANOIDA	.	.	.	94.90*	.	94.90
			SUBORDER CYCLOPOIDA	.	.	.	308.43*	.	308.43
			SUBORDER HARPACTICOIDA	.	.	.	23.73*	.	23.73
	10.0	1	BOSMINA	.	.	148.25	215.73	18.09	382.06
			CERIODAPHNIA	.	.	10.59	26.97	1.51	39.06
			DAPHNIA	.	.	114.36	107.87	6.03	228.26
			OTHER	.	.	14.82	17.98	1.51	34.31
			ROTIFERA	.	.	23.30	1,384.27	339.14	1,746.71
			SUBORDER CALANOIDA	.	.	226.61	89.89	10.55	327.04
			SUBORDER CYCLOPOIDA	.	.	290.14	161.80	73.86	525.79
			SUBORDER HARPACTICOIDA	.	.	.	8.99	.	8.99
		2	BOSMINA	.	.	.	76.19	.	76.19
			DAPHNIA	.	.	.	10.88	.	10.88
			MOINA	.	.	.	10.88	.	10.88 3
			OTHER	.	.	.	21.77	.	21.77
			ROTIFERA	.	.	.	1,643.54	.	1,643.54
			SUBORDER CALANOIDA	.	.	.	32.65	.	32.65
			SUBORDER CYCLOPOIDA	.	.	.	206.80	.	206.80
		3	BOSMINA	.	.	.	45.43*	.	45.43
			DAPHNIA	.	.	.	45.43*	.	45.43
			OTHER	.	.	.	1,113.04*	.	1,113.04
			ROTIFERA	.	.	.	3,407.28*	.	3,407.28
			SUBORDER CALANOIDA	.	.	.	90.86*	.	90.86
			SUBORDER CYCLOPOIDA	.	.	.	204.44*	.	204.44
		4	BOSMINA	.	.	.	438.02*	.	438.02
			DAPHNIA	.	.	.	48.67*	.	48.67
			OTHER	.	.	.	3,114.83*	.	3,114.83
			ROTIFERA	.	.	.	9,393.16*	.	9,393.16
			SUBORDER CALANOIDA	.	.	.	97.34*	.	97.34
			SUBORDER CYCLOPOIDA	.	.	.	1,168.06*	.	1,168.06

. NO SAMPLE
* SAMPLED WITH 76U NET
** SAMPLED WITH 76U NET THEN RE-SIEVED WITH 239U NET

TABLE A2-7-4 (Sheet 1 of 2)

BENTHIC DENSITIES NO./M2
FOR 1977-1978

MONTH	TAXON	STATION AC	AT	BC	BT	BT1	TOTAL
77 AUG	CHIRONOMIDAE	30.00	0	0	12.50	2.50	45.00
	COLEOPTERA	2.50	0	0	0	0	2.50
	CORBICULA	0	0	0	65.00	0	65.00
	CORBICULA MANILENSIS	20.00	2.50	0	25.00	0	47.50
	DIPTERA	0	0	0	2.50	0	2.50
	EPHEMEROPTERA	0	0	0	2.50	0	2.50
	GAMMARUS	0	0	2.50	0	0	2.50
	GYRAULUS	0	5.00	0	5.00	0	10.00
	NEMATODA	2.50	0	20.00	17.50	0	40.00
	TUBIFICIDAE(OLIGOCHAETA)	0	42.50	277.50	0	0	320.00
	TURBELLARIA	2.50	2.50	2.50	2.50	0	10.00
77 SEP	CHIRONOMIDAE	0	17.50	27.50	2.50	2.50	50.00
	CORBICULA MANILENSIS	5.00	0	0	152.50	0	157.50
	EPHEMEROPTERA	0	30.00	2.50	0	0	32.50
	ODONATA	2.50	5.00	0	0	0	7.50
	TUBIFICIDAE(OLIGOCHAETA)	0	75.00	0	0	0	75.00
78 FEB	CORBICULA MANILENSIS	37.50	0	0	2.50	0	40.00
	MACROBRACHIUM OHIONE	0	0	0	2.50	0	2.50
	ODONATA	0	2.50	0	0	2.50	5.00
	TUBIFICIDAE(OLIGOCHAETA)	0	150.00	150.00	0	0	300.00
78 APR	CHIRONOMIDAE	0	2.50	22.50	2.50	7.50	35.00
	CORBICULA MANILENSIS	0	7.50	0	0	0	7.50
	EPHEMERA	0	0	0	0	2.50	2.50
	MACROBRACHIUM OHIONE	0	0	0	2.50	0	2.50
	TUBIFICIDAE(OLIGOCHAETA)	0	1,850.00	5,275.00	237.50	787.50	8,150.00

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TABLE A2-7-4 (Sheet 2 of 2)

BENTHIC DENSITIES NO./M2
FOR 1978-1979

MONTH	TAXON	STATION AC	AT	BC	BT	BT1	TOTAL
78 JUL	CHIRONOMIDAE	0	0	0	2.50	0	2.50
	CORBICULA MANILENSIS	7.50	0	0	0	0	7.50
	GASTROPODA	0	5.00	0	0	0	5.00
	HIRUDINEA	0	2.50	0	0	2.50	5.00
	OLIGOCHAETA	52.50	140.00	677.50	342.50	90.00	1,302.50
78 OCT	CHIRONOMIDAE	0	10.00	0	12.50	0	22.50
	CORBICULA MANILENSIS	0	0	0	10.00	2.50	12.50
	HEXAGENIA	0	12.50	0	0	0	12.50
	ODONATA	2.50	5.00	5.00	5.00	0	17.50
	OLIGOCHAETA	0	150.00	0	202.50	0	352.50
79 JAN	CHIRONOMIDAE	22.50	0	0	0	0	22.50
	CORBICULA MANILENSIS	0	0	0	0	7.50	7.50
	HEXAGENIA	0	0	5.00	0	0	5.00
	ODONATA	12.50	2.50	5.00	0	0	20.00
	OLIGOCHAETA	0	9,492.50	192.50	165.00	30.00	9,880.00
79 APR	ODONATA	0	0	0	19.23	0	19.23
	OLIGOCHAETA	96.15	2,653.85	173.08	1,076.92	153.85	4,153.85
79 JUL	OLIGOCHAETA	65.00	0	10.00	12.50	10.00	97.50

EOF:

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TABLE A2-7-5

TOTAL NUMBERS OF FISH COLLECTED BY ALL GEARS IN THE VICINITY OF WATERFORD 3 FOR 1979-1980

FNAME	NUMBER	WEIGHT GMS.
AMERICAN EEL	3	1444.0
BIGMOUTH BUFFALO	1	2750.0
BLACK BULLHEAD	1	14.0
BLACK CRAPPIE	1	225.0
BLUE CATFISH	459	33166.0
CARP	2	845.0
CHANNEL CATFISH	40	8572.0
FLATHEAD CATFISH	3	1515.0
FRESHWATER DRUM	53	10921.0
GIZZARD SHAD	342	76663.0
GOLDEYE	12	504.0
LONGNOSE GAR	3	1010.0
MISSISSIPPI SILVERSIDE	2	7.0
MOONEYE	3	283.0
PADDLEFISH	2	105.0
QUILLBACK	1	46.0
RAINBOW SMELT	1	4.0
RIVER CARPSUCKER	2	940.0
RIVER SHRIMP	17	20.0
SAUGER	1	116.0
SHORTNOSE GAR	1	45.0
SHOVELNOSE STURGEON	7	15.0
SILVER CHUB	8	38.0
SKIPJACK HERRING	25	3977.0
SMALLMOUTH BUFFALO	3	1335.0
SPECKLED CHUB	16	16.0
STRIPED BASS	15	14550.0
STRIPED MULLET	35	10919.0
THREADFIN SHAD	2	21.0
WARMOUTH	1	2.0
WHITE BASS	37	9714.0
WHITE CRAPPIE	1	525.0

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TABLE A2-7-5 (Sheet 2 of 3)

TOTAL NUMBERS OF FISH COLLECTED BY ALL GEARS IN THE VICINITY OF WATERFORD 3 FOR 1978-1979

FNAME	NUMBER	WEIGHT GMS.
AMERICAN EEL	2	166.0
ATLANTIC NEEDLE FISH	2	119.0
BAY ANCHOVY	3	901.0
BIGMOUTH BUFFALO	2	1998.0
BLACK CRAPPIE	1	14.0
BLUE CATFISH	1154	96621.9
BLUE CRAB	3	928.0
BLUEGILL	22	1112.0
BOWFIN	1	545.0
CARP	14	17106.0
CHANNEL CATFISH	104	14214.1
FLATHEAD CATFISH	18	13406.0
FRESHWATER DRUM	230	23285.5
GIZZARD SHAD	725	181563.0
GOLDEYE	6	11.0
GULF MENHADEN	225	5025.0
HOG SUCKER	1	28.0
LONGEAR SUNFISH	1	10.0
LONGNOSE GAR	2	307.3
MOONEYE	2	16.0
RIVER CARPSUCKER	5	1774.0
RIVER SHRIMP	297	558.8
ROUGH SILVERSIDE	1	3.0
SAUGER	4	45.0
SHORTNOSE GAR	11	5249.0
SHOVELNOSE STURGEON	2	317.0
SHRIMP	1	.9
SKIPJACK HERRING	249	46594.2
SMALLMOUTH BUFFALO	8	5162.0
SOUTHERN FLOUNDER	3	2003.0
SPOTTED GAR	3	1261.0
STRIPED BASS	14	13876.0
STRIPED MULLET	193	45704.1
THREADFIN SHAD	156	1620.6
UNIDENTIFIED FISH	4	9.0
WALLEYE	2	27.0
WARMOUTH	1	119.0
WHITE BASS	28	3568.3
WHITE CRAPPIE	2	573.0
YELLOW BASS	9	2293.0

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TABLE A2-7-5 (Sheet 3 of 3)

TOTAL NUMBERS OF FISH COLLECTED BY ALL GEARS IN THE VICINITY OF WATERFORD 3 FOR 1977-1978

FNAME	NUMBER	WEIGHT GMS.
AMERICAN EEL	1	69.0
ATLANTIC NEEDLE FISH	1	6.0
ATLANTIC STINGRAY	2	2464.0
BAY ANCHOVY	9	12.0
BLACK BULLHEAD	1	253.0
BLACK CRAPPIE	2	497.0
BLUE CATFISH	353	104390.5
BLUE CRAB	6	1192.0
BLUEGILL	2	72.0
BOWFIN	1	2383.0
CARP	8	8566.0
CHANNEL CATFISH	14	5084.0
CYPRINID	1	175.0
FLATHEAD CATFISH	1	343.0
FRESHWATER DRUM	83	11565.0
GIZZARD SHAD	686	221462.4
HOG SUCKER	2	53.0
LADYFISH	1	232.0
LARGEMOUTH BASS	1	97.0
LONGNOSE GAR	2	3270.0
PADDLEFISH	4	166.0
QUILLBACK	2	877.0
RIVER CARPSUCKER	6	3735.0
RIVER SHRIMP	88	544.0
SHEEPSHEAD	4	1781.0
SHINER	1	5.0
SHORTNOSE GAR	1	851.0
SHOVELNOSE STURGEON	2	6.0
SKIPJACK HERRING	163	26027.0
SMALLMOUTH BUFFALO	1	1008.0
SOUTHERN FLOUNDER	5	4644.0
SPOTTED GAR	7	13433.0
STRIPED BASS	26	18549.0
STRIPED MULLET	365	79510.0
SUCKER	3	3.3
THREADFIN SHAD	436	19739.4
WHITE BASS	2	722.0
WHITE CRAPPIE	2	675.0
YELLOW BASS	2	284.0

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TABLE A2-7-6 (Sheet 1 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1978-1979

METHOD	DATE	STATION	DURATION*	COMMON NAME	COUNT**	CATCH***
ELECTROFISHING	78 JUL 21	AC	2.0	BLUE CATFISH	8	4.00
				GIZZARD SHAD	2	1.00
		AT	1.8	BLUE CATFISH	2	1.14
				FRESHWATER DRUM	1	.57
				STRIPED MULLET	1	.57
		BC	2.0	BLUE CATFISH	46	23.00
				FRESHWATER DRUM	2	1.00
				GIZZARD SHAD	2	1.00
				STRIPED MULLET	7	3.50
	78 JUL 24	BT	1.8	BLUE CATFISH	59	33.71
				GIZZARD SHAD	1	.57
				STRIPED MULLET	6	3.43
		INTAKE3	.5	BLUE CATFISH	2	4.00
	78 JUL 25	BT1	2.0	BLUE CATFISH	93	46.50
				GIZZARD SHAD	7	3.50
				STRIPED MULLET	1	.50
	78 SEP 30	INTAKE3	.5	BLUE CATFISH	4	8.00
	78 OCT 01	BC	2.0	BLUE CATFISH	21	10.50
				GIZZARD SHAD	2	1.00
				STRIPED MULLET	21	10.50
	78 OCT 02	AC	2.0	BLUE CATFISH	80	40.00
				GIZZARD SHAD	3	1.50
				STRIPED MULLET	7	3.50
		AT	1.8	BLUE CATFISH	49	28.00
				GIZZARD SHAD	1	.57
				STRIPED MULLET	4	2.29
				THREADFIN SHAD	40	22.86
		BT1	1.0	BLUE CATFISH	23	23.00
				GIZZARD SHAD	1	1.00
				STRIPED MULLET	2	2.00
				THREADFIN SHAD	1	1.00
	78 OCT 04	BT	1.8	BLUE CATFISH	137	78.29
				GIZZARD SHAD	3	1.71
				STRIPED MULLET	18	10.29
				THREADFIN SHAD	2	1.14
		BT1	1.0	BLUE CATFISH	73	73.00
				GIZZARD SHAD	2	2.00
				STRIPED MULLET	4	4.00
	79 JAN 14	BC	1.1	BLUE CATFISH	10	8.82
				FRESHWATER DRUM	14	12.35
				GIZZARD SHAD	31	27.35
	79 JAN 15	AT	2.0	BLUE CATFISH	1	.50
				GIZZARD SHAD	115	57.50
		BC	.9	FRESHWATER DRUM	1	1.15
				GIZZARD SHAD	13	15.00
	79 JAN 16	BT	1.8	FRESHWATER DRUM	21	12.00

* Duration is in hours.
** Count is the total catch over the stated duration.
*** Catch is the per hour average for the stated duration.

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TABLE A2-7-6 (Sheet 2 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1978-1979

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH
ELECTROFISHING	79 JAN 16	BT	1.8	GIZZARD SHAD	3	1.71
		BT1	1.8	GIZZARD SHAD	1	.57
		INTAKE3	.5	GIZZARD SHAD	3	6.00
	79 APR 11	AT	1.1	BLUE CATFISH	17	15.69
				GIZZARD SHAD	24	22.15
				THREADFIN SHAD	5	4.62
	79 APR 12	AT	.9	BLUE CATFISH	2	2.18
				GIZZARD SHAD	7	7.64
				THREADFIN SHAD	2	2.18
		BT	.9	BLUE CATFISH	11	12.45
				FRESHWATER DRUM	1	1.13
				GIZZARD SHAD	51	57.74
				THREADFIN SHAD	3	3.40
	79 APR 18	BC	1.0	BLUE CATFISH	4	4.00
		BT	.9	BLUE CATFISH	9	9.47
				FRESHWATER DRUM	1	1.05
				GIZZARD SHAD	17	17.89
		INTAKE3	.5	BLUE CATFISH	1	2.00
				GIZZARD SHAD	3	6.00
				THREADFIN SHAD	1	2.00
	79 APR 23	BC	1.0	GIZZARD SHAD	11	11.00
	79 JUL 22	BC	3.0	BLUE CATFISH	2	.67
				FRESHWATER DRUM	4	1.33
				GIZZARD SHAD	8	2.67
				STRIPED MULLET	18	6.00
	79 JUL 26	AC	1.5	BLUE CATFISH	1	.67
				FRESHWATER DRUM	1	.67
	79 JUL 27	AC	.5	GIZZARD SHAD	17	34.00
				STRIPED MULLET	1	2.00
				THREADFIN SHAD	3	6.00
		AT	2.0	FRESHWATER DRUM	24	12.00
				GIZZARD SHAD	7	3.50
				STRIPED MULLET	1	.50
				THREADFIN SHAD	2	1.00
		BT	1.4	BLUE CATFISH	2	1.41
				FRESHWATER DRUM	2	1.41
				GIZZARD SHAD	1	.71
				STRIPED MULLET	20	14.12
				THREADFIN SHAD	2	1.41
		BT1	1.4	FRESHWATER DRUM	1	.71
				GIZZARD SHAD	6	4.24
				STRIPED MULLET	1	.71
GILL NET	78 JUL 21	AC	24.0	BLUE CATFISH	2	.08
				GIZZARD SHAD	7	.29
		AT	24.0	BLUE CATFISH	11	.46
		BT1	24.0	BLUE CATFISH	2	.08

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TABLE A2-7-6 (Sheet 3 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1978-1979

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH
GILL NET	78 JUL 22	AC	24.0	GIZZARD SHAD	8	.33
		AT	24.0	BLUE CATFISH	7	.29
				FRESHWATER DRUM	1	.04
				GIZZARD SHAD	3	.13
		BT1	24.0	BLUE CATFISH	1	.04
				FRESHWATER DRUM	1	.04
	78 JUL 24	BC	24.0	BLUE CATFISH	1	.04
				GIZZARD SHAD	3	.13
		BT	24.0	GIZZARD SHAD	1	.04
	78 JUL 25	BC	24.0	GIZZARD SHAD	2	.08
		BT	24.0	BLUE CATFISH	1	.04
	78 SEP 29	AC	24.0	STRIPED MULLET	7	.29
		AT	24.0	BLUE CATFISH	1	.04
				FRESHWATER DRUM	3	.13
				GIZZARD SHAD	11	.46
		BC	24.0	BLUE CATFISH	9	.38
				GIZZARD SHAD	36	1.50
				STRIPED MULLET	2	.08
				THREADFIN SHAD	3	.13
		BT	24.0	BLUE CATFISH	1	.04
				STRIPED MULLET	4	.17
		BT1	24.0	GIZZARD SHAD	7	.29
				STRIPED MULLET	27	1.13
	78 SEP 30	AT	24.0	FRESHWATER DRUM	2	.08
				GIZZARD SHAD	13	.54
				STRIPED MULLET	1	.04
		BC	24.0	BLUE CATFISH	5	.21
				GIZZARD SHAD	35	1.46
				STRIPED MULLET	1	.04
		BT	24.0	STRIPED MULLET	5	.21
		BT1	24.0	BLUE CATFISH	1	.04
				GIZZARD SHAD	4	.17
				STRIPED MULLET	18	.75
	78 OCT 01	INTAKE3	24.0	BLUE CATFISH	3	.13
				GIZZARD SHAD	10	.42
				STRIPED MULLET	2	.08
	79 JAN 12	AC	24.0	BLUE CATFISH	1	.04
				GIZZARD SHAD	11	.46
		AT	24.0	FRESHWATER DRUM	1	.04
				GIZZARD SHAD	5	.21
		BC	24.0	BLUE CATFISH	1	.04
				GIZZARD SHAD	13	.54
		BT	24.0	BLUE CATFISH	2	.08
	79 JAN 13	AT	24.0	GIZZARD SHAD	2	.08
	79 APR 12	AC	23.7	THREADFIN SHAD	1	.04
		BC	23.6	BLUE CATFISH	2	.08

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TABLE A2-7-6 (Sheet 4 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1978-1979

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
GILL NET	79 APR 12	BC	23.6	GIZZARD SHAD	26	1.10	
				THREADFIN SHAD	1	.04	
	79 APR 13	AT	24.0	BLUE CATFISH	7	.29	
		BC	24.0	GIZZARD SHAD	32	1.33	
		BT	23.8	GIZZARD SHAD	1	.04	
		BT1	23.1	FRESHWATER DRUM	6	.26	
				GIZZARD SHAD	4	.17	
	79 APR 14	AT	24.0	BLUE CATFISH	3	.13	
		BT1	24.0	FRESHWATER DRUM	1	.04	
				GIZZARD SHAD	2	.08	
		INTAKE3	24.0	GIZZARD SHAD	1	.04	
	79 JUL 12	AC	24.0	GIZZARD SHAD	3	.13	
		BC	24.0	GIZZARD SHAD	47	1.96	
				STRIPED MULLET	12	.50	
		BT	24.0	BLUE CATFISH	1	.04	
				GIZZARD SHAD	12	.50	
	79 JUL 13	AC	24.0	GIZZARD SHAD	1	.04	
		BC	24.0	BLUE CATFISH	1	.04	
				GIZZARD SHAD	45	1.88	
				STRIPED MULLET	2	.08	
		BT	24.0	GIZZARD SHAD	3	.13	
	79 JUL 21	AT	24.0	FRESHWATER DRUM	2	.08	
				GIZZARD SHAD	1	.04	
		BT1	24.0	BLUE CATFISH	1	.04	
				FRESHWATER DRUM	2	.08	3
MIDWATER TRAWL	78 OCT 16	BC	.1	THREADFIN SHAD	1	12.00	
		BT	.2	BLUE CATFISH	1	6.00	
				FRESHWATER DRUM	1	6.00	
				THREADFIN SHAD	5	30.00	
	79 JUL 14	BC	.2	GIZZARD SHAD	11	44.00	
				THREADFIN SHAD	32	128.00	
		BT	.1	THREADFIN SHAD	9	108.00	
		BT1	.2	GIZZARD SHAD	7	28.00	
				THREADFIN SHAD	11	44.00	
OTTER TRAWL	78 OCT 17	AC	.2	BLUE CATFISH	162	648.00	
				FRESHWATER DRUM	48	192.00	
				GIZZARD SHAD	2	8.00	
		AT	.2	BLUE CATFISH	183	732.00	
				FRESHWATER DRUM	20	80.00	
		BC	.2	BLUE CATFISH	17	102.00	
				FRESHWATER DRUM	2	12.00	
		BT	.1	GIZZARD SHAD	1	10.00	
				THREADFIN SHAD	1	10.00	
	79 JAN 31	AT	.2	BLUE CATFISH	2	12.00	
	79 JUL 14	AC	.2	BLUE CATFISH	61	244.00	
				FRESHWATER DRUM	69	276.00	

TABLE A2-7-6 (Sheet 5 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1978-1979

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
OTTER TRAWL	79 JUL 14	AC	.2	GIZZARD SHAD	1	4.00	
		AT	.2	GIZZARD SHAD	2	12.00	
				THREADFIN SHAD	4	24.00	
		BC	.1	GIZZARD SHAD	3	36.00	
		BT	.1	GIZZARD SHAD	6	72.00	
		BT1	.1	GIZZARD SHAD	5	60.00	
SURFACE TRAWL	78 JUL 22	AC	.2	BLUE CATFISH	5	30.00	3
				THREADFIN SHAD	11	66.00	
		AT	.2	BLUE CATFISH	5	30.00	
				THREADFIN SHAD	4	24.00	
		BC	.2	BLUE CATFISH	1	6.00	
				THREADFIN SHAD	2	12.00	
		BT	.2	THREADFIN SHAD	7	42.00	
		BT1	.1	THREADFIN SHAD	1	12.00	
	78 OCT 03	BT1	.1	THREADFIN SHAD	2	24.00	

TABLE A2-7-6 (Sheet 6 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1977-1978

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
ELECTROFISHING	77 AUG 10	AC	2.0	GIZZARD SHAD	8	4.00	
				STRIPED MULLET	24	12.00	
	77 AUG 11	BT1	2.0	BLUE CATFISH	1	.50	
				STRIPED MULLET	14	7.00	
	77 AUG 15	BT	2.0	STRIPED MULLET	35	17.50	
				THREADFIN SHAD	3	1.50	
	77 AUG 16	AT	2.0	STRIPED MULLET	5	2.50	
				THREADFIN SHAD	8	4.00	
		BC	2.0	FRESHWATER DRUM	1	.50	
				GIZZARD SHAD	5	2.50	
				STRIPED MULLET	44	22.00	
	77 SEP	BT	2.0	BLUE CATFISH	9	4.50	
				STRIPED MULLET	78	39.00	
				THREADFIN SHAD	4	2.00	
		BT1	2.0	BLUE CATFISH	7	3.50	
				GIZZARD SHAD	3	1.50	
				STRIPED MULLET	32	16.00	
				THREADFIN SHAD	1	.50	
	77 SEP 26	AT	2.0	BLUE CATFISH	6	3.00	
				GIZZARD SHAD	4	2.00	
				STRIPED MULLET	4	2.00	
	77 SEP 28	BC	2.0	BLUE CATFISH	12	6.00	
				GIZZARD SHAD	7	3.50	3
				STRIPED MULLET	36	18.00	
	77 SEP 29	AC	2.0	BLUE CATFISH	19	9.50	
				FRESHWATER DRUM	1	.50	
				GIZZARD SHAD	11	5.50	
				STRIPED MULLET	7	3.50	
	78 JAN 21	BT	2.0	FRESHWATER DRUM	3	1.50	
				GIZZARD SHAD	10	5.00	
				STRIPED MULLET	1	.50	
		BT1	2.0	GIZZARD SHAD	12	6.00	
	78 JAN 22	AC	2.0	BLUE CATFISH	4	2.00	
				FRESHWATER DRUM	5	2.50	
				GIZZARD SHAD	2	1.00	
		AT	2.0	BLUE CATFISH	21	10.50	
				FRESHWATER DRUM	1	.50	
				GIZZARD SHAD	79	39.50	
				STRIPED MULLET	2	1.00	
		BC	2.0	FRESHWATER DRUM	14	7.00	
				GIZZARD SHAD	11	5.50	
	78 APR 18	AT	0	BLUE CATFISH	7	3.50	
				GIZZARD SHAD	5	2.50	
				THREADFIN SHAD	38	19.00	
	78 APR 19	BC	2.0	BLUE CATFISH	1	.50	
				FRESHWATER DRUM	2	1.00	

TABLE A2-7-6 (Sheet 7 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1977-1978

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
ELECTROFISHING	78 APR 19	BC	2.0	GIZZARD SHAD	22	11.00	
				STRIPED MULLET	1	.50	
				THREADFIN SHAD	40	20.00	
		BT1	2.0	BLUE CATFISH	2	1.00	
				GIZZARD SHAD	66	33.00	
				THREADFIN SHAD	53	26.50	
	78 APR 20	AC	2.0	GIZZARD SHAD	4	2.00	
				THREADFIN SHAD	90	45.00	
	78 APR 21	BT	2.0	BLUE CATFISH	10	5.00	
				GIZZARD SHAD	8	4.00	
				THREADFIN SHAD	3	1.50	
GILL NET	77 AUG 10	AC	24.1	BLUE CATFISH	2	.08	
				GIZZARD SHAD	19	.79	
				STRIPED MULLET	9	.37	
		AT	24.5	BLUE CATFISH	3	.12	
				FRESHWATER DRUM	2	.08	
				STRIPED MULLET	7	.29	
		BC	24.4	BLUE CATFISH	5	.20	
				GIZZARD SHAD	3	.12	
				STRIPED MULLET	1	.04	
		BT	23.1	STRIPED MULLET	7	.30	3
		BT1	22.8	GIZZARD SHAD	2	.09	
				STRIPED MULLET	1	.04	
	77 AUG 11	AC	30.3	GIZZARD SHAD	4	.13	
				STRIPED MULLET	1	.03	
		AT	27.9	BLUE CATFISH	1	.04	
				STRIPED MULLET	7	.25	
		BC	28.8	BLUE CATFISH	1	.03	
		BT	27.5	BLUE CATFISH	1	.04	
		BT1	26.8	GIZZARD SHAD	8	.30	
	77 SEP 25	AC	23.3	BLUE CATFISH	6	.26	
				GIZZARD SHAD	39	1.68	
				STRIPED MULLET	1	.04	
		AT	25.8	BLUE CATFISH	2	.08	
		BC	24.6	BLUE CATFISH	2	.08	
				GIZZARD SHAD	32	1.30	
				STRIPED MULLET	7	.28	
		BT	27.2	BLUE CATFISH	2	.07	
				GIZZARD SHAD	9	.33	
				STRIPED MULLET	4	.15	
		BT1	28.6	GIZZARD SHAD	5	.17	
	77 SEP 26	AC	24.3	BLUE CATFISH	4	.16	
				GIZZARD SHAD	22	.90	
				STRIPED MULLET	6	.25	
		AT	25.1	BLUE CATFISH	1	.04	
				GIZZARD SHAD	5	.20	

TABLE A2-7-6 (Sheet 8 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1977-1978

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
GILL NET	77 SEP 26	BC	24.3	BLUE CATFISH	13	.54	
				GIZZARD SHAD	33	1.36	
				STRIPED MULLET	32	1.32	
		BT	24.0	BLUE CATFISH	3	.13	
				GIZZARD SHAD	7	.29	
		BT1	22.8	BLUE CATFISH	1	.04	
				GIZZARD SHAD	7	.31	
				STRIPED MULLET	1	.04	
	78 JAN 18	AC	25.8	GIZZARD SHAD	1	.04	
		AT	25.4	BLUE CATFISH	1	.04	
				GIZZARD SHAD	18	.71	
		BC	24.4	GIZZARD SHAD	10	.41	
		BT	24.2	GIZZARD SHAD	10	.41	
	78 JAN 19	AT	24.3	GIZZARD SHAD	19	.78	
		BC	22.8	GIZZARD SHAD	4	.18	
		BT	24.1	GIZZARD SHAD	1	.04	
	78 JAN 20	BT1	24.0	GIZZARD SHAD	10	.42	
	78 APR 18	AT	42.0	BLUE CATFISH	3	.07	
				GIZZARD SHAD	17	.40	
				THREADFIN SHAD	39	.93	3
		BC	24.4	GIZZARD SHAD	20	.82	
				THREADFIN SHAD	36	1.47	
		BT1	24.7	BLUE CATFISH	6	.24	
				FRESHWATER DRUM	5	.20	
				GIZZARD SHAD	14	.57	
				THREADFIN SHAD	9	.36	
	78 APR 19	AC	23.2	GIZZARD SHAD	1	.04	
				THREADFIN SHAD	12	.52	
		AT	24.0	BLUE CATFISH	13	.54	
				GIZZARD SHAD	8	.33	
				THREADFIN SHAD	35	1.46	
		BC	24.0	BLUE CATFISH	1	.04	
				GIZZARD SHAD	45	1.88	
				THREADFIN SHAD	35	1.46	
		BT	24.3	BLUE CATFISH	2	.08	
				GIZZARD SHAD	33	1.36	
				THREADFIN SHAD	45	1.85	
		BT1	4.7	FRESHWATER DRUM	7	1.50	
				GIZZARD SHAD	7	1.50	
				THREADFIN SHAD	8	1.71	
	78 APR 20	BT	24.7	BLUE CATFISH	2	.08	
				GIZZARD SHAD	2	.08	
				THREADFIN SHAD	25	1.01	
	78 APR 22	INTAKE3	24.0	BLUE CATFISH	1	.04	
				THREADFIN SHAD	3	.13	
MIDWATER TRAWL	77 SEP 27	BC	.2	BLUE CATFISH	3	12.00	

TABLE A2-7-6 (Sheet 9 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1977-1978

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH	
MIDWATER TRAWL	77 SEP 27	BC	.2	GIZZARD SHAD	1	4.00	
		BT	.1	GIZZARD SHAD	1	12.00	
		BT1	.2	GIZZARD SHAD	4	16.00	
OTTER TRAWL	77 AUG 12	AC	.3	BLUE CATFISH	58	193.33	
				FRESHWATER DRUM	7	23.33	
		BC	.1	BLUE CATFISH	2	17.14	
				FRESHWATER DRUM	2	17.14	
	77 AUG 13	AT	.2	BLUE CATFISH	15	60.00	
				FRESHWATER DRUM	5	20.00	
		BT	.1	FRESHWATER DRUM	3	25.71	
		BT1	.2	BLUE CATFISH	8	32.00	
	77 SEP 27	AC	.2	BLUE CATFISH	22	88.00	
				FRESHWATER DRUM	16	64.00	
		AT	.2	BLUE CATFISH	18	72.00	
				FRESHWATER DRUM	26	104.00	
				GIZZARD SHAD	1	4.00	
		BC	.2	BLUE CATFISH	15	60.00	
				FRESHWATER DRUM	4	16.00	
		BT	.2	BLUE CATFISH	6	24.00	
				FRESHWATER DRUM	1	4.00	
		BT1	.1	BLUE CATFISH	1	12.00	3
	78 FEB 22	AT	.2	BLUE CATFISH	16	64.00	
		BC	.2	BLUE CATFISH	2	12.00	
SURFACE TRAWL	77 SEP 27	AC	.2	BLUE CATFISH	1	6.00	
				GIZZARD SHAD	1	6.00	
		AT	.2	BLUE CATFISH	41	164.00	
				THREADFIN SHAD	1	4.00	
		BC	.2	BLUE CATFISH	3	18.00	
				GIZZARD SHAD	1	6.00	
		BT1	.2	BLUE CATFISH	1	4.00	
				GIZZARD SHAD	11	44.00	
	78 JAN 23	BC	.1	GIZZARD SHAD	1	12.00	
	78 APR 22	BC	.1	THREADFIN SHAD	1	12.00	
		BT	.1	GIZZARD SHAD	4	48.00	
				THREADFIN SHAD	1	12.00	
		BT1	.1	THREADFIN SHAD	2	24.00	

TABLE A2-7-6 (Sheet 10 of 10)

CATCH PER EFFORT AT WATERFORD 3
FOR 1979-1980

METHOD	DATE	STATION	DURATION	COMMON NAME	COUNT	CATCH
ELECTROFISHING	79 SEP 29	AC	2.0	BLUE CATFISH	117	58.50
				GIZZARD SHAD	5	2.50
		BT	2.0	BLUE CATFISH	70	35.00
				FRESHWATER DRUM	2	1.00
				GIZZARD SHAD	17	8.50
	79 SEP 30	AT	2.0	BLUE CATFISH	15	7.50
				FRESHWATER DRUM	4	2.00
				GIZZARD SHAD	8	4.00
		BC	2.0	BLUE CATFISH	128	64.00
				FRESHWATER DRUM	1	.50
				GIZZARD SHAD	42	21.00
	79 OCT 02	BT1	2.0	BLUE CATFISH	8	4.00
				FRESHWATER DRUM	2	1.00
				GIZZARD SHAD	8	4.00
				THREADFIN SHAD	1	.50
	80 JAN 16	AC	2.0	GIZZARD SHAD	30	15.00
		BC	2.0	BLUE CATFISH	21	10.50
				FRESHWATER DRUM	2	1.00
				GIZZARD SHAD	49	24.50
	80 JAN 17	AT	2.0	GIZZARD SHAD	54	27.00
	80 JAN 18	BT	2.0	FRESHWATER DRUM	3	1.50
				GIZZARD SHAD	79	39.50
		BT1	2.0	FRESHWATER DRUM	1	.50
				GIZZARD SHAD	40	20.00
GILL NET	79 SEP 29	AC	21.8	BLUE CATFISH	1	.05
		AT	22.8	BLUE CATFISH	1	.04
		BT	21.6	BLUE CATFISH	1	.05
	79 SEP 30	AC	32.8	BLUE CATFISH	2	.06
		AT	32.6	BLUE CATFISH	2	.06
				FRESHWATER DRUM	1	.03
				GIZZARD SHAD	1	.03
	79 OCT 01	BC	31.8	BLUE CATFISH	15	.47
				FRESHWATER DRUM	1	.03
				GIZZARD SHAD	2	.06
	79 OCT 04	BT1	30.6	BLUE CATFISH	4	.13
				FRESHWATER DRUM	2	.07
				GIZZARD SHAD	3	.10
	79 OCT 05	BT1	17.3	BLUE CATFISH	1	.06
				FRESHWATER DRUM	1	.06
	80 JAN 16	BC	23.0	BLUE CATFISH	20	.87
	80 JAN 17	AT	22.0	GIZZARD SHAD	3	.14

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TABLE A2-7-7 (Sheet 1 of 3)

MAXIMUM AND MINIMUM LENGTHS AND WEIGHTS OF FISH SPECIES
IN THE VICINITY OF WATERFORD 3
1977-1978

COMMON NAME	MAXIMUM LENGTH CM.	MINIMUM LENGTH CM.	MAXIMUM WEIGHT GMS.	MINIMUM WEIGHT GMS.	
AMERICAN EEL	31.7	31.7	69.0	69.0	
ATLANTIC NEEDLE FISH	15.0	15.0	6.0	6.0	
ATLANTIC STINGRAY	68.0	67.1	1420.0	1044.0	
BAY ANCHOVY	47.0	3.8	3.0	1.0	
BLACK BULLHEAD	19.9	19.9	253.0	253.0	
BLACK CRAPPIE	25.3	22.5	275.0	222.0	
BLUE CATFISH	79.5	2.0	9534.0	1.0	
BLUE CRAB	45.5	12.2	406.0	66.0	
BLUEGILL	11.7	8.2	50.0	22.0	
BOWFIN	52.5	52.5	2383.0	2383.0	
CARP	51.1	11.2	2724.0	40.0	
CHANNEL CATFISH	38.5	8.2	1310.0	8.0	
CYPRINID	19.5	19.5	175.0	175.0	
FLATHEAD CATFISH	28.9	28.9	343.0	343.0	
FRESHWATER DRUM	35.2	2.7	1731.0	1.0	
GIZZARD SHAD	98.0	5.5	960.0	2.0	
HOG SUCKER	9.1	7.2	27.0	26.0	
LADYFISH	29.2	29.2	232.0	232.0	
LARGEMOUTH BASS	16.6	16.6	97.0	97.0	3
LONGNOSE GAR	87.4	71.0	2175.0	1095.0	
PADDLEFISH	29.8	22.0	63.0	28.0	
QUILLBACK	28.4	15.3	780.0	97.0	
RIVER CARPSUCKER	30.3	21.2	920.0	300.0	
SHEEPSHEAD	27.2	20.6	593.0	268.0	
SHINER	2.5	2.5	5.0	5.0	
SHORTNOSE GAR	52.5	52.5	851.0	851.0	
SHOVELNOSE STURGEON	8.9	6.8	3.0	3.0	
SKIPJACK HERRING	97.0	5.0	699.0	2.0	
SMALLMOUTH BUFFALO	30.9	30.9	1008.0	1008.0	
SOUTHERN FLOUNDER	44.1	28.9	1922.0	389.0	
SPOTTED GAR	97.0	47.8	4086.0	570.0	
STRIPED BASS	51.5	7.7	2781.0	10.0	
STRIPED MULLET	99.0	8.6	1186.0	9.0	
SUCKER	2.4	1.5	3.0	.1	
THREADFIN SHAD	85.0	5.0	355.0	3.0	
WHITE BASS	27.6	18.0	574.0	148.0	
WHITE CRAPPIE	23.4	22.1	338.0	337.0	
YELLOW BASS	18.8	14.2	214.0	70.0	

TABLE A2-7-7 (Sheet 2 of 3)

MAXIMUM AND MINIMUM LENGTHS AND WEIGHTS OF FISH SPECIES
IN THE VICINITY OF WATERFORD 3
1978-1979

COMMON NAME	MAXIMUM LENGTH CM.	MINIMUM LENGTH CM.	MAXIMUM WEIGHT GMS.	MINIMUM WEIGHT GMS.
AMERICAN EEL	43.1	20.2	148.0	18.0
ATLANTIC NEEDLE FISH	34.5	34.5	60.0	59.0
BAY ANCHOVY	29.5	5.3	454.0	2.0
BIGMOUTH BUFFALO	37.6	28.0	1763.0	235.0
BLACK CRAPPIE	7.6	7.6	14.0	14.0
BLUE CATFISH	55.5	2.9	4545.0	.4
BLUE CRAB	26.0	15.5	512.0	158.0
BLUEGILL	14.9	5.9	167.0	5.0
BOWFIN	43.5	43.5	545.0	545.0
CARP	46.7	10.5	2818.0	35.0
CHANNEL CATFISH	38.0	3.9	1135.0	.1
FLATHEAD CATFISH	55.4	5.5	4086.0	2.0
FRESHWATER DRUM	41.5	2.3	2096.0	.1
GIZZARD SHAD	39.9	2.7	981.0	1.0
GOLDEYE	5.2	3.4	2.0	1.0
GULF MENHADEN	12.4	4.5	46.0	1.0
HOG SUCKER	8.1	8.1	28.0	28.0
LONGEAR SUNFISH	6.0	6.0	10.0	10.0
LONGNOSE GAR	23.2	23.2	30.0	30.0
MOONEYE	10.0	6.2	13.0	3.0
RIVER CARPSUCKER	34.6	2.3	1233.0	1.0
ROUGH SILVERSIDE	6.8	6.8	3.0	3.0
SAUGER	10.6	6.1	17.0	5.0
SHORTNOSE GAR	70.0	27.0	1108.0	87.0
SHOVELNOSE STURGEON	40.0	23.4	263.0	54.0
SHRIMP	3.5	3.5	.9	.9
SKIPJACK HERRING	36.7	4.0	892.0	.4
SMALLMOUTH BUFFALO	35.0	16.6	1768.0	170.0
SOUTHERN FLOUNDER	33.5	30.9	795.0	589.0
SPOTTED GAR	49.1	36.0	755.0	243.0
STRIPED BASS	43.0	8.7	2270.0	11.0
STRIPED MULLET	37.4	8.5	1091.0	8.0
THREADFIN SHAD	26.3	1.8	355.0	.1
UNIDENTIFIED FISH	7.1	6.2	3.0	2.0
WALLEYE	10.2	9.7	15.0	12.0
WARMOUTH	14.1	14.1	119.0	119.0
WHITE BASS	27.1	4.2	678.0	2.0
WHITE CRAPPIE	23.1	20.6	321.0	252.0
YELLOW BASS	30.0	12.8	830.0	42.0

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TABLE A2-7-7 (Sheet 3 of 3)

MAXIMUM AND MINIMUM LENGTHS AND WEIGHTS OF FISH SPECIES IN THE VICINITY OF WATERFORD 3 1979-1980

COMMON NAME	MAXIMUM LENGTH CM.	MINIMUM LENGTH CM.	MAXIMUM WEIGHT GMS.	MINIMUM WEIGHT GMS.
AMERICAN EEL	760.0	133.0	1200.0	4.0
BIGMOUTH BUFFALO	430.0	430.0	2750.0	2750.0
BLACK BULLHEAD	86.0	86.0	14.0	14.0
BLACK CRAPPIE	189.0	189.0	225.0	225.0
BLUE CATFISH	460.0	28.0	2400.0	1.0
CARP	250.0	220.0	465.0	380.0
CHANNEL CATFISH	440.0	30.0	1650.0	1.0
FLATHEAD CATFISH	404.0	222.0	1050.0	165.0
FRESHWATER DRUM	385.0	62.0	1850.0	5.0
GIZZARD SHAD	355.0	79.0	960.0	8.0
GOLDEYE	180.0	90.0	100.0	15.0
LONGNOSE GAR	605.0	400.0	650.0	160.0
MISSISSIPPI SILVERSIDE	80.0	72.0	4.0	3.0
MOONEYE	235.0	120.0	230.0	25.0
PADDLEFISH	328.0	295.0	55.0	50.0
QUILLBACK	121.0	121.0	46.0	46.0
RAINBOW SMELT	85.0	85.0	4.0	4.0
RIVER CARPSUCKER	320.0	108.0	905.0	35.0
SAUGER	196.0	196.0	116.0	116.0
SHORTNOSE GAR	220.0	220.0	45.0	45.0
SHOVELNOSE STURGEON	93.0	48.0	5.0	1.0
SILVER CHUB	83.0	63.0	7.0	3.0
SKIPJACK HERRING	365.0	72.0	795.0	3.0
SMALLMOUTH BUFFALO	244.0	225.0	520.0	370.0
SPECKLED CHUB	33.0	24.0	1.0	1.0
STRIPED BASS	518.0	157.0	3000.0	110.0
STRIPED MULLET	322.0	135.0	665.0	50.0
THREADFIN SHAD	106.0	48.0	20.0	1.0
WARMOUTH	47.0	47.0	2.0	2.0
WHITE BASS	310.0	90.0	1000.0	15.0
WHITE CRAPPIE	261.0	261.0	525.0	525.0

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TABLE A2-7-8 (Sheet 1 of 3)

LENGTH FREQUENCIES FOR BLUE CATFISH

DATE	LENGTH-CM .0	10.0	20.0	30.0	40.0	50.0	60.0	70.0
77 AUG 10	0	3	2	2	1	2	0	0
77 AUG 11	0	2	0	2	0	0	0	0
77 AUG 12	36	24	0	0	0	0	0	0
77 AUG 13	23	0	0	0	0	0	0	0
77 SEP 25	13	3	2	2	6	2	0	0
77 SEP 26	6	8	6	5	2	1	0	0
77 SEP 27	70	12	1	1	0	0	2	0
77 SEP 28	12	0	0	0	0	0	0	0
77 SEP 29	15	1	3	0	0	0	0	0
78 JAN 18	0	0	0	0	0	1	0	0
78 JAN 22	5	7	6	4	3	0	0	0
78 FEB 22	2	0	2	7	7	0	0	0
78 APR 18	1	6	4	1	2	2	0	0
78 APR 19	0	4	5	4	4	1	0	1
78 APR 20	0	1	0	0	1	0	0	0
78 APR 21	7	2	1	0	0	0	0	0
78 APR 22	0	1	0	0	0	0	0	0
TOTAL	190	74	32	28	26	9	2	1

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TABLE A2-7-8 (Sheet 2 of 3)

LENGTH FREQUENCIES FOR BLUE CATFISH

DATE	LENGTH-CM .0	10.0	20.0	30.0	40.0	50.0
78 JUL 21	51	14	3	0	3	0
78 JUL 22	2	14	2	0	0	1
78 JUL 24	56	5	0	0	1	0
78 JUL 25	57	35	1	0	1	0
78 SEP 29	0	6	3	0	2	0
78 SEP 30	1	3	4	0	1	1
78 OCT 01	17	5	2	0	0	0
78 OCT 02	96	50	6	0	0	0
78 OCT 04	157	46	4	1	0	2
78 OCT 16	1	0	0	0	0	0
78 OCT 17	308	50	4	0	0	0
79 JAN 12	0	0	4	0	0	0
79 JAN 14	4	4	2	0	0	0
79 JAN 15	0	1	0	0	0	0
79 JAN 31	2	0	0	0	0	0
79 APR 11	4	8	3	2	0	0
79 APR 12	1	2	6	1	3	2
79 APR 13	0	0	4	1	1	1
79 APR 14	0	0	0	0	2	1
79 APR 18	1	2	6	1	4	0
79 JUL 12	0	0	0	0	0	1
79 JUL 13	0	1	0	0	0	0
79 JUL 14	47	14	0	0	0	0
79 JUL 21	0	1	0	0	0	0
79 JUL 22	0	2	0	0	0	0
79 JUL 26	0	1	0	0	0	0
79 JUL 27	0	2	0	0	0	0
TOTAL	805	266	54	6	18	9

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TABLE A2-7-8 (Sheet 3 Of 3)

LENGTH FREQUENCIES FOR BLUE CATFISH

DATE	LENGTH-CM .0	10.0	20.0	30.0	40.0
79 SEP 29	121	61	5	3	0
79 SEP 30	34	83	21	4	0
79 OCT 01	1	12	1	0	1
79 OCT 02	5	3	0	0	0
79 OCT 04	2	2	0	0	0
79 OCT 05	0	1	0	0	0
79 OCT 06	10	0	0	0	0
79 OCT 07	1	1	0	0	0
80 JAN 16	0	20	17	4	0
80 JAN 19	4	3	0	0	0
80 JAN 23	15	19	0	0	0
TOTAL	193	210	44	11	1

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TABLE A2-7-9 (Sheet 1 of 3)

LENGTH FREQUENCIES FOR GIZZARD SHAD

DATE \ LENGTH-CM	.0	10.0	20.0	30.0	40.0	50.0	70.0	90.0
77 AUG 10	0	16	13	2	0	0	0	1
77 AUG 11	0	0	8	4	0	0	0	0
77 AUG 16	4	1	0	0	0	0	0	0
77 SEP 25	0	13	54	20	1	0	0	0
77 SEP 26	1	13	50	12	0	0	1	0
77 SEP 27	17	2	0	0	0	1	0	0
77 SEP 28	2	3	2	0	0	0	0	0
77 SEP 29	1	4	5	1	0	0	0	0
78 JAN 18	0	0	31	8	0	0	0	0
78 JAN 19	0	0	16	8	0	0	0	0
78 JAN 20	0	0	9	1	0	0	0	0
78 JAN 21	0	3	12	6	0	0	0	1
78 JAN 22	4	12	64	11	0	0	1	0
78 JAN 23	0	0	0	1	0	0	0	0
78 APR 18	0	4	49	3	0	0	0	0
78 APR 19	0	22	155	4	0	0	0	0
78 APR 20	0	2	4	0	0	0	0	0
78 APR 21	0	1	6	1	0	0	0	0
78 APR 22	4	0	0	0	0	0	0	0
TOTAL	33	96	478	82	1	1	2	2

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TABLE A2-7-9 (Sheet 2 of 3)

LENGTH FREQUENCIES FOR GIZZARD SHAD

DATE	LENGTH-CM .0	10.0	20.0	30.0
78 JUL 21	2	1	8	0
78 JUL 22	0	1	10	0
78 JUL 24	1	1	3	0
78 JUL 25	4	3	2	0
78 SEP 29	0	6	41	7
78 SEP 30	0	7	38	7
78 OCT 01	1	2	8	1
78 OCT 02	2	3	0	0
78 OCT [illegible]4	4	1	0	0
78 OCT 17	2	0	1	0
79 JAN 12	0	0	28	1
79 JAN 13	0	0	0	2
79 JAN 14	3	8	18	2
79 JAN 15	1	14	96	17
79 JAN 16	1	0	5	1
79 APR 11	0	1	23	0
79 APR 12	2	13	65	4
79 APR 13	0	3	34	0
79 APR 14	0	1	2	0
79 APR 18	2	11	7	0
79 APR 23	0	5	6	0
79 JUL 12	0	25	36	0
79 JUL 13	0	9	39	1
79 JUL 14	35	0	0	0
79 JUL 21	0	0	1	0
79 JUL 22	0	8	0	0
79 JUL 27	23	7	1	0
TOTAL	83	130	472	43

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TABLE A2-7-9 (Sheet 3 of 3)

LENGTH FREQUENCIES FOR GIZZARD SHAD

DATE	LENGTH-CM .0	10.0	20.0	30.0
79 SEP 29	0	14	7	1
79 SEP 30	2	32	15	2
79 OCT 01	0	0	2	0
79 OCT 02	0	7	1	0
79 OCT 04	0	2	1	0
79 OCT 06	1	0	0	0
80 JAN 16	1	19	54	5
80 JAN 17	1	16	39	1
80 JAN 18	0	16	91	12
TOTAL	5	106	210	21

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TABLE A2-7-10 (Sheet 1 of 3)

LENGTH FREQUENCIES FOR THREADFIN SHAD

DATE	LENGTH-CM .0	10.0	50.0	70.0	80.0
77 AUG 15	3	0	0	0	0
77 AUG 16	0	0	0	4	4
77 SEP 25	5	0	0	0	0
77 SEP 27	0	0	1	0	0
78 APR 18	35	87	0	0	0
78 APR 19	10	215	0	0	0
78 APR 20	88	23	0	0	0
78 APR 21	2	1	0	0	0
78 APR 22	4	3	0	0	0
TOTAL	147	329	1	4	4

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TABLE A2-7-10 (Sheet 2 of 3)

LENGTH FREQUENCIES FOR THREADFIN SHAD

DATE	LENGTH-CM .0	10.0	20.0
78 JUL 22	25	0	0
78 SEP 29	3	0	0
78 OCT 02	40	1	0
78 OCT 03	2	0	0
78 OCT 04	2	0	0
78 OCT 16	6	0	0
78 OCT 17	1	0	0
79 APR 11	0	4	1
79 APR 12	3	4	0
79 APR 18	0	1	0
79 JUL 14	56	0	0
79 JUL 27	7	0	0
TOTAL	145	10	1

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TABLE A2-7-10 (Sheet 3 of 3)

LENGTH FREQUENCIES FOR THREADFIN SHAD

DATE	LENGTH-CM .0	10.0
79 OCT 02	0	1
80 JAN 19	1	0
TOTAL	1	1

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TABLE A2-7-11 (Sheet 1 of 3)

LENGTH FREQUENCIES FOR FRESHWATER DRUM

DATE	LENGTH-CM .0	10.0	20.0	30.0
77 AUG 10	0	2	0	0
77 AUG 12	9	0	0	0
77 AUG 13	7	1	0	0
77 AUG 16	1	0	0	0
77 SEP 27	27	5	2	0
77 SEP 29	0	1	0	0
78 JAN 21	0	0	3	0
78 JAN 22	3	15	2	0
78 APR 18	0	2	2	1
78 APR 19	0	1	7	1
TOTAL	47	27	16	2

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TABLE A2-7-11 (Sheet 2 of 3)

LENGTH FREQUENCIES FOR FRESHWATER DRUM

DATE	LENGTH-CM .0	10.0	20.0	30.0	40.0
78 JUL 21	3	0	0	0	0
78 JUL 22	0	1	1	0	0
78 SEP 29	0	0	3	0	0
78 SEP 30	1	0	1	0	0
78 OCT 16	1	0	0	0	0
78 OCT 17	70	0	0	0	0
79 JAN 12	0	0	1	0	0
79 JAN 14	0	7	6	1	0
79 JAN 15	0	1	0	0	0
79 JAN 16	1	5	11	3	1
79 APR 12	0	1	0	0	0
79 APR 13	0	0	4	2	0
79 APR 1[illegible]	0	0	1	0	0
79 APR 18	0	0	1	0	0
79 JUL 14	69	0	0	0	0
79 JUL 21	0	2	2	0	0
79 JUL 22	0	2	2	0	0
79 JUL 26	1	0	0	0	0
79 JUL 27	24	2	1	0	0
TOTAL	170	21	34	6	1

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TABLE A2-7-11 (Sheet 3 of 3)

LENGTH FREQUENCIES FOR FRESHWATER DRUM

DATE	LENGTH-CM .0	10.0	20.0	30.0
79 SEP 29	1	1	0	0
79 SEP 30	2	1	2	1
79 OCT 01	0	1	0	0
79 OCT 02	0	1	1	0
79 OCT 04	0	2	0	0
79 OCT 05	0	1	0	0
80 JAN 16	0	0	0	2
80 JAN 18	0	0	1	3
80 JAN 23	7	24	0	2
TOTAL	10	31	4	8

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TABLE A2-7-12

(Sheet 1 of 6)

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES
IN THE VICINITY OF WATERFORD 3 FOR 1977-1978
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL	
77 AUG	1	CHANNEL CAT	0	.0017	0	0	0	.0017	
		CYPRINID	0	.0069	.0083	.1130	.0072	.1354	
		FISH EGG	0	0	.0021	.0159	.0018	.0198	
		FRESH DRUM	0	0	0	.0018	0	.0018	
		SCIANIDAE	0	.0017	0	0	0	.0017	
		TIDEWATER SILVERSIDE	.0212	0	.0083	.0159	0	.0454	
*TOTAL SAMPLE	1		.0212	.0103	.0186	.1465	.0091	.2057	
	2	BLUE CAT	0	.0023	0	0	0	.0023	
		CHANNEL CAT	0	.0023	0	0	0	.0023	
		CYPRINID	0	.0023	0	0	.0019	.0042	
		FISH EGG	0	.0023	0	0	0	.0023	
		FRESH DRUM	.0161	1.2236	0	.3843	.0933	1.7174	
*TOTAL SAMPLE	2		.0161	1.2328	.0000	.3843	.0952	1.7286	
	3	ATLANT CROAKER	.	.	0	0	.0016	.0016	3
		BLUE CAT	.	.	.0021	0	0	.0021	
		CYPRINID	.	.	.0021	0	.0016	.0037	
		FISH EGG	.	.	0	.0017	0	.0017	
		FRESH DRUM	.	.	.0518	0	.0792	.1310	
*TOTAL SAMPLE	3		.	.	.0559	.0017	.0825	.1401	
*TOTAL MONTH 77 AUG			.0373	1.2431	.0746	.5325	.1868	2.0744	
77 SEP	1	ATLANT CROAKER	0	0	0	0	.0014	.0014	
		BAY ANCHOVY	.0014	0	0	0	0	.0014	
		BLUE CAT	0	.0125	0	0	0	.0125	
		CHANNEL CAT	0	.0016	0	0	0	.0016	
		CYPRINID	.0166	.0016	0	0	.0014	.0195	
		FRESH DRUM	0	0	.0014	.0016	0	.0030	
		RIVER SHRIMP	0	.0406	.0014	0	0	.0420	
		SHINER	0	0	0	.0016	0	.0016	
*TOTAL SAMPLE	1		.0180	.0562	.0028	.0031	.0027	.0828	
	2	CHANNEL CAT	0	.0015	0	0	0	.0015	
		CYPRINID	0	.0239	.0015	[illegible]	0	.0272	

TABLE A2-7-12 (Sheet 2 of 6)

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES
IN THE VICINITY OF WATERFORD 3 FOR 1977-1978
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL	
77 SEP	2	FRESH DRUM	0	.0060	0	0	0	.0060	
		RIVER SHRIMP	0	.0239	0	0	0	.0239	
*TOTAL SAMPLE	2		.0000	.0554	.0015	.0018	.000[illegible]	.0587	
	3	RIVER SHRIMP	.	.	.0011	0	0	.0011	
*TOTAL SAMPLE	3		.	.	.0011	.0000	.0000	.0011	
*TOTAL MONTH 77 SEP			.0180	.1116	.0053	.0050	.0027	.1425	
78 APR	1	BLACK CRAPPIE	.0279	0	0	.0118	.0050	.0447	
		CARP	.0901	.0016	0	.1218	.0302	.2438	
		CARPSUCKER	.2403	.0038	.7965	.3105	.1722	1.5233	
		CYPRINID	0	0	.0295	0	0	.0295	
		FRESH DRUM	.0021	0	0	.0020	.0038	.0079	
		GIZZARD SHAD	2.5000	.0127	2.7142	1.4620	.7390	7.4278	
		LEAST KILLIFISH	0	.0001	0	0	0	.0001	
		MORONE SP	.0107	.0001	0	.0020	.0050	.0178	3
		POMEXIS	0	.0001	0	0	0	.0001	
		SAUGER	.0011	.0001	.0148	.0196	.0101	.0456	
		TADPOLE	.0011	0	0	0	0	.0011	
		UNIDENT LARV	.0054	.0006	.0295	0	.0019	.0373	
		WHITE CRAPPIE	.0236	0	.0885	.0118	.0075	.1314	
*TOTAL SAMPLE	1		2.9024	.0191	3.6730	1.9414	.9747	9.5105	
	2	BLACK CRAPPIE	0	0	0	.0118	0	.0118	
		CARP	.0138	.0008	.1475	.0275	.0023	.1919	
		CARPSUCKER	.0734	.0004	.1770	.0825	.0047	.3380	
		FRESH DRUM	.0023	0	0	.0314	0	.0337	
		GIZZARD SHAD	.1238	.0042	.7670	1.1593	.0772	2.1316	
		PERCH	0	0	0	.0020	0	.0020	
		UNIDENT LARV	.0046	.0002	.0148	.0039	.0105	.0340	
		WHITE CRAPPIE	0	.	0	0	0	.0000	
*TOTAL SAMPLE	2		.2178	.0056	1.1063	1.3185	.0948	2.7430	
	3	CARP	.	.	.0071	.0340	.0014	.0425	
		CARPSUCKER	.	.	.0283	.0471	.0055	.0810	

TABLE A2-7-12 (Sheet 3 of 6)

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES
IN THE VICINITY OF WATERFORD 3 FOR 1977-1978
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL
78 APR	3	FRESH DRUM	.	.	0	.0013	0	.0013
		GIZZARD SHAD	.	.	.0396	.9870	.0967	1.1234
		PIRATE PERCH	.	.	0	.0013	0	.0013
		UNIDENT LARV	.	.	.0057	.0092	.0041	.0190
		WHITE CRAPPIE	.	.	.0028	.0013	0	.0041
*TOTAL SAMPLE	3		.	.	.0835	1.0812	.1078	1.2726
*TOTAL MONTH	78 APR		3.1202	.0247	4.8628	4.3412	1.1772	13.5261
TOTAL			3.1755	1.3794	4.9427	4.8787	1.3667	15.7430

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TABLE A2-7-12 (Sheet 4 of 6)

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES
IN THE VICINITY OF WATERFORD 3 FOR 1978-1979
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL
78 JUL	1	CARP	0	0	0	.0013	0	.0013
		CARPIODES SP	0	0	.0011	0	0	.0011
		CYPRINID	.0023	0	0	0	0	.0023
		FRESH DRUM	.0280	.1108	.0987	.0846	.0155	.3375
		HYBOPSIS SP	.0420	.0350	.0413	.0159	.0129	.1470
		LEAST KILLIFISH	0	0	0	0	.0013	.0013
		QUILLBACK	0	.0087	.0069	.0053	0	.0209
		RIVER CARPSUCKER	0	.0058	0	.0013	.0013	.0084
		RIVER SHRIMP	.0012	0	0	0	0	.0012
		THREADFIN SHAD	0	.0015	.0046	0	.0013	.0073
		UNIDENT LARV	0	0	.0034	0	0	.0034
*TOTAL SAMPLE	1		.0734	.1618	.1561	.1083	.0322	.5319
	2	CARP	0	0	0	0	.0020	.0020
		CHANNEL CAT	.0125	0	0	0	0	.0125 3
		CYPRINID	0	0	0	.0112	0	.0112
		FRESH DRUM	0	.0120	0	.0019	0	.0138
		HYBOPSIS SP	0	.0120	0	0	0	.0120
		QUILLBACK	0	.0012	0	0	0	.0012
		THREADFIN SHAD	0	.0012	0	0	0	.0012
*TOTAL SAMPLE	2		.0125	.0263	.0000	.0131	.0020	.0539
	3	CYPRINID	.	.	.0066	0	0	.0066
		FRESH DRUM	.	.	0	.0273	0	.0273
		HYBOPSIS SP	.	.	.0262	0	0	.0262
		MORONE SP	.	.	0	.0014	0	.0014
		QUILLBACK	.	.	.0131	0	0	.0131
		UNIDENT LARV	.	.	0	.0014	0	.0014
*TOTAL SAMPLE	3		.	.	.0459	.0300	.0000	.0759
*TOTAL MONTH 78 JUL			.0859	.1881	.2020	.1514	.0342	.6617
78 OCT	1	BAY ANCHOVY	0	.0014	0	0	0	.0014
		FRESH DRUM	0	.0014	0	0	0	.0014
		RIVER SHRIMP	0	0	.0019	.0017	0	.0035
		THREADFIN SHAD	0	0	0	0	.0015	.0015
*TOTAL SAMPLE	1		.0000	.0029	.0019	.0017	.0015	.0079

TABLE A2-7-12 (Sheet 5 of 6)

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES
IN THE VICINITY OF WATERFORD 3 FOR 1978-1979
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL
78 OCT	2	FRESH DRUM	.0019	0	0	0	0	.0019
		ICTALURIDAE	0	.0025	0	0	0	.0025
*TOTAL SAMPLE 2			.0019	.0025	.0000	.0000	.0000	.0044
	3	BAY ANCHOVY	.	.	0	0	.0017	.0017
		RIVER SHRIMP	.	.	0	.0020	0	.0020
		UNIDENT LARV	.	.	.0041	0	0	.0041
*TOTAL SAMPLE 3			.	.	.0041	.0020	.0017	.0078
*TOTAL MONTH 78 OCT			.0019	.0054	.0059	.0036	.0032	.0201
79 APR	1	BANDED KILLIFISH	0	0	.0021	0	0	.0021
		BLUEGILL	0	0	0	.0016	0	.0016
		CARP	.0162	.0079	.0128	.0079	.0019	.0466
		CARPSUCKER	.0445	.0118	.0255	.0158	.0151	.1128
		MORONE SP	.0020	.0020	0	.0016	.0076	.0131
		RIVER CARPSUCKER	.0182	.0316	.0234	.0142	.0227	.1101
		THREADFIN SHAD	.0324	.0217	.0341	.0063	.0151	.1096
		UNIDENT LARV	.0040	0	.0021	.0016	0	.0077
		WHITE CRAPPIE	.0061	0	0	.0063	.0019	.0143
*TOTAL SAMPLE 1			.1234	.0750	.1000	.0551	.0643	.4179
	2	CARP	.0138	0	0	0	.0107	.0245
		CARPSUCKER	.0052	.0021	[illegible]	0	.0250	.0375
		MORONE SP	.0017	0	0	0	0	.0017
		RIVER CARPSUCKER	.0189	.0042	.0053	.0014	.0161	.0459
		THREADFIN SHAD	.0138	0	.0018	0	.0107	.0262
		WHITE CRAPPIE	.0052	0	0	0	0	.0052
*TOTAL SAMPLE 2			.0585	.0063	.0123	.0014	.0624	.1410
	3	CARPSUCKER	.	.	0	0	.0067	.0067
		RIVER CARPSUCKER	.	.	.0021	0	.0100	.0121
*TOTAL SAMPLE 3			.	.	.0021	.0000	.0167	.0187
*TOTAL MONTH 79 APR			.1819	.0813	.1145	.0566	.1434	.5776

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TABLE A2-7-12

AVERAGE DENSITIES (PER M3) BY STATION AND DEPTH OF ICHTHYOPLANKTON SAMPLES IN THE VICINITY OF WATERFORD 3 FOR 1978-1979
(ID3)

MONTH	DEPTH	COMMON NAME	STATION AC	AT	BC	BT	BT1	TOTAL
79 JUL	1	BLUEGILL	0	0	0	0	.0010	.0010
		CATOSTOMIDAE	0	.0013	0	0	0	.0013
		CYPRINID	0	.0013	0	.0059	.0020	.0091
		EMERALD SHINER	0	0	.0120	0	.0010	.0130
		FRESH DRUM	.0203	.0050	.1346	.0494	.0255	.2349
		GIZZARD SHAD	0	0	0	0	.0137	.0137
		HYBOPSIS SP	.0034	.0013	.0156	.0119	.0196	.0517
		LEPOMIS SP	.0011	0	.0048	0	0	.0059
		QUILLBACK	.0011	.0050	.0012	.0277	.0195	.0546
		SHINER	.0023	.0013	.0024	0	.0010	.0069
		THREADFIN SHAD	.0090	.0200	.0168	.0356	.0333	.1148
		UNIDENT LARV	0	0	0	.0010	0	.0010
*TOTAL SAMPLE	1		.0372	.0350	.1875	.1315	.1167	.5080
	2	BLUE CAT	0	.0015	0	0	0	.0015
		BLUEGILL	0	0	0	.0010	0	.0010
		CYPRINID	0	0	0	.0010	0	.0010
		EMERALD SHINER	0	0	.0013	0	.0014	.0026
		FRESH DRUM	.0149	0	.0204	.0039	.0014	.0406
		GIZZARD SHAD	.0019	.0118	.0013	.0291	.0014	.0455
		HYBOPSIS SP	.0392	.0311	.0255	.0087	.0163	.1208
		LEPOMIS SP	0	0	0	.0010	0	.0010
		QUILLBACK	0	.0059	.0076	.0078	.0014	.0227
		SHINER	.0019	0	0	0	0	.0019
		THREADFIN SHAD	.0187	.0148	.0013	.0078	0	.0425
		UNIDENT LARV	.0019	0	0	0	0	.0019
*TOTAL SAMPLE	2		.0784	.0651	.0573	.0[illegible]02	.0217	.2828
	3	CYPRINID	.	.	0	0	.0012	.0012
		FRESH DRUM	.	.	.0220	.0138	0	.0359
		GIZZARD SHAD	.	.	0	.0010	.0024	.0034
		HYBOPSIS SP	.	.	.0024	.0069	0	.0094
		QUILLBACK	.	.	.0024	.0059	.0012	.0095
		SHINER	.	.	.0024	0	0	.0024
		THREADFIN SHAD	.	.	.0024	.0010	.0024	.0058
*TOTAL SAMPLE	3		.	.	.0318	.0287	.0071	.0676
*TOTAL MONTH 79 JUL			.1156	.1002	.2767	.2204	.1456	.8584
TOTAL			.3854	.3750	.5991	.4320	.3263	2.1178

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TABLE A2-7-13 (Sheet 1 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1977-1978

DATE	PARAMETER		STATION BC	BT
77 AUG 17	ALKALINITY	MG/L	114.0	113.0
	ARSENIC	MG/L	-.0	-.0
	BOD	MG/L	1.2	.9
	CADMIUM	UG/L	2.4	2.8
	CALCIUM	MG/L	98.0	96.0
	CHLORIDE	MG/L	30.0	33.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	-.0	-.0
	COD	MG/L	28.0	20.0
	COPPER	UG/L	-.0	-.0
	IRON	UG/L	56.0	83.0
	LEAD	UG/L	-.0	-.0
	MAGNESIUM	MG/L	63.7	51.6
	OIL GREASE	MG/L	.2	.2
	ORTHO PHOSPHOROUS	MG/L	.2	.2
	SULFATE	MG/L	46.0	48.0
	TDS	MG/L	293.0	306.0
	TOTAL AMMONIA	MG/L	.2	.2
	TOTAL BACTERIA	MG/L	.	9300.0
	TOTAL MERCURY	MG/L	-.0	.6
	TOTAL NITRATE	MG/L	.6	.4
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.2	.2
	TSS	MG/L	11.4	11.6
	ZINC	UG/L	36.0	39.0
77 OCT 02	ALKALINITY	MG/L	105.0	103.0
	ARSENIC	MG/L	-.0	-.0
	BOD	MG/L	1.3	.8
	CADMIUM	UG/L	22.0	22.0
	CALCIUM	MG/L	41.7	40.1
	CHLORIDE	MG/L	24.8	24.8
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	60.0	80.0
	COD	MG/L	27.1	23.3
	COPPER	UG/L	25.0	25.0
	FECAL COLIFORM	MG/L	-.0	1000.0
	IRON	UG/L	9750.0	9750.0
	LEAD	UG/L	13.0	13.0
	MAGNESIUM	MG/L	12.2	12.2
	OIL GREASE	MG/L	2.4	1.6
	ORTHO PHOSPHOROUS	MG/L	.1	.1
	SULFATE	MG/L	51.4	50.6
	TDS	MG/L	278.0	295.0
	TOTAL AMMONIA	MG/L	.1	.1
	TOTAL BACTERIA	MG/L	11000.0	19000.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

TABLE A2-7-13 (Sheet 2 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1977-1978

DATE	PARAMETER		STATION BC	BT
77 OCT 02	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	1.1	1.0
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.7	.6
	TSS	MG/L	299.0	239.0
	ZINC	UG/L	960.0	980.0
78 FEB 18	ALKALINITY	MG/L	98.7	96.6
	ARSENIC	MG/L	-.0	-.0
	BOD	MG/L	1.2	1.8
	CADMIUM	UG/L	325.0	300.0
	CALCIUM	MG/L	34.5	35.0
	CHLORIDE	MG/L	21.2	20.4
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	21.0	23.0
	COD	MG/L	43.0	37.0
	COPPER	UG/L	14.0	16.0
	FECAL COLIFORM	MG/L	100.0	200.0
	IRON	UG/L	10000.0	10500.0
	LEAD	UG/L	30.0	30.0
	MAGNESIUM	MG/L	16.5	17.6
	OIL GREASE	MG/L	.2	-.0
	ORTHO PHOSPHOROUS	MG/L	-.0	-.0
	SULFATE	MG/L	37.9	37.2
	TDS	MG/L	195.0	191.0
	TOTAL AMMONIA	MG/L	.2	.2
	TOTAL BACTERIA	MG/L	8700.0	6400.0
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	.8	.8
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.1	.1
	TSS	MG/L	56.0	52.0
	ZINC	UG/L	1830.0	2110.0
78 APR 28	ALKALINITY	MG/L	103.0	103.0
	ARSENIC	MG/L	.	-.0
	BOD	MG/L	8.0	8.0
	CADMIUM	UG/L	210.0	220.0
	CALCIUM	MG/L	31.5	32.5
	CHLORIDE	MG/L	26.0	26.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	21.0	23.0
	COD	MG/L	19.0	19.0
	COPPER	UG/L	20.0	22.0
	FECAL COLIFORM	MG/L	300.0	600.0
	IRON	UG/L	7200.0	7500.0
	LEAD	UG/L	24.0	24.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS
. NO SAMPLE

TABLE A2-7-13 (Sheet 3 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1977-1978

DATE	PARAMETER		STATION BC	BT
78 APR 28	MAGNESIUM	MG/L	15.0	15.5
	OIL GREASE	MG/L	.5	.7
	ORTHO PHOSPHOROUS	MG/L	.1	1
	SULFATE	MG/L	42.0	40.0
	TDS	MG/L	298.0	290.0
	TOTAL AMMONIA	MG/L	.2	.2
	TOTAL BACTERIA	MG/L	1000.0	1500.0
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	.9	.7
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.1	.3
	TSS	MG/L	290.0	254.0
	ZINC	UG/L	1600.0	1700.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

. NO SAMPLE

TABLE A2-7-13 (Sheet 4 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1978-1979

DATE	PARAMETER		STATION BC	BT
78 JUL 26	ALKALINITY	MG/L	121.0	121.0
	ARSENIC	MG/L	8.0	5.0
	BOD	MG/L	3.0	1.2
	CADMIUM	UG/L	2.0	2.0
	CALCIUM	MG/L	64.0	50.0
	CHLORIDE	MG/L	29.0	29.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	25.0	22.0
	COD	MG/L	26.0	20.0
	COPPER	UG/L	39.0	28.0
	FECAL COLIFORM	MG/L	300.0	600.0
	IRON	UG/L	5400.0	4700.0
	LEAD	UG/L	25.0	25.0
	MAGNESIUM	MG/L	17.0	15.0
	OIL_GREASE	MG/L	.4	.4
	ORTHO PHOSPHOROUS	MG/L	.1	.2
	SULFATE	MG/L	50.0	50.0
	TOS	MG/L	202.0	196.0
	TOTAL AMMONIA	MG/L	-.0	-.0
	TOTAL BACTERIA	MG/L	1100.0	1500.0
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	.5	.5
	TOTAL NITRITE	MG/L	.1	-.0
	TOTAL PHOSPHOROUS	MG/L	.2	.2
	TSS	MG/L	54.0	52.0
	ZINC	UG/L	110.0	60.0
78 OCT 17	ALKALINITY	MG/L	126.0	127.0
	ARSENIC	MG/L	-.0	-.0
	BOD	MG/L	1.1	.9
	CADMIUM	UG/L	-.0	-.0
	CALCIUM	MG/L	52.0	62.0
	CHLORIDE	MG/L	23.0	23.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	50.0	40.0
	COD	MG/L	11.0	19.0
	COPPER	UG/L	17.0	8.0
	FECAL COLIFORM	MG/L	600.0	400.0
	IRON	UG/L	547.0	421.0
	LEAD	UG/L	50.0	50.0
	MAGNESIUM	MG/L	14.0	15.0
	OIL_GREASE	MG/L	.8	-.0
	ORTHO PHOSPHOROUS	MG/L	.1	.1
	SULFATE	MG/L	76.0	68.0
	TOS	MG/L	320.0	234.0
	TOTAL AMMONIA	MG/L	-.0	-.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

TABLE A2-7-13 (Sheet 5 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1978-1979

DATE	PARAMETER		STATION BC	BT
78 OCT 17	TOTAL BACTERIA	MG/L	7000.0	3700.0
	TOTAL MERCURY	MG/L	.2	.1
	TOTAL NITRATE	MG/L	.9	.7
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.2	.3
	TSS	MG/L	82.0	97.0
	ZINC	UG/L	28.0	15.0
79 JAN 26	ALKALINITY	MG/L	83.4	47.3
	ARSENIC	MG/L	-.0	-.0
	BOD	MG/L	2.4	2.3
	CADMIUM	UG/L	26.0	26.0
	CALCIUM	MG/L	21.6	43.2
	CHLORIDE	MG/L	13.0	18.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	13.0	19.0
	COD	MG/L	16.0	16.0
	COPPER	UG/L	21.0	21.0
	FECAL COLIFORM	MG/L	120.0	170.0
	IRON	UG/L	8300.0	8900.0
	LEAD	UG/L	29.0	29.0
	MAGNESIUM	MG/L	10.2	10.6
	OIL GREASE	MG/L	3.0	2.1
	ORTHO PHOSPHOROUS	MG/L	.1	.1
	SULFATE	MG/L	9.2	9.0
	TDS	MG/L	144.0	175.0
	TOTAL AMMONIA	MG/L	.2	.1
	TOTAL BACTERIA	MG/L	2200.0	1900.0
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	.1	.1
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.3	.3
	TSS	MG/L	1223.0	1257.0
	ZINC	UG/L	263.0	228.0
79 APR 23	ALKALINITY	MG/L	50.0	75.0
	ARSENIC	MG/L	5.0	4.0
	BOD	MG/L	3.0	4.0
	CADMIUM	UG/L	12.0	15.0
	CALCIUM	MG/L	43.0	70.0
	CHLORIDE	MG/L	20.0	17.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	67.0	33.0
	COD	MG/L	24.0	47.0
	COPPER	UG/L	26.0	19.0
	FECAL COLIFORM	MG/L	90.0	20.0
	IRON	UG/L	462.0	462.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

TABLE A2-7-13 (Sheet 6 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1978-1979

DATE	PARAMETER		STATION BC	BT
79 APR 23	LEAD	UG/L	36.0	36.0
	MAGNESIUM	MG/L	40.0	96.0
	OIL_GREASE	MG/L	-.0	-.0
	ORTHO PHOSPHOROUS	MG/L	.1	.1
	SULFATE	MG/L	43.0	28.0
	TDS	MG/L	200.0	214.0
	TOTAL AMMONIA	MG/L	-.0	-.0
	TOTAL BACTERIA	MG/L	18000.0	40000.0
	TOTAL MERCURY	MG/L	6.0	6.0
	TOTAL NITRATE	MG/L	1.5	1.5
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	.1	.1
	TSS	MG/L	126.0	304.0
	ZINC	UG/L	224.0	100.0
79 JUL 29	ALKALINITY	MG/L	91.0	96.0
	ARSENIC	MG/L	3.0	4.0
	BOD	MG/L	3.6	6.3
	CADMIUM	UG/L	2.0	2.0
	CALCIUM	MG/L	18.0	36.0
	CHLORIDE	MG/L	24.0	25.0
	CHLORINE	MG/L	-.0	-.0
	CHROMIUM	UG/L	-.0	-.0
	COD	MG/L	16.0	16.0
	COPPER	UG/L	14.0	14.0
	FECAL COLIFORM	MG/L	.	150.0
	IRON	UG/L	1900.0	2000.0
	LEAD	UG/L	53.0	27.0
	MAGNESIUM	MG/L	2.1	9.5
	OIL_GREASE	MG/L	2.6	4.0
	ORTHO PHOSPHOROUS	MG/L	-.0	-.0
	SULFATE	MG/L	97.0	88.0
	TDS	MG/L	219.0	246.0
	TOTAL AMMONIA	MG/L	-.0	-.0
	TOTAL BACTERIA	MG/L	460.0	420.0
	TOTAL MERCURY	MG/L	3.0	3.0
	TOTAL NITRATE	MG/L	6.8	8.1
	TOTAL NITRITE	MG/L	-.0	-.0
	TOTAL PHOSPHOROUS	MG/L	-.0	-.0
	TSS	MG/L	49.0	58.0
	ZINC	UG/L	214.0	63.0

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VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

. NO SAMPLE

TABLE A2-7-13 (Sheet 7 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1979-1980

DATE	PARAMETER		STATION BC	BT
79 OCT 01	ALDRIN	UG/L	-.0	-.0
	ALKALINITY	MG/L	99.0	98.0
	ARSENIC	MG/L	-.0	-.0
	ATP	MG/M3	76.2	7.7
	BOD	MG/L	30.9	5.1
	CADMIUM	UG/L	-.0	-.0
	CALCIUM	MG/L	40.0	40.0
	CHLORDANE	UG/L	-.0	-.0
	CHLORIDE	MG/L	16.6	6.5
	CHLORINE	MG/L	-.0	-.0
	CHLORINE,FREE	MG/L	-.0	-.0
	CHLOROPHYLL A	MG/M2	5.9	5.9
	CHLOROPHYLL B	MG/M2	3.9	5.1
	CHLOROPHYLL C	MG/M2	13.1	19.2
	CHROMIUM	UG/L	-.0	-.0
	COPPER	UG/L	-.0	-.0
	DDD	UG/L	-.0	-.0
	DDE	UG/L	-.0	-.0
	DDT	UG/L	-.0	-.0
	DIAZINON	UG/L	-.0	-.0
	DIELDRIN	UG/L	-.0	-.0
	ENDRIN	UG/L	-.0	-.0
	FECAL COLIFORM	MG/L	340.0	420.0
	HEPTACHLOR	UG/L	-.0	-.0
	HEPTACHLOR EPOXIDE	UG/L	-.0	-.0
	IMIDAN	UG/L	.7	.6
	IRON	UG/L	7.5	2.2
	LEAD	UG/L	-.0	-.0
	LINDANE	UG/L	.1	.1
	MAGNESIUM	MG/L	9.0	10.0
	MALATHION	UG/L	-.0	-.0
	METHOXYCHLOR	UG/L	-.0	-.0
	METHYL-PARATHION	UG/L	-.0	-.0
	OIL GREASE	MG/L	-.0	-.0
	PARATHION	UG/L	-.0	-.0
	PCB-1242	UG/L	.1	.1
	PCB-1254	UG/L	.1	.1
	PCB-1260	UG/L	.5	.5
	PHOSPHATE	MG/L	.5	.5
	PHOSPHOROUS SOL.	MG/L	.3	.4
	SULFATE	MG/L	40.0	44.0
	TOTAL AMMONIA	MG/L	.5	.3
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	2.6	1.2
	TOTAL NITRITE	MG/L	-.0	-.0

3

VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

TABLE A2-7-13 (Sheet 8 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1979-1980

DATE	PARAMETER		STATION BC	BT
79 OCT 01	TOXAPHENE	UG/L	.1	.1
	TRS	MG/L	121.0	150.0
	TSS	MG/L	217.0	219.0
	TURBIDITY	FTU	45.0	55.0
	ZINC	UG/L	-.0	-.0
80 JAN 21	ALDRIN	UG/L	-.0	-.0
	ALKALINITY	MG/L	106.0	103.0
	ARSENIC	MG/L	-.0	-.0
	ATP	MG/M3	5.4	5.5
	BOD	MG/L	2.0	2.0
	CADMIUM	UG/L	-.0	-.0
	CALCIUM	MG/L	41.0	40.0
	CHLORDANE	UG/L	-.0	-.0
	CHLORIDE	MG/L	19.6	17.6
	CHLORINE	MG/L	-.0	-.0
	CHLORINE,FREE	MG/L	-.0	-.0
	CHLOROPHYLL A	MG/M2	5.1	-.0
	CHLOROPHYLL B	MG/M2	1.3	-.0
	CHLOROPHYLL C	MG/M2	4.5	-.0
	CHROMIUM	UG/L	-.0	-.0
	COD	MG/L	26.0	24.0
	COPPER	UG/L	-.0	-.0
	DDD	UG/L	-.0	-.0
	DDE	UG/L	-.0	-.0
	DDT	UG/L	-.0	-.0
	DIAZINON	UG/L	-.0	-.0
	DIELDRIN	UG/L	-.0	-.0
	ENDRIN	UG/L	-.0	-.0
	FECAL COLIFORM	MG/L	15400.0	8300.0
	HEPTACHLOR	UG/L	-.0	-.0
	HEPTACHLOR EPOXIDE	UG/L	-.0	-.0
	IMIDAN	UG/L	-.0	-.0
	IRON	UG/L	4.5	7.5
	LEAD	UG/L	-.0	-.0
	LINDANE	UG/L	-.0	-.0
	MAGNESIUM	MG/L	13.0	13.0
	MALATHION	UG/L	-.0	-.0
	METHOXYCHLOR	UG/L	-.0	-.0
	METHYL-PARATHION	UG/L	-.0	-.0
	OIL GREASE	MG/L	-.0	-.0
	PARATHION	UG/L	-.0	-.0
	PCB-1242	UG/L	-.0	-.0
	PCB-1254	UG/L	-.0	-.0
	PCB-1260	UG/L	-.0	-.0
	PHOSPHATE	MG/L	.3	.3

VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

TABLE A2-7-13 (Sheet 9 of 9)

MISSISSIPPI WATER QUALITY IN THE VICINITY OF WATERFORD 3
1979-1980

DATE	PARAMETER		STATION BC	BT
80 JAN 21	PHOSPHOROUS SOL.	MG/L	.2	.1
	SULFATE	MG/L	43.0	4.7
	TOTAL AMMONIA	MG/L	.2	.1
	TOTAL MERCURY	MG/L	-.0	-.0
	TOTAL NITRATE	MG/L	1.8	1.4
	TOTAL NITRITE	MG/L	-.0	-.0
	TOXAPHENE	UG/L	-.0	-.0
	TRS	MG/L	81.0	81.0
	TSS	MG/L	231.0	232.0
	TURBIDITY	FTU	50.0	46.0
	ZINC	UG/L	-.0	-.0

3

VALUES INDICATED AS -.0 ARE BELOW DETECTION LIMITS

APPENDIX 3-1

Introduction

This appendix contains two analyses of compliance with 10 CFR 50, Appendix I for Waterford Unit No. 3. The original analysis was prepared to demonstrate compliance with Appendix I and is contained as an attachment to a letter to the NRC dated June 4, 1976. This original analysis was based on the following: three years of onsite meteorological data; Regulatory Guide 1.111, dated March 1976; Draft Regulatory Guide 1.109 and the results of an April 1976 field survey which located critical receptors. The original analysis and the transmittal letter for this demonstration of compliance with Appendix I are contained in their entirety herein.

This second analysis for compliance with 10 CFR 50, Appendix I incorporates the most recently available site meteorological data, updated critical receptor locations and plant design modifications. Since aspects of these parameters have changed since the June 4, 1976 analysis, it was considered necessary to update the Appendix I compliance analysis. The meteorological data includes data from the fourth year of onsite monitoring and the critical receptor locations are based on a June 1979 field survey. X/Q's and D/Q's were developed using the XOQDOQ Code obtained from the USNRC, according to procedures contained in Revision 1 to Regulatory Guide 1.111, dated July 1977. Finally, the following plant design modifications are factored into the second analysis:

1) X/Q's and D/Q's are calculated assuming ground level releases for conservatism;

2) Filtration capability for air ejector iodine releases incorporates an air ejector monitor setpoint of 10^{-4} uCi/cm^3; 3

3) A filtration efficiency of 90 percent for the Reactor Auxiliary Building filter during all normal operations, including containment building purge; and

4) Iodine charcoal efficiency of 50 percent for the Airborne Radioactivity Removal System inside the containment.

The updated information and results of this second analysis are presented in Tables A-2a, A-3a and A-5a. The results of this analysis does not alter the original conclusion of compliance with the Appendix I limits.

TABLE A-3a*

ATTACHMENT 1

ATMOSPHERIC DISPERSION AND DEPOSITION FACTORS
(June 1972-June 1975, February 1977-February 1978)

Receptor[1]	Direction	Distance (Miles)	Ground Level Release: Annual X/Q (sec/M^3)	Ground Level Release: Annual X/Q Depleted (sec/M^3)	Ground Level Release: Annual Deposition (M^{-2})	
Site Boundary	ESE	0.6	1.1×10^{-5}	9.8×10^{-6}	2.3×10^{-8}	
Milk Cows	NW	0.9	7.4×10^{-6}	6.5×10^{-6}	2.3×10^{-8}	
Beef Cattle	NNW	0.8	1.2×10^{-5}	1.1×10^{-5}	3.3×10^{-8}	
Milk Goats	N	3.9	3.9×10^{-7}	3.0×10^{-7}	5.1×10^{-10}	
Vegetable Garden	NNE	0.8	9.1×10^{-6}	8.1×10^{-6}	2.0×10^{-8}	3
	NW	0.9	7.4×10^{-6}	6.5×10^{-6}	2.3×10^{-8}	
Critical Residence	N	0.8	1.0×10^{-5}	8.9×10^{-6}	2.4×10^{-8}	

(1) Receptor locations based on survey by Ebasco, June, 1979.

* This table is not part of the original June, 1976 submittal to the NRC. It is provided as an update to the original Table A-3 as a demonstration that the radiological evaluations and conclusions originally provided in June 1976 remain valid.

Table A-5a*

MAXIMUM INDIVIDUAL DOSES FROM TERRESTRIAL PATHWAYS(1)

Pathway	Air Dose (mrad/yr.)	Whole Body (mrem/yr.)	Thyroid (mrem/yr.)	Skin (mrem/yr.)
All Age Groups:				
Gamma Air Dose At Site Boundary	1.16(0)(2)			
Beta Air Dose At Site Boundary	3.44(0)			
Tissue Dose From External Exposure		6.3(-1)	6.3(-1)	1.9(0)
Ground Shine Dose		2.2(-1)	2.2(01)	2.5(-1)
Adults:				
Inhalation Dose		4.0(-1)	4.8(-1)	4.0(-1)
Ingestion Dose		1.1(0)	1.3(0)	1.1(-1)
Leafy Vegetables		3.8(-1)	1.2(0)	3.2(-1)
Cow Milk		3.1(-2)	5.0(-2)	2.7(-2)
Goat Milk		3.4(-1)	3.7(-1)	3.3(-1)
Beef				
Teen:				
Inhalation Dose		4.1(-1)	5.0(-1)	4.0(-1)
Ingestion Doses				
Leafy Vegetables		1.5(0)	1.6(0)	1.4(0)
Cow Milk		5.5(-1)	1.9(0)	4.9(-1)
Goat Milk		4.2(-2)	7.6(-2)	3.9(-2)
Beef		2.5(-1)	2.8(-1)	2.5(-1)
Child:				
Inhalation Dose		3.6(-1)	4.7(-1)	3.6(-1)
Ingestion Doses				
Leafy Vegetables		2.9(0)	3.1(0)	2.8(0)

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(1) The Location of each pathway of exposure and the atmospheric dispersion and deposition factors used to obtain these values are presented in Table A-3 of Section 3-5 of the ER.

(2) ( ) denotes power of 10.

*This Table is not part of the original June, 1976 submittal to the NRC. It is provided as an update to the original Table A-5 as a demonstration that the radiological evaluations and conclusions originally provided in June, 1976 remain valid.

Table A-5a (Cont'd)

Pathway	Air Dose (mrad/yr.)	Whole Body (mrem/yr.)	Thyroid (mrem/yr.)	Skin (mrem/yr.)	
Cow Milk		1.0(0)	3.8(0)	1.0(0)	
Goat Milk		7.2(-2)	1.5(-1)	7.3(-2)	
Beef		4.2(-1)	4.7(-1)	4.2(-1)	
Infant:					3
Inhalation Dose		2.1(-1)	3.1(-1)	2.1(-1)	
Ingestion Doses		N/A	N/A	N/A	
Cow Milk		1.9(0)	8.6(0)	1.9(0)	
Goat Milk		1.3(-1)	3.1(-1)	1.3(-1)	
Beef		N/A	N/A	N/A	