

FL0002283

A 316(b) DEMONSTRATION  
FOR THE  
SCHOLZ ELECTRIC GENERATING CENTER  
SNEADS, FLORIDA

PREPARED FOR:  
GULF POWER COMPANY  
P. O. BOX 1151  
75 NORTH PACE BOULEVARD  
PENSACOLA, FLORIDA 32520

BY:  
BREEDLOVE and ASSOCIATES  
1213 NW 6th STREET  
GAINESVILLE, FLORIDA 32601

# GULF POWER COMPANY

75 NORTH PACE BOULEVARD  
POST OFFICE BOX 1151  
PENSACOLA, FLORIDA 32520  
November 21, 1977

Mr. John White ✓  
Regional Administrator  
Region IV  
U. S. Environmental Protection Agency  
345 Courtland Street, N. E.  
Atlanta, Georgia 30308

RE: 316(b) Assessment for the Scholz Electric Generating Center

Dear Mr. White:

Pursuant to the requirements of NPDES Permit No. FL 000 2283 and Section 316(b) of Public Law 92-500, please find enclosed two (2) copies of a report entitled A 316(b) Demonstration for the Scholz Electric Generating Center.

If any questions arise, please feel free to call.

Sincerely,

  
George O. Layman  
Director, Power Supply

GOL/mf

Enclosure

cc: Mr. Paul Frye, w/attachment  
Mr. John Jackson, w/attachment  
Mr. Bill Lyford, w/attachment  
Mr. Ben Breedlove, w/attachment

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## 1.0 EXECUTIVE SUMMARY

### 1.1 Introduction

Under the Federal Water Pollution Control Act Amendments of 1972, Section 316(b), Gulf Power Company is required to demonstrate to the U.S. Environmental Protection Agency that the cooling water intake structure of the Scholz Electric Generating Center reflects the best technology available for minimizing adverse environmental impacts. The Scholz Center is located on the Apalachicola River below Chattahoochee, Florida. The analysis of presently available data was considered an adequate means to demonstrate that the operation of the present condenser cooling water intake system has a relative lack of impact on the Apalachicola River system biota.

### 1.2 Analysis Methodology

In this report an assessment was conducted to determine the need for a 316(b) demonstration relative to impacts of the location, design, construction and capacity of the cooling water intake structure of the Scholz Center. This was done by analyzing existing data relating to the river biota and discharge, and examining the water withdrawal and flow rates of the intake structure. Conclusions were drawn from these analyses concerning adverse environmental impacts.

### 1.3 Apalachicola River System

The Jim Woodruff Lock and Dam at the confluence of the Flint and Chattahoochee Rivers marks the beginning of the Apalachicola River. Lake Seminole is a 37,500 acre impoundment which serves as the headwaters of the river. Since operations began at the lock and dam in 1957, the Apalachicola River has experienced a river hydroperiod significantly different than the recorded period prior to the dam construction. This has occurred for two reasons. First, so that the river navigational channel is maintained at a depth of nine (9.0) feet, flow releases from the impoundment have resulted in a higher low discharge for the river. Secondly, the retention of floodwaters in the impoundment and their subsequent controlled release has depressed the river flood peaks and resulted in higher flows to release accumulated waters. The annual mean discharge at the U.S. Highway 90 bridge gaging station (Station Number 02358000) for the period of record was approximately 22,000 cfs. The lowest mean discharge of one-day record for the period was 5010 cfs. The comparable flow in the 1958-1975 period with normal operations of the Woodruff Lock and Dam was 8,900 cfs. This represented a 77.5% increase in the lowest mean discharge.

### 1.4 Scholz Electric Generating Center

The Scholz Electric Generating Center is located on the Apalachicola River 3.6 mi. below the Jim Woodruff Lock and Dam. The Center uses a

once through (non-recirculating) cooling system whereby water is withdrawn from the river, used for cooling purposes and directly discharged back into the river. The water is taken in from the Apalachicola River through a channel cut 700 feet across the river floodplain to an intake system consisting of trash racks and traveling screens. The intake canal is cut to a depth of 31.0 ft., the same depth as the river channel. It has 2.5:1 slopes and joins the river at approximately a right angle to the river channel. The trash racks are deeply recessed and have no history of debris accumulation while the traveling screens are operated at infrequent intervals and have significant accumulations of debris only during autumn leaf fall. Four condenser cooling water pumps continuously withdraw water from the river at the rate of 86,000 gpm (191.54 cfs) while the Center is in operation.

#### 1.5 Results and Conclusions

During the period of operation since the filling of Lake Seminole (1958-1975) the 60 day duration low mean discharge has been 11,000 cfs. Cooling water withdrawals would require approximately 1.7% of this discharge.

The 1958-1975 lowest mean monthly spawning season flows and associated percentage river withdrawals are summarized below.

| Month    | 1 Day Duration | Percent Withdrawal | 30 Day Duration | Percent Withdrawal |
|----------|----------------|--------------------|-----------------|--------------------|
| January  | 16700          | 1.1                | 31600           | 0.6                |
| February | 22600          | 0.8                | -               | -                  |
| March    | 23300          | 0.8                | 43300           | 0.4                |
| April    | 20300          | 0.9                | 40900           | 0.5                |
| May      | 12600          | 1.5                | 22700           | 0.8                |

The condenser cooling water intake flow will utilize 0.5 - 1.0 percent of the river flow during the spawning season. This is not regarded as a particularly significant impact on the anadromous fishery.

During the spawning season approximately one percent (1%) of any eggs and larvae could be affected during the one day duration lowest mean monthly river discharges. When the 30 day duration river flow is considered, the potential impact decreases to approximately 0.5%. Both figures are reasonable bases for probable impact levels to be experienced in the future. Also, neither of the above impact levels is considered significant for the anadromous fishery. Other species living throughout the year in the river generally build nests in back water areas and are probably not affected by the generating center through the egg and larval stages.

There has not been an observable impingement problem. No impinged fish were observed during a period of screen rotation for this

specific purpose. The traveling screen rotations are infrequent and mainly serve to remove accumulations of leaves and woody debris. This is not an extensive problem because the intake canal joins the river at a right angle in a bend where a strong flow exists. Most debris therefore, tends to be swept pass the intake with little opportunity for capture by intake flow or eddy currents.

Based on the available data and analyses thereof, it is concluded that 316(b) impacts associated with the operation of Scholz

Electric Generating Center are sufficiently insignificant that "the protection and propogation of a blanced indigenous population of shellfish, fish, and wildlife" in the Apalachicola River System is assured.

## 2.0 INTRODUCTION

In Section 412 of the Federal Water Pollution Control Act (the Act), a National Pollutant Discharge Elimination System was established. Under this system, the federal government, through the U.S. Environmental Protection Agency, must issue a permit before prescribed pollutants may be discharged into the navigable waters of the nation. Also, Section 316(b) requires that

"any standard established to Section 301 or Section 306 of the Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

Gulf Power Company, subsequent to the provisions of the Act, applied for and received an NPDES permit (FL 000 2283) for the operation of its Scholz Electric Generating Center. The Scholz Center is located on the Apalachicola River 3.6 miles below the Jim Woodruff Lock and Dam. One of the provisions of the permit was that pursuant to Section 316(b) of the Act, Gulf Power would demonstrate that the cooling water intake structure of the Scholz Center reflects the best technology available for minimizing adverse environmental impacts. An evaluation and analysis of currently available data was considered a proper procedure to make such a demonstration.

### 3.0 ANALYSIS METHODOLOGY

This report evaluates: 1) the operating characteristics of the Scholz Center intake and condenser cooling water system; 2) the flow regime, and water quality characteristics of the Apalachicola River; 3) the pertinent life history aspects of the river fauna of particular management interest; and 4) provides analysis of the probable impact of the present Scholz Center cooling water intake operations.

River discharge data were obtained from the United States Geological Survey Sub-regional Office in Tallahassee, Florida. Also obtained were data concerning lowest mean flows for the period of record for various periods of flow duration, highest mean flows, probability of occurrence curves and water quality data.

From these data, analyses were performed based on: discharge values which progressively incorporated larger periods of flow duration up to a period of thirty (30) days which would include most of the spawning period; discharges occurring only during the spawning season which coincides with the period of highest annual discharge; and discharges of record from 1958-1975 which show the influence of the Jim Woodruff Lock and Dam Operations. A set of hypothetical worst case conditions was also determined based on lowest mean discharges of record.

The biotic system was reviewed for rare and endangered species as well as for those species for which a major sport or commercial fishery exists. Striped bass, Alabama shad, skipjack herring and the southern sea sturgeon were treated in depth. The readily available literature was reviewed for spawning and early life history data as well as immigration and emigration data. The period of occurrence of various activities, the associated river discharge and proximity of the activities to the Scholz Center and the Woodruff Dam were evaluated in making an impact analysis. A 100 percent mortality rate was assumed for entrained eggs and larvae and for impingement of small fish. Conclusions were drawn from the impact analysis as to any 316(b) effects arising from center operations.

#### 4.0 APALACHICOLA RIVER SYSTEM

##### 4.1 General

The Apalachicola River is formed by the confluence of the Flint and Chattahoochee rivers. It is 107 miles long, has a gradient of 0.45 feet per mile and an average flow of approximately 21,000 cfs (Barkuloo, 1970). The Jim Woodruff Lock and Dam were constructed at the river junction. In 1957, Lake Seminole, a 37,500 acre impoundment, was filled and flood control and navigation functions initiated.

The river valley occupies the divide between two topographic regions. The Tallahassee Hills occupy the area to the east of the upper river. The highest part of this region is a plain about 300 feet in elevation in the northwestern part of Gadsden County and adjacent to the Apalachicola River. The Marianna Lowlands, which form the west bank of the Apalachicola River, are underlain by limestone and have a low, generally flat or rolling topography (Cooke, 1945).

Reservoir operations have modified the flow characteristics and ecology of the Apalachicola River. Post-impoundment river flows fluctuate less and are of reduced volume during flood stages. Organisms in the discharge are those typical of reservoir impoundments. Closure of the system to migratory fish species by placement of the dam has restricted all migratory activity to that portion of the watershed downstream of the dam and within tributaries such as the Chipola River.

#### 4.2 Channel Maintenance

Navigation functions of the Apalachicola River require a nine foot draft, 100 foot channel from the intersection of the Apalachicola River with the Intracoastal Waterway north to the confluence of the Chattahoochee-Flint rivers, a distance of 104 miles. Maintenance dredging is performed annually in the area to maintain the channel as near as possible to its authorized depth of nine feet. The average annual quantity of material dredged from the Apalachicola River is approximately one million cubic yards. Dredged material has been disposed of in open water or on the shore. In the vicinity of the Scholz Center, between mile 96 and 107, an average of 143,580 cubic yards are dredged each year. Dredging has occurred annually in the vicinity of the plant from 1957-1974, excluding 1964 (U.S. Army Corps of Engineers, Mobile District, 1975).

Dredged material in the upper reaches of the Apalachicola River is low silt content sand. Due to the nature of the material and the fact that open water disposal is practiced on the Apalachicola River, the levels of turbidity and suspended solids increase significantly during dredging. However, levels are within the natural ranges of the river except at the immediate point of discharge (U.S. Army Corps of Engineers, Mobile District, 1975).

In an effort to provide the 9 x 100 foot navigation channel year-round, the river has been modified by dredging, contraction dikes, and cutoffs. These modifications have resulted in a changed bottom contour due to

removal of ridges and shoal areas, and a change in the width to depth ratio. The navigation channel occupies 20 percent of the river cross-sectional area and the contraction dikes opposite the channel serve as dredge disposal areas. The constant channel scour and sediment displacement have resulted in decreased benthic habitat stability and suitability. Reaeration rate is decreased as a result of these actions (U.S. Army Corps of Engineers, Mobile District, 1975).

Snagging is performed annually in the navigation channel throughout the low water season. Obstructions to navigation, such as trees, stumps, limbs, and other debris, are lifted from the stream and placed on the nearest available river bank (U.S. Army Corps of Engineers, Mobile District, 1975).

The Corps of Engineers has conducted programs for the control of mosquito populations and aquatic plant growth on the Apalachicola River. Mosquito control measures include eliminating floating materials and spraying areas where mosquito breeding might occur. Such areas are treated from an airplane with a low volume application of malathion. Undesirable aquatic plants have been treated with 2,4-D (U.S. Army Corps of Engineers, Mobile District, 1975).

#### 4.3 Water Quality

Water quality records were obtained from STORET and U.S.G.S. files. Both STORET and U.S.G.S. systems provide data summaries which have been included. (Appendix A,B, and C).

The water quality of the upper Apalachicola River was evaluated by the Florida State Board of Health (1964). The study noted no adverse effects on the river biota due to the water quality of the river. Beck's Biotic Index was at or above 20 at all stations.

During the period 1967-1974, the Florida Game and Fresh Water Fish Commission conducted a series of broad scale studies on the upper Apalachicola River as part of their stream investigations (FGFWFC, 1967-1974). The impact of the dredging activity required to maintain the navigation channel was noted in the studies as well as impacts due to barge traffic and the release of waters from Lake Seminole into the river. Seasonal and annual changes are noted in the progress reports. Data to support impacts said to be due to low dissolved oxygen waters from Lake Seminole and pesticides are not presented. Therefore, no independent evaluation is possible. It was stated that most fish species are maintaining recent population levels and that the white catfish population is increasing. Therefore, no recent major impacts seem to have occurred in the vicinity of the upper Apalachicola River. It appears that no particular or critical water quality problem exists in the Upper Apalachicola River and that most biotic impacts are due to navigation related activities such as Jim Woodruff Lock and Dam and its water releases, operation of barges, and the various dredging or construction activities associated with channel maintenance.

#### 4.4 River Discharge Characteristics

Apalachicola River discharge for the period 1929-1975 was examined for low flow characteristics of various consecutive days flow duration. The discharge volume was recorded by month for one, seven, and thirty day duration mean low flows. An examination of the year of occurrence of the values indicated that the closing of Jim Woodruff Dam and the filling of Lake Seminole was responsible for a majority of the most severe low flow discharges (5010 cfs during 1954). It appears safe to assume that this worst case condition should not be considered in assessing the impact of the cooling water intake system due to the fact that it will not occur again during the life of the system.

A more realistic estimate of the Scholz Center impact was sought by examining lowest mean daily discharge for the post dam closure period of 1958-1975 (Table 4-1). The presented annual data for this period (1958-1975) would also be considered conservative because the period of particular interest for this study is from January through May when spawning occurs (Table 4-2). River discharge is at an annual peak during this time due to late winter and spring runoff. The one to thirty-day span is sufficiently small to bias the value toward a low value yet sufficiently broad to incorporate the period of time during which the majority of spawning by any species should occur.

Mean Lowest Annual Discharge of Apalachicola River and Scholz Intake Flow Between 1958-1975.\*

| <u>Consecutive Days Duration of Discharge</u> |              |               |              |                |              |
|-----------------------------------------------|--------------|---------------|--------------|----------------|--------------|
| <u>1 Day</u>                                  |              | <u>7 Days</u> |              | <u>30 Days</u> |              |
| River Dischg.                                 | Intake Flow+ | River Dischg. | Intake Flow+ | River Dischg.  | Intake Flow+ |
| (cfs)                                         | (% of River) | (cfs)         | (% of River) | (cfs)          | (% of River) |
| 8900                                          | 2.2          | 9300          | 2.0          | 10,000         | 1.9          |

| <u>60 Days</u> |              | <u>365 Days</u> |              |
|----------------|--------------|-----------------|--------------|
| River Dischg.  | Intake Flow+ | River Dischg.   | Intake Flow+ |
| (cfs)          | (% of River) | (cfs)           | (% of River) |
| 11,000         | 1.7          | 24,300          | 0.8          |

\* Discharge rates include those years since operation of Woodruff Lock and Dam.

+ Calculations based on maximum intake flow of 86,000 gpm (191.54 cfs).

Lowest Mean Monthly Discharge of Apalachicola River and Scholz Intake Flow Between 1958-1975.\*

| Month                                             | Consecutive Days Duration of Discharge |                      |               |                      |               |                      |
|---------------------------------------------------|----------------------------------------|----------------------|---------------|----------------------|---------------|----------------------|
|                                                   | 1 Day                                  |                      | 7 Days        |                      | 30 Days       |                      |
|                                                   | River Dischg.                          | Intake Flow†         | River Dischg. | Intake Flow†         | River Dischg. | Intake Flow†         |
|                                                   | (cfs)                                  | (% of River Dischg.) | (cfs)         | (% of River Dischg.) | (cfs)         | (% of River Dischg.) |
| January                                           | 16,700                                 | 1.1                  | 23,000        | 0.8                  | 31,600        | 0.6                  |
| February                                          | 22,600                                 | 0.8                  | 27,100        | 0.7                  | no data       |                      |
| March                                             | 23,300                                 | 0.8                  | 27,900        | 0.6                  | 43,300        | 0.4                  |
| April                                             | 20,300                                 | 0.9                  | 24,200        | 0.8                  | 40,900        | 0.4                  |
| May                                               | 12,600                                 | 1.5                  | 15,400        | 1.2                  | 22,700        | 0.8                  |
| June                                              | 12,600                                 | 1.5                  | 14,100        | 1.3                  | 19,600        | 0.9                  |
| July                                              | 11,800                                 | 1.6                  | 13,300        | 1.4                  | 17,100        | 1.1                  |
| August                                            | 11,700                                 | 1.6                  | 13,000        | 1.5                  | 16,300        | 1.2                  |
| September                                         | 10,200                                 | 1.8                  | 10,900        | 1.8                  | 12,400        | 1.5                  |
| October                                           | 9,900                                  | 1.9                  | 11,000        | 1.7                  | 13,800        | 1.3                  |
| November                                          | 10,400                                 | 1.8                  | 11,100        | 1.7                  | 12,800        | 1.5                  |
| December                                          | 11,800                                 | 1.6                  | 14,200        | 1.3                  | 20,400        | 0.9                  |
| Spawning Season<br>(Jan-May) $\bar{X}$<br>Values  | 19,100                                 | 1.0                  | 23,500        | 0.8                  | 34,600        | 0.5                  |
| Juvenile Season<br>(June-Aug) $\bar{X}$<br>Values | 12,000                                 | 1.6                  | 13,500        | 1.4                  | 17,700        | 1.1                  |

\* Discharge rates include those years since operation of Woodruff Lock and Dam.

† Calculations based on maximum intake flow of 86,000 gpm (191.54 cfs).

## 4.5 River Biology

### 4.5.1 General

Statements from contacted persons familiar with the area and a research of the available literature indicates that there exists a limited data base for the upper Apalachicola River.

The broadest study accomplished over a relatively long period of time would be the effort by the Florida Game and Fresh Water Fish Commission (FGFWFC, 1967-1975) to evaluate the water quality, fishery and benthic macroinvertebrates of the Apalachicola River. Improvements in sampling, taxonomy and data analysis occurred throughout the study. Data were taken over a sufficient period of time that some early interpretations were modified on the basis of data collected during later efforts. Recognition of the causes of system functions and the significance of barge traffic and channel maintenance as major determinants of water quality and biological diversity occurred late in the study.

The Alabama shad (Alosa alabamae) and skipjack herring (Alosa chrysochloris) in the Apalachicola River have been studied (Mills, 1971; Laurence and Yerger, 1966; Mills, 1972). The studies are initial efforts but do include data similar to that mentioned for the striped bass. No fishery exists for these species. No efforts are currently being conducted to stimulate the fishery.

The southern sea sturgeon (Gulf of Mexico sturgeon) (Acipenser oxyrinchus desotoi) is present in the river. However, the only significant regional study of the fish has been performed in the Suwannee River (Huff, 1975). Carr (personal communication) has initiated a study of the species in the Apalachicola River, but has not collected data to date.

Suttkus of Tulane University (personal communication) has collected fish from the river for approximately 20 years as part of a larger sampling program of southeastern rivers. Publication of the material is planned.

Striped bass (Morone saxatilis) spawning migrations into the Flint and Chattahoochee Rivers were blocked by construction of the Jim Woodruff Lock and Dam. Large catches of these fish in the years immediately following completion of the dam apparently prompted an interest in this anadromous fishery (Barkuloo, 1967, 1970, 1974). This is probably the best compilation of specific studies applicable to the area. Data from these studies include fecundity data, spawning times, conditions, locations, and the fact that major tributaries downstream of the plant also have spawning populations of striped bass. A long-term study on the fishery has been started by the U.S. Fish and Wildlife Service (Talley, personal communication).

No other local biological efforts of significance on the upper Apalachicola River were located. Studies performed elsewhere are used to supplement and support the profiles developed for the four anadromous species. The Florida State Board of Health (1964) conducted a water quality investigation which indicated both the major sources of pollution in the upper river, the travel time of the river and its associated recovery from pollutant input. Most of these data are interesting but are of only secondary interest in developing parameter baseline conditions for the river.

Data of particular use for impingement analyses such as growth rates of young fish and avoidance swim speeds were not found in the available literature. However, general life history characteristics which were found and are applicable are presented.

#### 4.5.2 Alabama Shad (Alosa alabamae)

The Alabama shad is considered to be the most abundant anadromous fish on the Gulf Coast. It is found throughout the Flint-Chattahoochee-Apalachicola river drainage and, apparently a breeding population still occurs above the Jim Woodruff Dam. The Alabama shad has never been an important food fish (Mills, 1971).

Adult Alabama shad enter the Apalachicola River to spawn as early as January and as late as March. Male shad enter the Apalachicola River in larger numbers than females at temperatures below 17°C, while females outnumber males entering the river at temperatures above 17°C. All shad collected during the spawning run were less than four years old. The

predominant year class of spawning Alabama shad were two year olds which represented 79.8% of the catch population, with one and three year olds representing 5.2% and 14.9% of the spawning run, respectively. Mills (1971) reported that spawning habitats of Alabama shad is essentially the same as Godwin and Adams' (1969) description for American shad in the Altamaha River, Georgia. Spawning apparently occurs at 19-22°C in moderate currents over bottoms of coarse sand and gravel (Mills, 1972). Laurence and Yerger (1966) observed a gradual ripening of gonads until water temperature reached 20°C in late April. At that time spawning took place abruptly. Fecundity estimates range from 61,238 to 257,655.

Good food habit studies based on stomach analyses reveal that adults take little or no food during spawning and that juveniles feed largely on small fish and aquatic dipterans (Laurence and Yerger, 1966).

Eggs and larvae of Alabama shad were collected by towing and bottom sets with a 0.5 meter nylon plankton net with 20 meshes per inch. Attempts to collect eggs and larvae during daylight sampling were unsuccessful. In April, 1971 eight shad eggs and 431 clupied larvae were collected in the main river channel from Jim Woodruff Dam to mile 102 at temperatures of 19-23°C. No eggs were collected below river mile 102 which is below the Scholz Center. All small larvae were collected at night and only in areas of appreciable current (Mills, 1972). Laurence and Yerger (1966) reported that two weeks of sampling with a plankton net for eggs and developing larvae produced negative results.

Mills (1968, 1971) sampled several types of habitat. However, juveniles were never collected in areas of still or backwaters. During July, 1970, juvenile shad over 125 mm FL were not collected in the river and emigration into saltwater by larger juveniles independent of temperatures was noted (Mills, 1972). Large numbers of juvenile shad were taken along the banks of the river below the Woodruff Dam by Laurence and Yerger (1966) using a minnow seine. On May 26, 1966, fifty juvenile Alabama shad, with an average length of 1.8 inches and a range of 1.1 to 2.4 inches were collected below the Woodruff Dam. On June 6th, four shad were collected below the Woodruff Dam whose average length was 2.1 inches with a range of 1.6 to 2.4 inches. On June 21st, a third collection of 47 shad was made whose average length was 2.6 inches with a range of 1.7 to 3.7 inches. Periodic collections were made until the juveniles disappeared about July 1st. On September 2nd, five juvenile shad, 4.5 inches TL were captured (Laurence and Yerger, 1966).

Juvenile shad in the Woodruff Dam region contained a greater mean volume of food per stomach than did fish collected down river and they fed to a greater extent on fish. Large numbers of juvenile threadfin and gizzard shad, Dorosoma petenese and Dorosoma cepedianum, which spawned after Alabama shad, provided abundant forage for these fish. The food in the Woodruff Dam area was also more varied than down river due to the input of reservoir waters containing plankton. It appears that these young fish are opportunists and feed largely on whatever is available. This view is supported by Walburg (1957) who concluded that the diet of juvenile shad is quite diversified and varies from river to river (Laurence and Yerger, 1966).

Length frequency analyses of juveniles indicated the progeny of three spawning groups present in the river. The origins of these spawning groups were the Chipola River, the Chattahoochee-Flint River and the Jim Woodruff Dam. Growth occurred at the rate of 30 mm per month and juveniles emigrated from the river at 125 mm FL, or in December (Mills, 1971).

Length frequency progressions of juveniles in the Apalachicola River indicated that the three spawning populations may be encountered between July and November. The first population is known to spawn between river mile 102 and 107 or in the stretch immediately below Jim Woodruff Dam. The length frequency progression mode for the upper Apalachicola River group appeared in July. During August, it reached 105 mm, although it had originally occurred at 75 mm. It had become less prominent in the grass, indicating that some emigration from the river had occurred (Mills, 1971).

A second spawning group, represented by a prominent node at 65 mm in August and 95 mm in September, probably resulted from spawning in the Chipola River. Spawning probably occurs north of Marianna, Florida in late April or May. The low water temperatures caused by numerous springs feeding into the Chipola River allowed spawning to occur after the Jim Woodruff group. Absence of a node in October indicated that this group had emigrated from the river (Mills, 1971).

The third spawning group, represented by a less prominent node at 55 mm, became the only node in October and November at 65 and 75 mm.

It is possible that this group spawns above Jim Woodruff Dam. Navigation locks at Jim Woodruff and at the Columbus and Walker F. George Dams north of Jim Woodruff Dam could allow passage of substantial numbers of shad (Mills, 1971).

The studies conducted by Mills (1971 and 1972) are supported by the life history study of Laurence and Yerger (1966).

#### 4.5.3 Skipjack Herring (Alosa chrysochloris)

The skipjack herring has not been studied in detail and little is known of its characteristics in drainages leading to the Gulf of Mexico. Wolfe (1969) collected specimens in the upper Apalachicola River from December 29, 1967 to April 12, 1968 during their spawning run. He observed that skipjack herring have a prolonged spawning period lasting approximately two months, from early March to late April and that both adults and juveniles are piscivorous.

Based on data from 15 females collected from the upper Apalachicola River during late March and early April, 1968, Wolfe (1969) estimated a fecundity range of 76,260 to 961,540 for the skipjack herring.

The two lowest values in the range were for fish which appeared to be partially spent and the highest value was based on eggs from an unusually large female of age class IV whose ovaries weighed over four times more than any other specimen examined. Mature ova were 0.8-1.0 mm in diameter.

Spawning of the skipjack herring was speculated to occur in the depths of the main channel near an extensive gravel bar below Jim Woodruff Dam (Wolfe, 1969). The site has a coarse sand-gravel bottom and a moderate to fast current. The site is similar to spawning areas preferred by the American shad (Massmann, 1952).

On March 29, 1968, at a temperature of 17.5°C, skipjack herring were abundant below Woodruff Dam, but only 8.4% were in a partially or completely spent condition. Most females were in a "maturing" state. They were heavy with roe but ova were not exuded when heavy pressure was applied. An increasing percentage of spent females were taken during April 2-12, 1968. Water temperatures ranged from 18-22°C during the period (Wolfe, 1969).

Efforts to collect larvae in the period immediately following spawning were unsuccessful. Collection of the first young of the year occurred on June 10, 1968. The two specimens were 59 and 69 mm TL and were thought to be about two years old. On June 27th, forty-nine specimens (36-103 mm TL) were taken. The size variability suggested a prolonged spawning period extending from early March to late April (Wolfe, 1969). Coker (1930) stated that spawning occurred over a similar length of time (early May - early July) in the upper Mississippi River.

Food habits of adult skipjack herring in the upper Apalachicola River were surveyed based on a collection of sixty-one stomachs from fish collected below the Jim Woodruff Dam in December - January and March - April. Active feeding occurs during the spawning run. The main food

item, threadfin shad (Dorosoma petenense), occurred in 67% of the stomachs (Wolfe, 1969). Coker (1930) determined that over one third of the stomachs examined from fish in the upper Mississippi River contained fish or fish remains.

Juvenile skipjack herring collected in the upper Apalachicola River below the Woodruff Dam during June - July, September, May, and July had stomach contents composed primarily of fish and aquatic insect larvae. Much of the benthic macroinvertebrate food was apparently discharged from Lake Seminole (Wolfe, 1969).

Available evidence indicates that the skipjack herring is not anadromous although it is occasionally found in open sea water (Wolfe, 1969). It is known to adapt to entirely freshwater systems in mid-continent locations (Coker, 1930).

The skipjack herring has several characteristics which support the contention that it is not anadromous. It does not form a false annulus as does the sub-adult American shad upon re-entering freshwater. It maintains its piscivorous food habits as an adult, but the American and Alabama shad become filter feeders as adults. Skipjack herring continue to feed during the spawning run while Alabama and American shad do not. It also appears that the spawning of skipjack herring may continue for a period of a couple of months while the anadromous species spawn within a short period of time following the occurrence of an appropriate threshold temperature.

#### 4.5.4 Southern Sea Sturgeon (Acipenser oxyrhynchus desotoi)

Two sturgeon species are found in Florida. These are the Atlantic sturgeon (Acipenser oxyrhynchus oxyrhynchus), whose distribution occurs along the Atlantic coast from Labrador to Jacksonville, and the southern sea sturgeon (A. oxyrhynchus desotoi), which occur from the northern Gulf of Mexico and west coast of Florida to French Guiana (Briggs, 1958). The separation of the two species is maintained by the projection of peninsular Florida into the thermal barrier of the Gulf Stream (Huff, 1975).

Yerger (1974) considers the southern sea sturgeon to be a rare species in the Apalachicola River. It is a slow growing and long lived fish. Specimens taken from the Suwannee River from four to 25 years of age measured from 69.8 cm (27.5 in.) to 188 cm (74 in.). Their weight ranged from 6.8 kg to 72.6 kg (15-160 lbs.) (Huff, 1975). The largest known specimen taken from the Apalachicola-Flint River drainage in Georgia weighed approximately 420 lbs. (Yerger, 1974).

Huff (1975) conducted a study of the southern sea sturgeon in the Suwannee River, Florida and collected 301 male and 331 female adult and juvenile sturgeon during pre-spawning (March to early May) and post-spawning (October to December) migrations of 1972 and 1973. These species ranged from 38-188 cm FL (fork length). Age groups four to 17 were continuously represented, although older age groups through approximately age 42 were represented. Ages one through five were represented in supplementary trammel net collections. Huff found that sturgeon began entering the fishery at ages four and five and were significantly exploited by age six. Annual survivorship was 53.7% from ages eight through 12.

Huff (1975) reported that mature active females ranged in age from eight to 17 years and active males from seven to 21 years. A ripe female was aged at approximately 31 years and a regressing female at approximately 42 years. Approximately 72.5% of collected females were immature. Active gonads were considered the criterion of sexual maturity. Spawning may be delayed by several years because behavioral and hormonal development may not be sufficient to elicit spawning. However, microscopic evaluation of gonad material indicated patterns of extended sexual development typical of other *Acipenser* species.

No spent males were encountered by Huff in 1973, although a 13 year old spent male was collected in the fall of 1972. No overall male migration pattern was indicated in weekly mean fork lengths.

Both males and females displayed a higher mean FL in spring pre-spawning migrations than in fall post-spawning migrations. Male mean FL's were almost identical between like seasons of 1972-73, which indicates possible homogeneous seasonal size composition. Females did not display this characteristic which may reflect a heterogeneous seasonal size composition caused by the greater length and longevity of females (Huff, 1975).

Huff also reported that sex ratios were significantly different between pre- and post-spawning migrations. Females were heavily represented during pre-spawning migrations. The heterogeneity of sex ratios between contrasting spawning runs in spring vs. fall and homogeneity of sex

ratios between like seasons of 1972-73 were considered strong evidence that sturgeon chose different migration routes according to sex and direction of in-river movement. Larger females apparently sought shallow water when migrating upstream and deep water when migrating downstream. Therefore, sex ratios of gill net landings would be affected by this characteristic.

Southern sea sturgeon spawn over hard bottoms and running water in pools below waterfalls (Huff, 1975). The spawning grounds are not definitely known, but are thought to be in deeper channels of the river or in major arms and lakes connecting with the river (Yerger, 1974). Fathometer tracings recorded by Huff during the spring flooding of the Suwannee River in 1973 revealed suitable bottom and conditions existing in many areas between Ellaville and White Springs, Florida. These anadromous fish ascend the major rivers during their spring spawning migration (March to June), spawn, and return to salt-water in the fall (post-spawning migration) (Yerger, 1974).

Hardness and water temperatures were determined for the Suwannee River between May and July, 1972. Surface water temperatures and bottom temperatures ranged from 23.0-28.5°C. Surface and bottom temperatures, with one exception, never varied more than 0.5°C (Huff, 1975).

Huff (1975) was unsuccessful in capturing sturgeon eggs and larvae. Yerger (1974) also reported that no eggs or larvae have been collected in Gulf Coast waters, however, juveniles less than one year old,

265 mm long and 80 g in weight, have been collected over tidal sand bars near river mouths. Huff had hoped that the plankton nets placed close enough to spawning sites would capture short-term free-floating eggs before they became attached to the substrate. The eggs apparently have sufficient specific gravity for them to remain relatively unaffected by swift river currents and therefore are not collected by plankton nets. Huff suggested that perhaps larval and juvenile sturgeon remain closely associated with deep bottom habitat and never rise sufficiently in the water column to become susceptible to capture. Although one meter bottom plankton nets failed to collect eggs and larvae, field observation, interviews, and suitable bottom characteristics suggest spawning areas from Ellaville upstream to White Springs and possibly farther, depending on river height (Huff, 1975).

Sturgeon eggs are large (2.6-3.0 mm diam.), demersal and adhesive. Vladykov reported that an external egg membrane absorbs water and become sticky within one hour after spawning (Huff, 1975).

During spring 1973, 106 juvenile sturgeon ranging in age from less than one to five years were captured in a drifted trammel net. Gonads were too small and were not collected from 55 of these specimens. Five gonads of 51 (9.8%) removed for histological examination were undifferentiated. Twenty (39.2%) were male and 26 (51.0%) were female. Sexes began to differentiate at approximately 500 to 700 mm FL. Differentiation generally occurred at ages two, three and four. No undifferentiated

age five sturgeon were found in either trammel or gill netted collections; however, six gill netted females, ages six to eight (800-1119 mm FL) contained all oogonia with no stage I and II oocytes (Huff, 1975).

Miscellaneous observations, interviews, and collections by Huff (1975) indicate that common sturgeon may begin anadromous migrations as yearlings. Vladykov speculated that sturgeon fry "gradually move to the estuaries and eventually to the sea" (Huff, 1975).

The food of juvenile sturgeon consists mostly of estuarine isopods, while adults consume large quantities of vegetable matter and small invertebrates (Yerger, 1974). The stomach of sturgeon gill netted in East Pass of the Suwannee River contained partially digested, fibrous dark green vegetable material, interspersed with occasional crab hard parts. Most post-spawning migrants had no crab parts. Opportunistic feeding is indicated. Data reveal that post-spawning migrants spend little time feeding in the tidally influenced lower river. Stomach contents were similar among trammel netted juveniles. They fed almost exclusively upon gammaridean amphipods (Family: Haustoriidae). Other food, less than approximately 5% by weight, found in randomly preserved stomachs included isopods (Cyathura burbancia), midge larvae, mud shrimp - probably Callinassa sp., an eel (Moringua sp.) and some unidentifiable tubular animal or vegetable matter (Huff, 1975).

Sturgeon fishing seasons have historically varied among areas. The early

Suwannee River fishery was February 1 - May 1, which obviously excluded exploitation of fall migrations. Sturgeon fishing in Apalachicola Bay and River was from mid-April to the end of June, also excluding exploitation of post-spawning migrations. Sturgeon in this river migrated more than 200 miles (322 km) upstream, but were only netted in the first 30 river miles (48 km). In spring, 1957, Jim Woodruff Dam was completed across Apalachicola River at the Georgia-Florida state line (Huff, 1975). The majority of specimens taken recently in the Apalachicola came from just below the Jim Woodruff Dam. Others have been taken at several localities near Blountstown, Bristol, and Brothers River (Yerger, 1974). A hook and line sport fishery developed at the base of the Jim Woodruff Dam beginning in August, 1962. This fishing was conducted from April through June and August through September (Huff, 1975).

Harkness and Dymond (1961) studied the lake sturgeon (Acipenser fulvescens). They found that lake sturgeon were shallow water fish. Most occurred in water less than 80 feet deep and a majority within this zone were collected in water less than 15 feet in depth. This pattern was associated with their food habits which require extensive areas of mud or gravel bottom.

The food of the lake sturgeon was composed primarily of benthic macro-invertebrates. Mollusks of less than half an inch in length were common as were mayflies and chironomids. Crayfish and small bottom feeding fish were found in some stomachs. Food selection is apparently based

on feel rather than sight or smell and appears to be relatively non-selective. Ingestion is by suction with debris ejected through the mouth and gills (Harkness and Dymond, 1961).

A relatively small percentage of sexually mature females spawn in any one year. A given female may spawn only at four to seven year intervals. Males arrive at the spawning area prior to the females. Optimum temperatures for spawning appear to be 57-60°F (13.9-15.5°C). Spawning occurs in swift current below structures restricting further upstream movement. Apparently the spawning activity is easily disturbed and a disturbance results in a failure to spawn (Harkness and Dymond, 1961).

The number of eggs per fish ranges from 50,000 to 667,000 or from 4,300 to 6,000 eggs per pound of fish. The eggs are heavier than water, adhesive and attach to underwater structures (Harkness and Dymond, 1961).

#### 4.5.5 Striped Bass (Morone saxatilis)

Striped bass are found in freshwater streams and estuarine waters of all major drainages of northwest Florida. No substantial fishery for them exists in any Florida Gulf Coast drainage except the Apalachicola River (Barkuloo, 1958). McErlean (1961) reviewed the literature on striped bass.

Fertilized eggs of the striped bass die rapidly when temperatures exceed 72°F (22.2°C) or fall below 54°F (12.2°C). Natural spawning occurs only in flowing water at temperatures of 58-71°F (14.4-21.6°C).

Spawning occurs in the Apalachicola River during March and April and may extend into May during some years. Fertilized eggs must remain suspended by currents during the period of incubation which is approximately 44 hours at 65°F (18.3°C), 33 hours at 70°F (21.1°C), and 70 hours at 60°F (15.5°C). The number of eggs per female ranges from 14,000 for a three pound female to 4.5 million for a 46 pound fish (Barkuloo, 1967). The larvae become fry at five to seven days after hatching (Barkuloo, 1970).

Fishing success for striped bass in the Apalachicola River has a fall peak (September - December) and a spring peak (March - May). Most catches are in the immediate vicinity of Jim Woodruff Dam (Barkuloo, 1961).

Albrecht (1964) performed controlled studies on survival of striped bass eggs in California. He found that suspension of the eggs was essential to their survival and that hatching successfully occurred within a temperature range of 55-75°F (12.8-23.9°C) with 97 percent hatching of eggs incubated at 67-69°F (19.4-20.5°C).

Larval mortality occurred sooner at higher temperatures which was probably due to a higher yolk absorption rate at the higher temperature. Yolk absorption at 72 hours for larvae reared at 75°F (23.9°C) was nearly comparable to yolk absorption in larvae reared at 62-64°F

(16.6-17.8°) at 144 hours of development. Survival might be similar at these two temperatures if adequate food was available (Albrecht, 1964).

Albrecht (1964) observed that eggs were distributed at all collecting depths at various tidal velocities. At surface velocities of 0.6-0.9 fps, eggs were generally collected in larger numbers near the bottom. Distribution was more variable at higher velocities. Four consecutive large collections made at velocities exceeding 2.3 fps indicated eggs were more concentrated near the surface. The same pattern was observed in a collection made at 1.1 fps. This was thought to be due to recent spawning at or near the surface. The velocity required to insure egg suspension appeared to be about one fps.

Striped bass eggs normally require about two days to hatch. Therefore, at a one fps flow required to maintain the eggs in suspension, thirty miles of river are required for egg development (Albrecht, 1964).

The most comprehensive review of striped bass literature was performed by Raney (1952). The following document abstract is presented with included quotes of reviewed papers.

#### 4.5.6 Literature Review

Raney, Edward C. 1952. The Life History of the Striped Bass, *Morone saxatilis* (Walbaum). Bulletin of the Bingham Oceanographic Collection. Vol. 14, No. 1. pp. 5-97.

Striped bass reproduce in fresh or virtually fresh water from April to July. The number of eggs produced varies with size. A three pound female may produce 14,000 eggs, while nearly five million may be produced by a 50 pound specimen. Some females reach maturity at four years of age. More than half are mature at five years and virtually all are mature at six. Most males mature at two and all are mature at three years. Most males spawn at a length of ten inches or more and most females are mature at 17-18 inches. Spawning ground vary somewhat from riffles in turbulent areas to relatively quiet areas. Spawning may vary from early April in Alabama to June and early July in New Brunswick. Spawning occurs mostly when the water temperatures range from 58-70°F. At spawning, a single large female is surrounded by a few or many (up to 50) males. The eggs, deposited near the surface during the splashing which accompanies the so-called "rock fights", are spherical, non-adhesive, slightly heavier than freshwater, greenish in color, and contain an oil globule. Shortly after laying, they are about 1/16 inch in diameter. The incubation period varies with temperature, being about 48 hours at 64°F. In the Gulf of Mexico according to Pearson (1938:827), it is found in fresh or brackish coastal rivers west of Louisiana, but it is not known in saltwater. In recent years, a considerable sport fishery has taken striped bass weighing five to 40 pounds in the Coosa River at Wetumpka and in the Tallahassee River at Tallapoosa, Alabama, which are freshwater situations several hundred miles from the Gulf of Mexico.

The species needs a rather extensive spawning ground with some current and a nearby nursery area where food is abundant. In the east, the tidal mouths of the rivers entering Chesapeake Bay meet its requirements, and in California, the lowland section of the Sacramento and San Joaquin Rivers in the San Francisco Bay area provide good spawning and nursery areas.

The young and juveniles stay in rivers and in the brackish estuaries until nearly two years old. Jackson and Tiller (1952:12) pointed out that mature females do not necessarily spawn every season. The Roanoke River and Susquehanna River spawning sites indicate a liking for rock strewn areas. Spawning apparently takes place near the fall line which is characterized by rapids and strong currents. However, spawning does occur in other coastal rivers, such as the Chickahominy River, Virginia in the absence of any pronounced rapids such as those found in most southeastern rivers.

Tresselt (1952) made a thorough study of spawning grounds in Virginia, tributary to the Chesapeake. He took eggs and plankton nets during April and May and concluded that spawning activity occurs mostly within the first 25 miles of freshwater in this region. In Maryland, Vladykov and Wallace (1952) gave the spawning grounds as the upper tide water reaches of freshwater rivers. The bottom is usually sand or mud and the current 2-1/2 to 3 mph.

#### Time of Spawning

In the Alabama River near Montgomery, a female with ripe eggs was taken on April 7, 1883 (Pearson, 1938:829). In the Gulf of Mexico area, Bigelow and Welsh (1925:256) stated that June is the height of the season. He quotes Woodhull (1947:99) as stating that striped bass during the spawning season appear at the surface and splash about in the so-called "rock fights". The temperature of the water was 67°F, turbid, and visibility limited about 15 inches. He observed what appeared to be isolated females at the surface, swimming about slowly, with parts of the back and dorsal fin above water. Occasionally, when joined by other large fish they sounded. Later, groups of five to 30 bass appeared at the surface. Each milled about for a few moments, then headed up or downstream, the fish rolling over on their sides at about a 45° angle, splashing water in all directions with their caudal fins. These groups remained at the surface for several minutes and the various groups indulged in this activity for a distance of about three miles along the river, mainly in the shallower portions, although a few were seen over deep water. Judging from their actions and from the positions of their bodies they were undoubtedly spawning and it was easy to approach within several feet of them. A no. 6 plankton net was hauled through a group of these spawning fish. The eggs taken were not water hardened, an indication that they were freshly laid. Their mean diameter was 1.78 mm, about 1/16 inch. A nearby observer reported that the bass were splashing all night. A few groups were observed the next morning, still spawning, and splashing continued until about noon. High winds and rough waters made further observations impossible. No spawning bass were taken by the many anglers present and trying to catch them by every possible means. However, a group of anglers close by obtained 42 males, all with flowing milk. Morgan and Gerlach (1950:13) described spawning of bass in the Coos River, Oregon. The peak of activity continuing for one or two days. Spawning occurred throughout the day, but it appeared to be most common in the late afternoon and early evening, especially on the flood tide. Males greatly outnumbered females. During the act of spawning, a group of only three or four bass, or many times that number, milled around in a circle at which time they splashed for about a minute and threw water as much as four or five feet into the air. Shortly after this they submerged abruptly. They could be observed close at hand. Shad were found to be spawning at the same time.

#### Location of the Eggs After Spawning

In plankton net hauls made the day after spawning observed in California, Woodhull (1947:101) found developing eggs at water depths of 15-35 feet, but generally they were taken within five feet of the river bottom. In Virginia, Tresselt (1952) found more eggs at the surface and set plankton nets, but he also took them in numbers on the bottom. Because of their semi-bouyant nature, the eggs are undoubtedly swept downstream rather rapidly in places where the current is swift. Merriman (1941) pointed out that hatching may not take place until the eggs are close to the mouth of the Roanoke River or even in Albermarle Sound.

#### Description of Eggs and Incubation Period

Pearson (1938:831) described the striped bass egg immediately after fertilization as spherical, nonadhesive, and 1.28-1.36 mm in diameter. It is slightly heavier than freshwater and sinks in perfectly quiet

water; however, only a slight movement of the water keeps the eggs off the bottom. Woodhull (1947) found that freshly laid eggs in California, which were not yet water hardened, had a mean diameter of 1.78 mm (1/16 inch). The incubation period (Pearson, 1938:831) is 48 hours at a temperature averaging 64.2°F. Bigelow and Welsh (1925) gave 74 hours as the hatching time at a water temperature of 58°F, and 48 hours at 67°F. Merriman (1941) gave about 30 hours at 71-72°F and 70-74 hours at 58-60°F.

#### Larvae and Postlarvae

Pearson (1938) described the newly hatched larvae as 2.5 mm long with an oval yolk sac. At 60 hours the larvae measure 3.2 mm in length and the oil globule in the interior end of the yolk sac projects beyond the head. At this time, the larvae sink to the bottom of still water despite their best swimming efforts, but a strong current keeps the larvae suspended and in more or less constant motion. It is soon after this stage that they are liberated in the rivers from the hatchery at Weldon, North Carolina. At 84 hours they are 4.4 mm long and the head extends beyond the oil globule of the yolk sac. At 120 hours they are 5.2 mm long, at 144 5.8 mm, and 192 hours, 6 mm. If food is not available, the larvae begin to die at a length of 6 mm. Otherwise they reach a post-larval stage at 240 hours after fertilization at 9 mm. Leim (1924) took larval striped bass in plankton tows during the summers of 1922 and 1923 near the head of the tidal zone in the Shubenacadie River, Nova Scotia. Calhoun and Woodhull (1948) noted a close correlation between towing time and the number of fry caught. They assumed that the fry were rather evenly distributed horizontally. On the other hand, the vertical distribution was highly variable.

#### Young

When 3-4 weeks old and 36 mm (1.4 inches) long, young striped bass are shaped like the adult, have scales and have fully developed fins and fin rays. When they are 130 mm (5.1 inches) long and about one year old, they have 6-8 dark lateral stripes as well as seven fainter vertical dark bars along the sides.

Young taken by the New York Conservation Department Biological Survey (Curran and Ries, 1937) found the fish in considerable numbers from Newburgh to Yonkers where they seemed to prefer gravelly beaches, although a few were found over other types of bottom. At night they were associated with river herring and white perch, but in day seine hauls shad usually replaced the herring. Young of white perch and striped bass were practically always caught together. The Hudson River water at this point has a low salinity, approximately 10.0 - 8,560 ppm.

#### Food of Young Striped Bass

Scofield and Coleman (1910) studied the stomach contents of 50 young striped bass taken in Napa Creek on September 10, 1908. Marine worms comprised 50% of the food, marine crustaceans 48%, and small fishes only 2%. The young shrimp and fishes were taken from stomachs of young bass 3-4 inches in length, and the other small crustaceans were found in stomachs of specimens three inches and under.

In the Hudson River, New York, Curran and Ries (1937) and Townes (1937) found that 117 young and a few yearling striped bass ranging from three to 11 cm in length, with the majority between three and five cm, were feeding mostly on freshwater shrimp (*Gammarus*) which formed about 60% of the food. Diptera (chironomid) larvae were the next most important item. The remains of small fishes and plankton crustaceans formed a small percentage of the food.

Merriman (1941) noted that 19 out of 30 juvenile and yearling striped bass from 11 to 23 cm long, taken in the Delaware River near Pennsville, New Jersey on November 8, 1937, contained remains of fishes. A herring-like fish, probably menhaden, formed the main diet and white perch and spottail shiners were also commonly eaten. He pointed out that small striped bass often eat rather large prey, for in this sample a 6-1/2 inch bass swallowed a three inch perch, while a 7-1/4 inch bass had eaten a four inch minnow, *Notropis*.

#### Food of Large Striped Bass of the Atlantic Coast

Merriman (1937a, 1941) examined the stomach contents of 550 striped bass ranging in size from 6.5 to 115 cm, of which 52% were empty. Over 75% of the stomachs were from striped bass that ranged in size from 30-50 cm. His conclusions regarding the feeding habits were as follows: the rugose lining of the stomach of the striped bass probably indicate a rapid rate of digestion. The fish is not a steady feeder, since it may gorge itself in a comparatively short time and stop feeding until its stomach is completely empty again. There is evidence that members of a single striped bass school feed simultaneously and digest the food over essentially the same period of time. Often a high percentage of bass in one seine hauls was filled with freshly eaten fish such as menhaden or silversides, while the stomach contents of bass taken in a later haul were partially or well digested. At other times, most of the fish taken were entirely empty. An examination of the contents of specimens larger than 25 cm confirmed the commonly held view that this species is voracious and has a fairly general choice of food. It is also noteworthy that bass often take food from the bottom.

Hollis (1952) made a detailed analysis of the food of striped bass from Chesapeake Bay. By weight, fish comprise 95.5% of the food of striped bass. Twenty-six different kinds of fish were eaten by striped bass, with anchovy, menhaden, spot and croaker being taken most often. Crustacea constituted the next most important category or organisms; they varied from 0 to 46.3% by occurrence, but by weight they occupied less than 2% of the total.

Seasonal and regional variations in food habits were noted. In freshwater, especially below Conowingo Dam, the black crappie, yellow perch, spottail shiner, blacknose dace, and bullhead were often present, as was also *Leptodora*, a crustacean usually found in lakes. Hollis found no striped bass feeding on its own young, although great numbers of young striped bass were present.

The striking difference between the results of Merriman and Hollis were that Hollis found only seven silversides (*Menidia*) in five stomachs of the 955 that contained food, although the silverside is a common fish in Chesapeake Bay. These facts seem to indicate that bass will feed on the silverside but that they prefer anchovy when it is present in abundance. In Chesapeake Bay, top minnows are exceedingly abundant but seldom eaten, whereas in Connecticut, they were the third most common fish consumed.

In Chesapeake Bay, stomach analyses indicate that there is a tendency toward cessation of feeding from mid-May to June, which corresponds with the spawning period for this species in this area; this is in accord with the findings of Woodhull (1947) in California.

It is thought that striped bass follow and feed on schools of fishes. It is true that their most important food as determined by stomach analyses is gregarious forms. The amount of feeding varies with time of day and with the season. Bass are known to feed avidly in the evening just after dark and sometimes they also feed well just before dawn. Young bass feed largely on the bottom on crustaceans and other small invertebrates. It is during the latter part of their second summer that they begin to school more extensively and then feed more heavily on schooling fishes.

#### 4.5.7 Other Species

Detailed consideration of other species is not believed to be warranted. Largemouth bass, the various sunfish species, and catfish spawn in nests in relatively quiet or slow flowing areas. Their young generally remain in such areas and a portion of the adult population may occur in the river channel. However, impingement of adults of these species is not generally recognized to be a problem.

## 5.0 SCHOLZ ELECTRIC GENERATING CENTER

### 5.1 Nameplate Description

The Scholz Electric Generating Center is located on the western bank of the Apalachicola River approximately 3.6 miles below the Jim Woodruff Lock and Dam and 2.3 miles south of U. S. Highway 90. (Figure 5-1). The Scholz Center consists of two electrical generating units with turbine nameplate ratings of 40 MWe for each. Both units use coal as their primary fuel source.

### 5.2 Cooling System

#### 5.2.1 General

The cooling function of the steam condenser cooling water at the Scholz Center consists of a once-through (non-recirculating) system. Water is withdrawn from the Apalachicola River through the cooling water intake structure, used for cooling purposes and directly discharged back into the river. Due to the small size of the Center (80 MWe), only a maximum of 191.54 cfs flowing through the intake structure is required for cooling purposes.

#### 5.2.2 Intake and Discharge Description

The intake and discharge system consists of an intake and discharge canal cut from the river channel through the floodplain to the bluff occupied by the Generating Center (Figure 5-2). The intake canal is angled slightly upstream. The discharge canal is angled downstream. Flow exiting the discharge canal into the river appears to hug the west bank and mix rapidly with the river water.

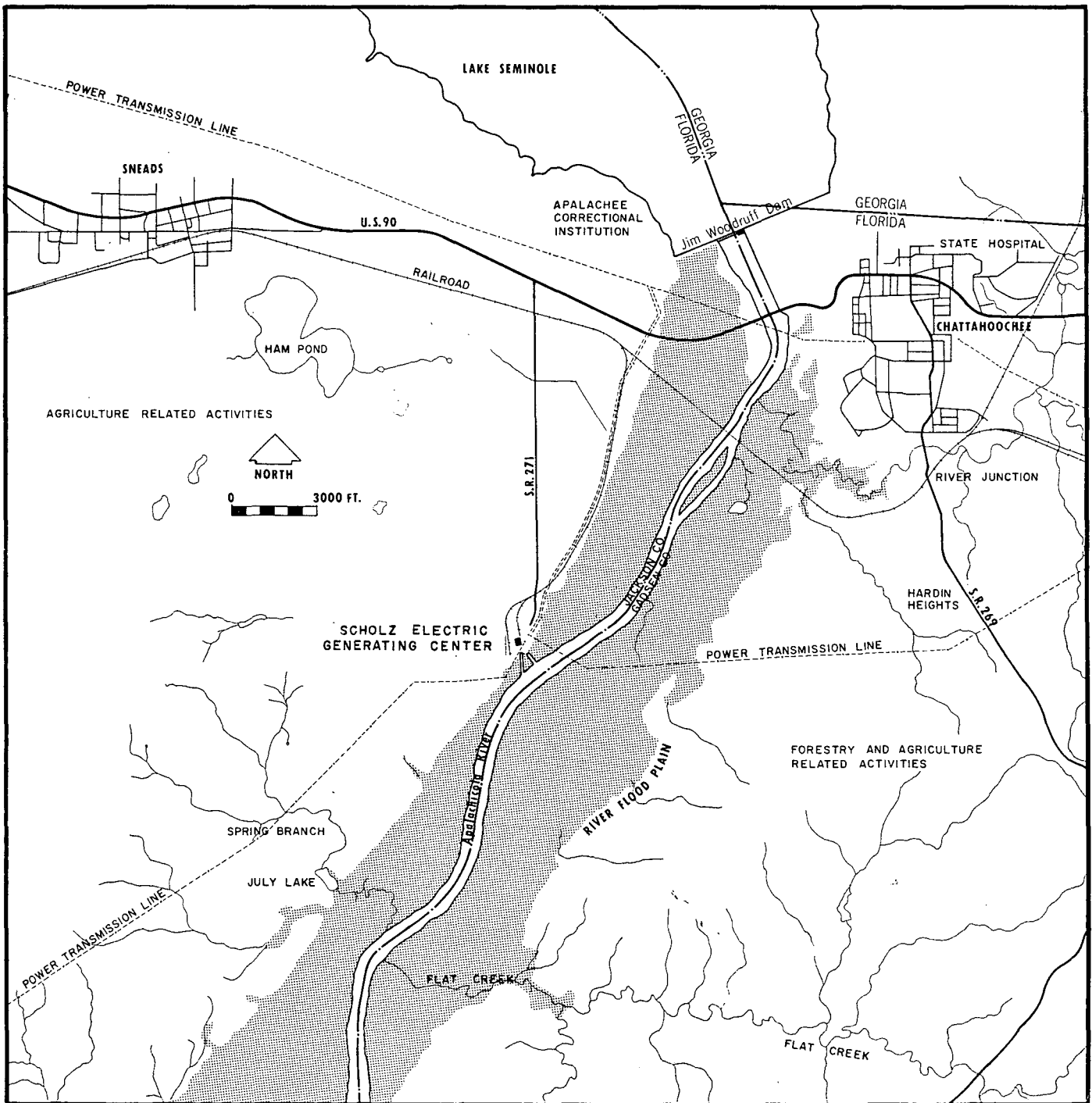


Figure 5-1 General Vicinity Map for the Gulf Power Company Scholz Electric Generating Center, Sneads, Florida.

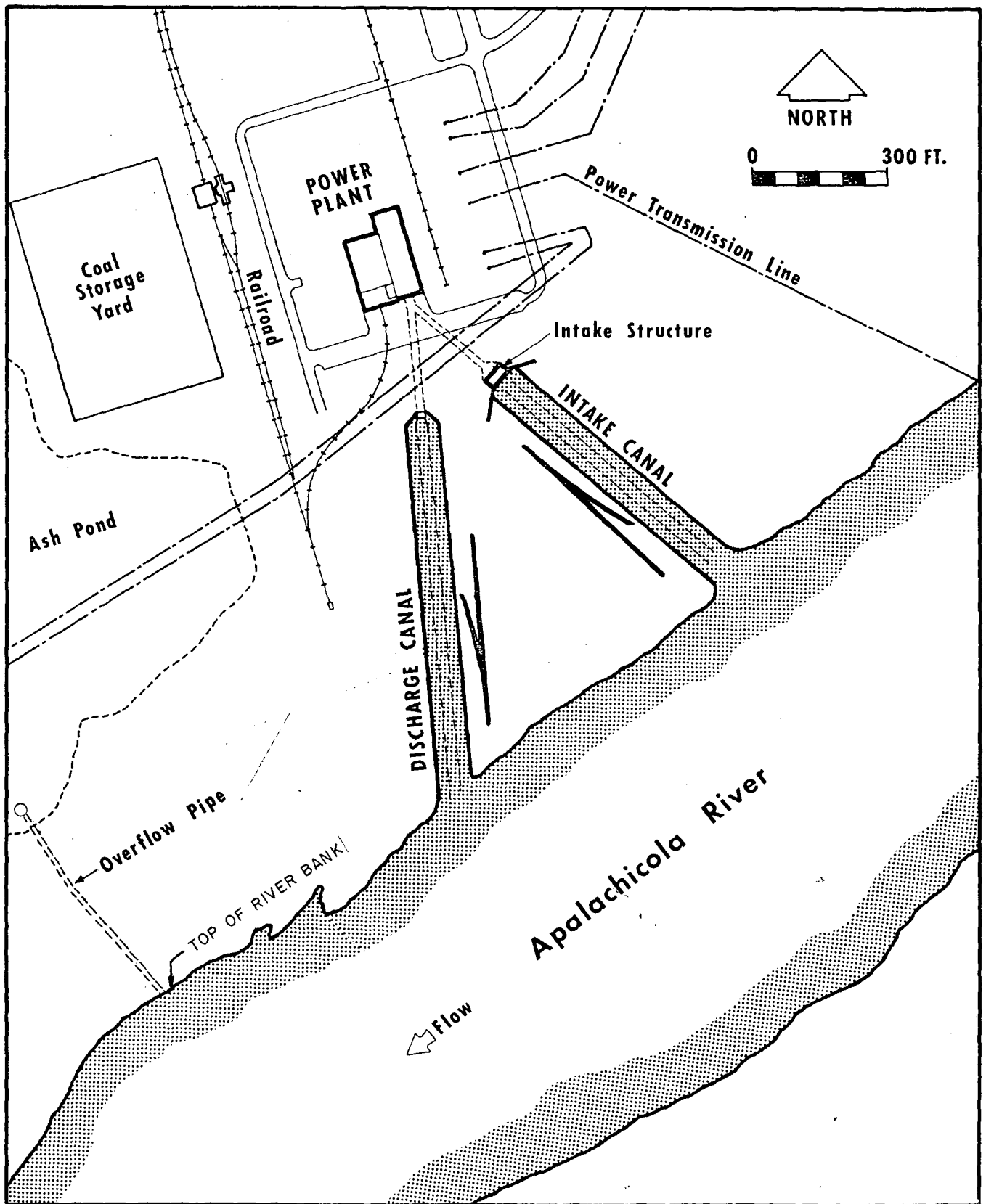


Figure 5-2 Relationship of the Intake and Discharge Structures, the Apalachicola River, and the Scholz Electric Generating Center.

River water flows through a 700 foot canal (Figure 5-3) to the intake structure (Figure 5-4). Four pumps operate continuously taking water from the intake structure when both units are on line. The design pumping rate is 86,000 gpm (191.54 cfs) with four pumps in operation. The intake canal cross-section is trapezoidal with 2.5:1 slopes and a bottom width of approximately 200 feet at an elevation of 3.5 feet MSL. The canal extends into the river channel and was cut slightly deeper than the river channel depth (Figure 5-3).

### 5.2.3 The Relationship of River Flow and Intake Canal Velocities

#### 5.2.3.1 Correlation of River Discharge and Scholz Center Intake Water Level

Water surface elevation decreases as river flow decreases.

This results in a decreased water cross-section in the intake canal and a consequent increase in intake channel velocity if a constant pumping rate 86,000 gpm (191.54 cfs) is maintained.

The relationship between Apalachicola River discharge, gage height, and gage elevation are known (Table 5-1), as are the Scholz Center intake canal dimensions and elevation (Figure 5-3). Intake canal water level was estimated assuming: 1) the river discharge to gage height relationship at the U. S. 90 bridge (Station # 02358000)(U.S.G.S., personal communication) is valid at the Scholz Center intake, 2) the river slopes 0.45 feet per mile (480.08 feet @ 21000 cfs/107 mi.=0.45 ft./mi.), and 3) the U. S. 90 to the Scholz Center distance is 2.3 miles.

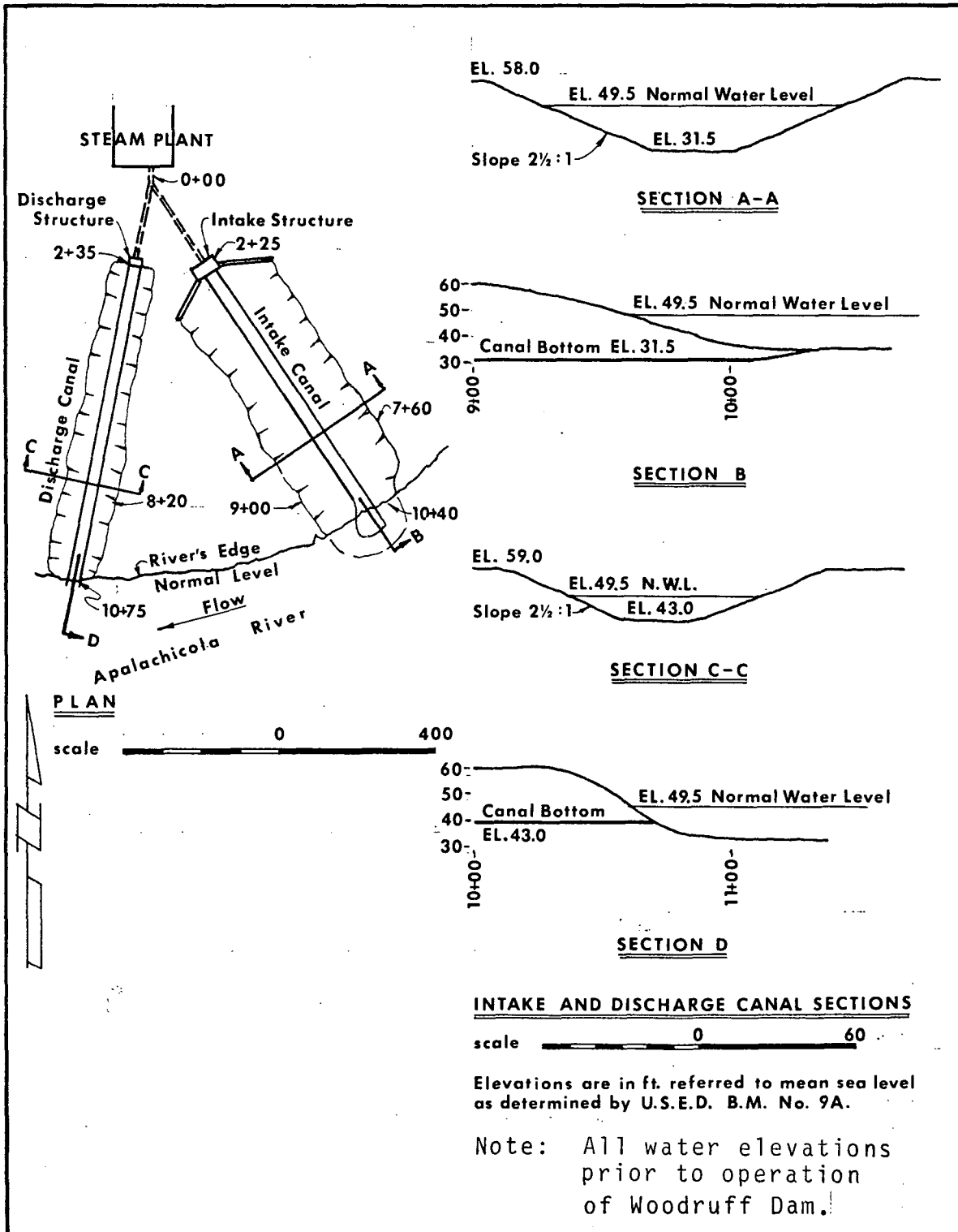


Figure 5-3 Dimensions of the Intake and Discharge Canals at the Gulf Power Company Scholz Electric Generating Center, Sneads, Florida.

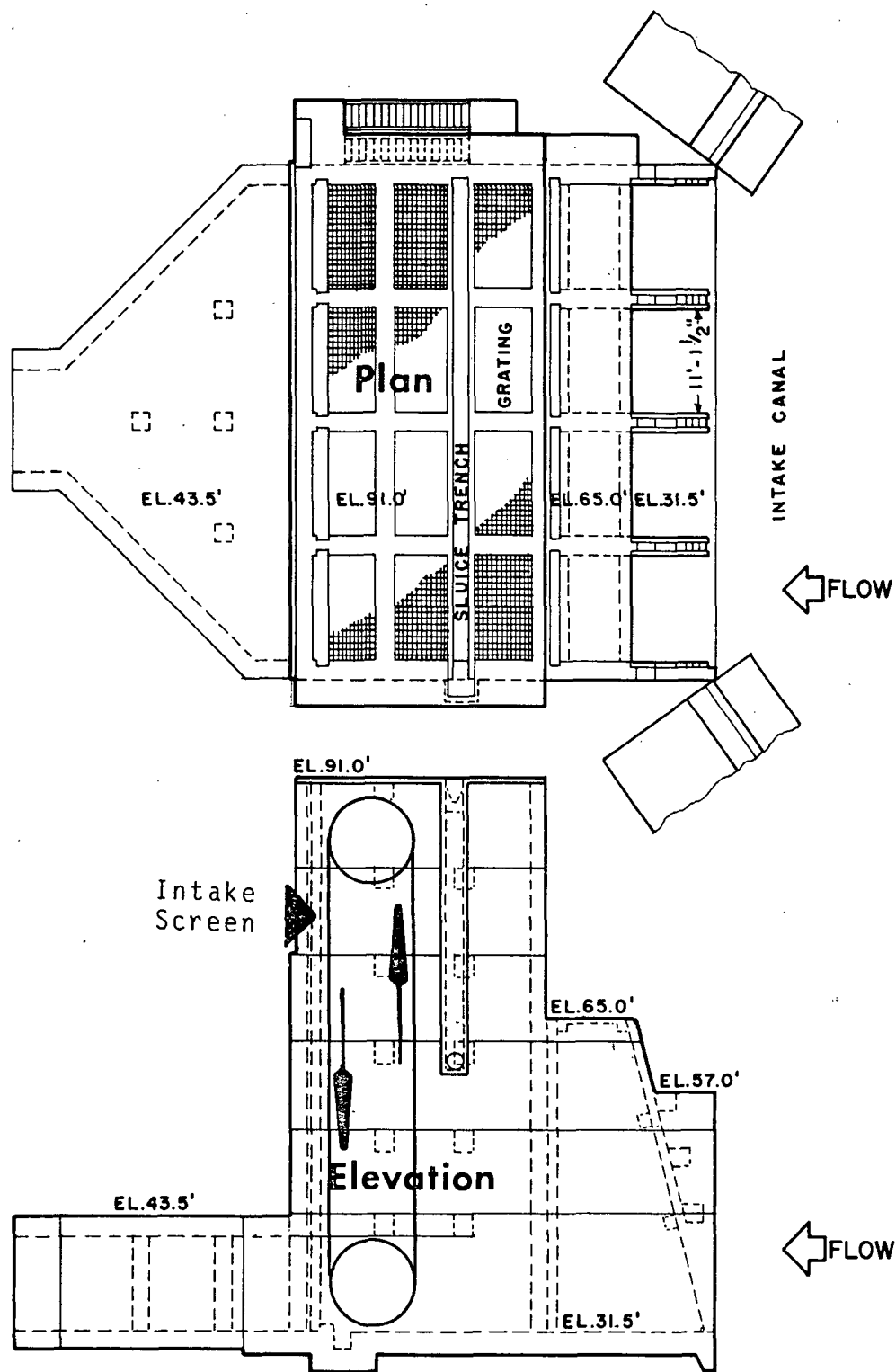


Figure 5-4 Intake Structure at the Gulf Power Company Scholz Electric Generating Center, Sneads, Florida.

Table 5-1 Estimated Gage Height at the Scholz Electric Generating Center Intake for a Range of Discharge Volumes.

| U.S. 90<br>Gage<br>Height<br>(feet) | Dis-<br>charge<br>(cfs) | Scholz<br>Intake<br>Level<br>(ft. MSL) | U.S. 90<br>Gage<br>Height<br>(feet) | Dis-<br>charge<br>(cfs) | Scholz<br>Intake<br>Level<br>(ft. MSL) |
|-------------------------------------|-------------------------|----------------------------------------|-------------------------------------|-------------------------|----------------------------------------|
| 0.00                                |                         | 39.23                                  | 4.40                                | 13260                   | 43.63                                  |
| 0.10                                |                         | 39.33                                  | 4.50                                | 13500                   | 43.73                                  |
| 0.20                                |                         | 39.43                                  | 4.60                                | 13740                   | 43.83                                  |
| 0.30                                | 6520                    | 39.53                                  | 4.70                                | 13980                   | 43.93                                  |
| 0.40                                | 6660                    | 39.63                                  | 4.80                                | 14220                   | 44.03                                  |
| 0.50                                | 6800                    | 39.73                                  | 4.90                                | 14460                   | 44.13                                  |
| 0.60                                | 6940                    | 39.83                                  | 5.00                                | 14700                   | 44.23                                  |
| 0.70                                | 7080                    | 39.93                                  | 5.10                                | 14940                   | 44.33                                  |
| 0.80                                | 7220                    | 40.03                                  | 5.20                                | 15180                   | 44.43                                  |
| 0.90                                | 7360                    | 40.13                                  | 5.30                                | 15420                   | 44.53                                  |
| 1.00                                | 7500                    | 40.23                                  | 5.40                                | 15660                   | 44.63                                  |
| 1.10                                | 7640                    | 40.33                                  | 5.50                                | 15900                   | 44.73                                  |
| 1.20                                | 7780                    | 40.43                                  | 5.60                                | 16150                   | 44.83                                  |
| 1.30                                | 7920                    | 40.53                                  | 5.70                                | 16400                   | 44.93                                  |
| 1.40                                | 8060                    | 40.63                                  | 5.80                                | 16650                   | 45.03                                  |
| 1.50                                | 8200                    | 40.73                                  | 5.90                                | 16900                   | 45.13                                  |
| 1.60                                | 8350                    | 40.83                                  | 6.00                                | 17150                   | 45.23                                  |
| 1.70                                | 8500                    | 40.93                                  | 6.10                                | 17400                   | 45.33                                  |
| 1.80                                | 8660                    | 41.03                                  | 6.20                                | 17650                   | 45.43                                  |
| 1.90                                | 8820                    | 41.13                                  | 6.30                                | 17900                   | 45.53                                  |
| 2.00                                | 8920                    | 41.23                                  | 6.40                                | 18150                   | 45.63                                  |
| 2.10                                | 9140                    | 41.33                                  | 6.50                                | 18400                   | 45.73                                  |
| 2.20                                | 9300                    | 41.43                                  | 6.60                                | 18670                   | 45.83                                  |
| 2.30                                | 9460                    | 41.53                                  | 6.70                                | 18940                   | 45.93                                  |
| 2.40                                | 9620                    | 41.63                                  | 6.80                                | 19210                   | 46.03                                  |
| 2.50                                | 9780                    | 41.73                                  | 6.90                                | 19480                   | 46.13                                  |
| 2.60                                | 9940                    | 41.83                                  | 7.00                                | 19750                   | 46.23                                  |
| 2.70                                | 10100                   | 41.93                                  | 7.10                                | 20020                   | 46.33                                  |
| 2.80                                | 10260                   | 42.03                                  | 7.20                                | 20290                   | 46.43                                  |
| 2.90                                | 10430                   | 42.13                                  | 7.30                                | 20560                   | 46.53                                  |
| 3.00                                | 10600                   | 42.23                                  | 7.40                                | 20830                   | 46.63                                  |
| 3.10                                | 10770                   | 42.33                                  | 7.50                                | 21100                   | 46.73                                  |
| 3.20                                | 10940                   | 42.43                                  | 7.60                                | 21380                   | 46.83                                  |
| 3.30                                | 11120                   | 42.53                                  | 7.70                                | 21660                   | 46.93                                  |
| 3.40                                | 11300                   | 42.63                                  | 7.80                                | 21940                   | 47.03                                  |
| 3.50                                | 11480                   | 42.73                                  | 7.90                                | 22220                   | 47.13                                  |
| 3.60                                | 11660                   | 42.83                                  | 8.00                                | 22500                   | 47.23                                  |
| 3.70                                | 11840                   | 42.93                                  | 8.10                                | 22780                   | 47.33                                  |
| 3.80                                | 12020                   | 43.03                                  | 8.20                                | 23060                   | 47.43                                  |
| 3.90                                | 12200                   | 43.13                                  | 8.30                                | 23340                   | 47.53                                  |
| 4.00                                | 12380                   | 43.23                                  | 8.40                                | 23620                   | 47.63                                  |
| 4.10                                | 12570                   | 43.33                                  | 8.50                                | 23800                   | 47.73                                  |
| 4.20                                | 12780                   | 43.43                                  | 8.60                                | 24180                   | 47.83                                  |
| 4.30                                | 13020                   | 43.53                                  | 8.70                                | 24460                   | 47.93                                  |

Table 5-1 (Continued)

| U.S. 90<br>Gage<br>Height<br>(feet) | Dis-<br>charge<br>(cfs) | Scholz<br>Intake<br>Level<br>(ft. MSL) | U.S. 90<br>Gage<br>Height<br>(feet) | Dis-<br>charge<br>(cfs) | Scholz<br>Intake<br>Level<br>(ft. MSL) |
|-------------------------------------|-------------------------|----------------------------------------|-------------------------------------|-------------------------|----------------------------------------|
| 8.80                                | 24740                   | 48.03                                  | 11.50                               | 33100                   | 50.73                                  |
| 8.90                                | 25020                   | 48.13                                  | 11.60                               | 33420                   | 50.83                                  |
| 9.00                                | 25300                   | 48.23                                  | 11.70                               | 33740                   | 50.93                                  |
| 9.10                                | 25580                   | 48.33                                  | 11.80                               | 34060                   | 51.03                                  |
| 9.20                                | 25860                   | 48.43                                  | 11.90                               | 34380                   | 51.13                                  |
| 9.30                                | 26140                   | 48.53                                  | 12.00                               | 34700                   | 51.23                                  |
| 9.40                                | 26400                   | 48.63                                  | 12.10                               | 35020                   | 51.33                                  |
| 9.50                                | 26700                   | 48.73                                  | 12.20                               | 35340                   | 51.43                                  |
| 9.60                                | 27020                   | 48.83                                  | 12.30                               | 35660                   | 51.53                                  |
| 9.70                                | 27340                   | 48.93                                  | 12.40                               | 35980                   | 51.63                                  |
| 9.80                                | 27660                   | 49.03                                  | 12.50                               | 36300                   | 51.73                                  |
| 9.90                                | 27980                   | 49.13                                  | 12.60                               | 36650                   | 51.83                                  |
| 10.00                               | 28300                   | 49.23                                  | 12.70                               | 37000                   | 51.93                                  |
| 10.10                               | 28620                   | 49.33                                  | 12.80                               | 38050                   | 52.03                                  |
| 10.20                               | 28940                   | 49.43                                  | 12.90                               | 38400                   | 52.13                                  |
| 10.30                               | 29260                   | 49.53                                  | 13.00                               | 38750                   | 52.23                                  |
| 10.40                               | 29580                   | 49.63                                  | 13.10                               | 39100                   | 52.33                                  |
| 10.50                               | 29900                   | 49.73                                  | 13.20                               | 38750                   | 52.43                                  |
| 10.60                               | 30220                   | 49.83                                  | 13.30                               | 39100                   | 52.53                                  |
| 10.70                               | 30540                   | 49.93                                  | 13.40                               | 39450                   | 52.63                                  |
| 10.80                               | 30860                   | 50.03                                  | 13.50                               | 39800                   | 52.73                                  |
| 10.90                               | 31190                   | 50.13                                  | 13.60                               | 40150                   | 52.83                                  |
| 11.00                               | 31500                   | 50.23                                  | 13.70                               | 40500                   | 52.93                                  |
| 11.10                               | 31820                   | 50.33                                  | 13.80                               | 40850                   | 53.03                                  |
| 11.20                               | 32140                   | 50.43                                  | 13.90                               | 41200                   | 53.13                                  |
| 11.30                               | 32460                   | 50.53                                  |                                     |                         |                                        |
| 11.40                               | 32780                   | 50.63                                  |                                     |                         |                                        |

Therefore, the Scholz Center intake water surface elevation for a given discharge will be 1.55 feet below the U. S. 90 bridge elevation. The appropriate Scholz Center intake elevations were calculated based on the above plus the fact that the U. S. 90 bridge gage station at an annual mean flow of 21000 cfs is 48.08 feet MSL (U.S.G.S., personal communication). This corresponds to an estimated elevation of 46.73 feet at the Scholz Center.

#### 5.2.3.2 Calculation of Intake Canal and Through the Screen Flow Velocities

A plot of intake canal flow velocities versus river discharge was based on the intake canal cross-sectional area with various discharge volumes and a maximum use of cooling water (191.54 cfs)(Figure 5-5). Through the screen velocities are 2.5 times the intake channel velocity for a given discharge. Tables 4-1 and 4-2 show various mean discharges of the Apalachicola River since operation of the Woodruff Lock and Dam. Intake velocities associated with; 1) the mean annual discharge, 2) the thirty day lowest mean discharge, 3) the lowest thirty day mean discharge for the spawning season (Jan.-May), 4) the lowest thirty day mean discharge for larval and juvenile fish (June-Aug.) are plotted for comparison.

#### 5.2.4 Determination of Probable River Flow Characteristics

The lowest one-day mean flow of record in the Apalachicola River occurred in 1954, prior to the operation of the Woodruff Lock and Dam. Discharge on this date was 5010 cfs. Low discharges such as this would result in maximum intake and through the screen velocities and require a higher percentage of river flow withdrawal. However, it should be emphasized that since the reservoir and dam has been in use,

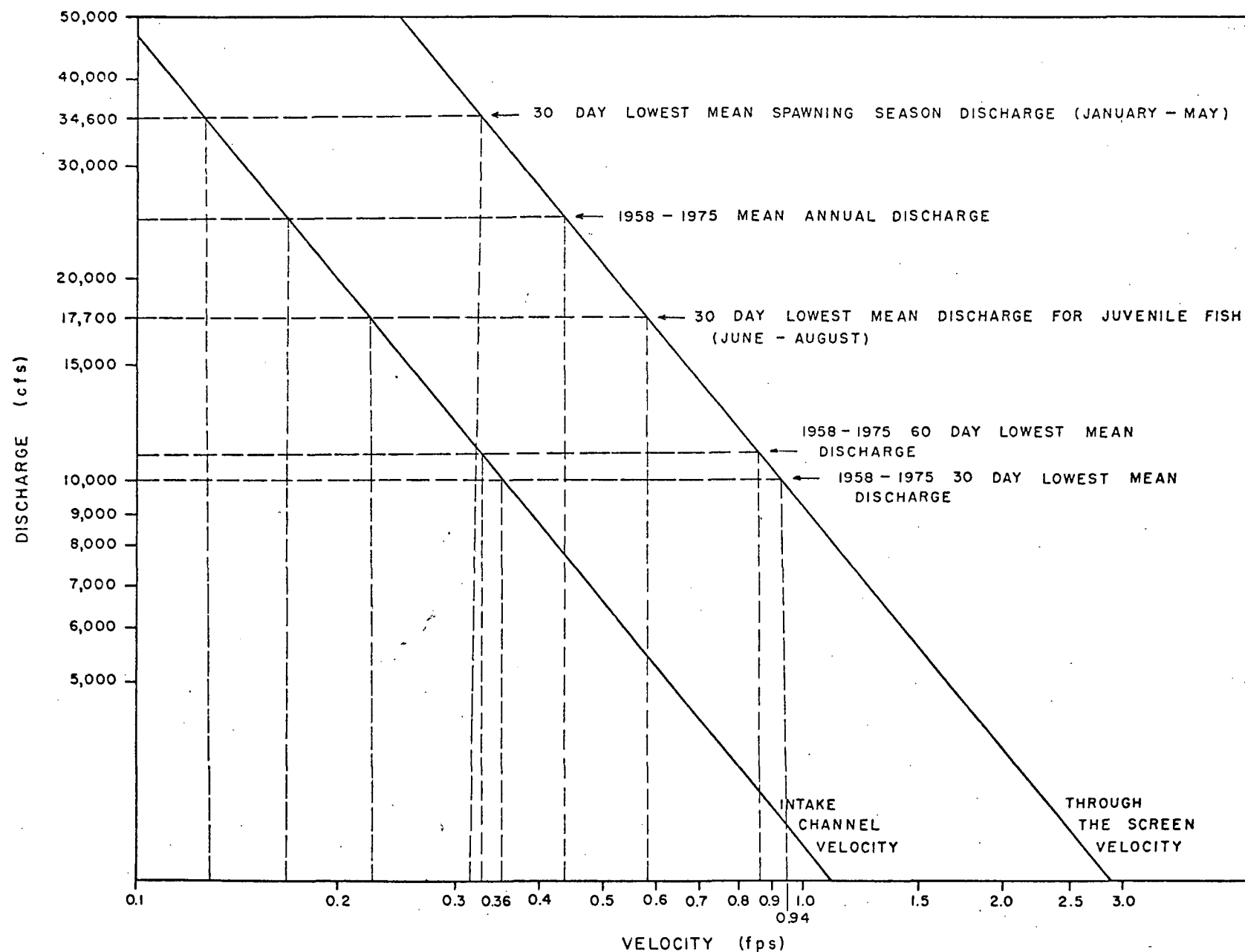


Figure 5-5 Scholz Electric Generating Center Intake Channel and Traveling Screen Flow Velocities Versus Apalachicola River Discharge.

discharges below the dam have become more stable. Peak discharges are less through flood control and low discharges are greater in order to achieve navigational purposes of the river.

The mean annual discharge was selected as one flow which would warrant analysis. Because it is an annual mean and natural system impacts are usually related to seasonal events, the figure is of interest primarily as a basis for general comparison with other figures.

The 1958-1975 30-day duration lowest mean discharge was selected as a realistically conservative basis for an impact analysis. It encompasses the period since initiation of operations of the Jim Woodruff Lock and Dam and therefore, is more indicative of future flow conditions than are the long-term values. However, this mean discharge incorporates discharges of the river during nonspawning seasons.

Spawning is a temperature dependent phenomenon occurring in the Apalachicola River over a relatively short period of time within the period January through May. It was assumed that most spawning would occur within a relatively short thirty-day period following the first occurrence of proper temperatures. Therefore, a thirty-day lowest mean discharge for the spawning period was considered to be a realistic basis for an analysis

of the impact of the Scholz Center intake system on anadromous fish in the river. Note that the thirty-day mean spawning season discharge is approximately 34,600 cfs which is greater than the mean annual discharge of 24,300 cfs (Tables 4-1 and 4-2). This is due to spawning occurring during that part of the year when river discharges are greatest.

Intake channel velocities for present river discharge characteristics range from approximately 0.15 fps to 0.3 fps. Intake channel velocities for the spawning period and juvenile fish period are less than 0.5 fps generally regarded as an acceptable velocity against which small fish would swim at a sustained rate. Water velocity through the screen ranged between 0.31 - 0.84 fps.

## 6.0 IMPACT ANALYSIS

### 6.1 General

The once-through cooling system influences the biological systems associated with the volume of water withdrawn. Two general classes of organisms may be identified as being associated with the withdrawal. Organisms which are passively transported by the current or which have no effective means of readily moving about constitute one group. These will be collectively referred to as planktonic. The other group, nekton, consists of organisms which are more mobile and generally can select and/or maintain a position in the river in spite of the current. Each group requires a different basis for evaluating the impact of center cooling water intake operations.

Planktonic organisms are effected at a rate dependent upon the percentage of river flow which passes through the intake cooling water system and upon factors which would preferentially concentrate organisms within the volume of cooling water withdrawn. These may include river flow characteristics, bathymetry and distribution of spawning habitat. This is entrainment loss.

Nektonic organisms have the ability to select areas for use or habitation; therefore, they are generally affected at a rate dependent on their distribution in the area and their successful avoidance of intake flows. This

is impingement loss. Current speed is a primary factor in determining whether escape is possible and an established threshold intake velocity of 0.15 m/sec (0.5 fps) has been stated to be an appropriate design criteria for most species (EPA, 1973).

The Apalachicola River has spawning runs of striped bass, Alabama shad, skipjack herring, and southern sea sturgeon. Each fish is known to spawn immediately below Jim Woodruff Lock and Dam located 3.6 miles above the Scholz Center. Upstream movement beyond this point is prevented by the lock and dam. Spawning of threadfin and gizzard shad (Dorosoma petenense, D. cepedianum) also occur in the area but no interest has been shown for developing a fishery in the region.

#### 6.2 Entrainment Impact

The percent of river discharge used for cooling water was calculated for a range of lowest monthly mean discharges (Table 4-2) for years following operation of the Woodruff Dam. In all areas, a maximum design intake pumping rate of 86,000 gpm (191.54 cfs) was used in the calculation. The maximum entrainment is assumed to occur when the river discharge is lowest and random distribution of planktonic organisms exists. At the mean lowest annual discharge (8900 cfs), 2.2 percent of the river discharge volume would pass through the condenser cooling water system (Table 4-1). The element of conservatism in evaluating the data is decreased by considering the spawning season flows which coincide with the period of highest monthly discharges. Lowest mean

one day duration discharges for the spawning season, January through May, ranged from 12,600 to 23,300 cfs and resulted in a corresponding passage of 0.8% to 1.1% of the river discharge through the cooling water intake. An average value for the whole spawning period indicates 1% of the river flowing through the intake system. Increasing the period of flow duration further decreases the percentage of river flow moving through the cooling system.

If 100% mortality of entrained eggs and larvae is assumed, then a worst case mortality estimate of 2.2% may be made. This level of mortality is not considered to be particularly significant. Natural egg mortality has been conservatively estimated at 90% (Southward and Demir, 1974) and the mortality of larvae and zero to one year old fish is assumed to be 99.79% (Pearcy, 1962; Stevenson, 1962) and 30% (Schaaf and Huntsman, 1972), respectively.

Assuming an average fecundity of 100,000 eggs per female, which is reasonable for all species considered, and the maximum egg and larvae mortality rates above, plus the assumed worst entrainment mortality of 2.2% of production, the number of adults would decrease from 21 to 20.53 survivors. At a one percent Generating Center induced mortality level which would be anticipated with one day duration lowest mean season spawning season discharges, 20.8 adult survivors should remain. These changes are not to be regarded as particularly significant.

If the distribution of eggs is other than random in the river cross-section, an assessment means which considers the particular distribution, its location in the river discharge cross-section, and the relationship of the intake and river flow must be considered.

Data are not available on distribution of eggs and larvae of the anadromous species in the upper Apalachicola River. However, each specie, except the sturgeon, has non-adhesive eggs which require a current in order to remain suspended in the water column. Wolfe (1969) collected skipjack herring eggs and larvae off a gravel bar on the eastern river shore below Woodruff Dam. However, the current is relatively swift and a relatively random distribution of the eggs probably occurs within a short distance downstream.

Sturgeon eggs are adhesive and demersal. They were not collected by Huff (1975) in the Suwannee River nor were fry collected. He felt they remained closely associated with the bottom and were not susceptible to capture by methods used in the study. Given the lack of information on sturgeon eggs and larvae, it is impossible to estimate the zone of egg adhesion. Bottom transport of these eggs may result in a higher percentage of eggs passing through the Scholz Center intake. This could occur since the intake is cut as deep as the river channel (Figure 5-3) and the channel at the Scholz Center follows the west bank containing the intake (FGFWFC, 1975). Subsequently, the possible concentration of eggs within a definable section of the river and the proximity of that section to the intake may result in increased egg mortality.

The counter position may be taken with equal or better justification. Bars characteristically develop at junctions of streams with the main channel. The lower velocity in the intake canal allows sedimentation of particulates to occur. This partial blockage would result in withdrawal of water from the upper part of the river. The sediment bar would prevent the near bottom water layer from passing through the intake and allow demersal eggs to pass downstream with relatively little opportunity for Generating Center related impacts to occur. After hatching, sturgeon fry seek shelter among bottom rocks and do not venture out to feed until the yolk sac is absorbed (Harkness and Dymond, 1961). Their close association with the bottom (Huff, 1975) would apparently limit the possibility of being passed through the cooling water intake. Therefore, a significant entrainment problem is not probable.

The Scholz Center is located 3.6 mi. downstream of Jim Woodruff Lock & Dam spawning area. Hatching eggs is temperature dependent. Striped bass eggs require a minimum of 33 hours incubation at 21.1°C (70°F) for hatching (Barkuloo, 1967). This is the upper temperature level at which striped bass spawning occurs and it may serve as a reasonable basis for estimating the point in the river at which larvae would be expected to occur from eggs released at the Woodruff Dam. The river flow has been estimated to be 1.66 mph at a discharge of 18,000 cfs.

Drogue tests during the spawning season in April, 1973, and at a flow of 96,000 cfs, indicated a flow of 4.0 mph (Florida State Board of Health, 1964). Under these conditions, eggs would be six miles downstream within 1.5 hours after spawning had occurred. Under the assumed shortest incubation time, a current speed of 0.1 mph would be required to place larvae at the Scholz Center from eggs spawned at Jim Woodruff Dam. Therefore, it would appear that entrainment at the Center would primarily involve fish eggs and, based on previous mortality estimated, it is not likely that the Generating Center cooling water intake induced mortality is significant.

### 6.3 Impingement Impact

The flow characteristics of the Scholz Center intake system for a range of anticipated and conservative river discharges was calculated and a summary graph developed.

The lowest mean one day duration discharge occurring since filling of the reservoir was 8900 cfs (Table 4-1) which resulted in intake cross-section and through-the-screen velocities of (0.43 fps) and approximately (1.0 fps), respectively (Figure 5-5). These intake and screen velocities are too conservative because low flows characteristically occur in this area during the fall when small anadromous fish have left the upper river or increased in size. Therefore, impingement at these discharges is unlikely because the presence of the small anadromous fish species and lowest flows do not coincide.

The 1958-1975 30-day duration lowest mean discharge of approximately 10,000 cfs results in intake channel and traveling screen velocities of 0.35 fps and slightly over 0.94 fps, respectively. The 30-day lowest mean discharge for June through August is approximately 17,700 cfs and results in intake channel and screen velocities of .22 and .56 fps (Figure 5-5). These estimates are a more realistic basis from which impingement impact may be assessed because they coincide with that season when larval and juvenile fish are present.

From an intake channel velocity of .35 fps for the 1958-1975 30-day duration lowest mean discharge, it is apparent that the EPA criteria of .5 fps in which fish can swim is not being exceeded. Center personnel operate the traveling screen infrequently because material does not accumulate on the screens. Impingement is neither recognized as a significant problem or known to occur at a level which has been noticed by Center personnel (personal communication, Scholz Center Manager.)

In spite of the long intake canal, the juncture of the intake at near a right angle with the river bank, its location at a point near the maximum channel depth, and the relatively fast current through the area would also tend to minimize impingement impact.

## 7.0 RESULTS AND CONCLUSIONS

Section 316(b) of the Federal Water Pollution Control Act requires a demonstration to show "that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact".

Pursuant to NPDES permit FL 000 2283, Gulf Power Company was required to provide such a demonstration for the Scholz Electric Generating Center. It was decided that due to the low volume of water being withdrawn from the Apalachicola River by the Scholz Center, an assessment and analysis of available data would show the impacts of cooling water intake structure operations.

Through the analysis of impacts (Section 6), it was shown that the 316(b) impacts associated with the operation of Scholz Electric Generating Center's cooling water intake structure are sufficiently insignificant that "the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife" in the Apalachicola River System will be assured.

## 8.0 BIBLIOGRAPHY

- Albrecht, Arnold B. 1964. Some Observations on Factors Associated With Survival of Striped Bass Eggs and Larvae. California Fish and Game. Vol. 50, No. 2. pp. 100-113.
- Barkuloo, James M. 1970. Taxonomic Status and Reproduction of Striped Bass (Morone saxatilis) in Florida. U.S.D.I. Bureau of Sport Fisheries and Wildlife. Technical Paper 44. 16 pp.
- Barkuloo, James M. Distribution and Abundance of Striped Bass (Roccus saxatilis, Walbaum) on the Florida Gulf Coast. Florida Game and Fresh Water Fish Commission, Panama City, Florida. 6 pp.
- Barkuloo, James M. 1967. Florida Striped Bass. Florida Game and Fresh Water Fish Commission. Dingell-Johnson Project F-10-R. Fishery Bulletin No. 4. 24 pp.
- Briggs, John C. 1958. A List of Florida Fishes and Their Distribution. Bulletin of the Florida State Museum. Vol. 2, No 8. University of Florida, Gainesville, Florida. pp. 223-318.
- Carr, A. 1976. University of Florida, Gainesville, Florida. Personal Communication.
- Coker, R.E. 1940. Studies of Common Fishes of the Mississippi River at Keokuk. Fisheries Bulletin of the U.S. Bureau of Fisheries. Vol. 45. pp. 142-225.
- Cooke, C. Wythe. 1945. Geology of Florida. Florida Geological Survey. Geological Bulletin No. 29. 339 pp.
- Florida Game and Fresh Water Fish Commission. 1967-1968. Annual Progress Report for Research Project as Required by Federal Aid in Fish Restoration Dingell-Johnson Project F-25-R-1 Stream Investigations. Segment Job Progress Reports Nos. I and II. 17 pp.
- Florida Game and Fresh Water Fish Commission. 1968-1969. Annual Progress Report for Research Project As Required by Federal Aid in Fish Restoration, Dingell-Johnson Project F-25-2, Stream Investigations. Upper Apalachicola River Study. Job Progress Reports Nos. I and II. 71 pp.
- Florida Game and Fresh Water Fish Commission. 1969-1970. Annual Progress Report for Research Project As Required by Federal Aid in Fish Restoration, Dingell-Johnson Project F-25-3, Stream Investigations. Upper Apalachicola River Study. Job Progress Reports Nos. I and II. 109 pp.

- Florida Game and Fresh Water Fish Commission. 1970-1971. Annual Progress Report for Research Project As Required by Federal Aid in Fish Restoration, Dingell-Johnson Project F-25-4, Stream Investigations. Upper Apalachicola River Study (Study I, Jobs 1 & 2); Upper Suwannee River Study (Study II, Jobs 1 & 2); and St. Johns River Study (Study III, Jobs 1, 2, 3, & 4). 209 pp.
- Florida Game and Fresh Water Fish Commission. 1972. Job Progress Report, Research Project Segment. Upper Apalachicola River Study (1 July 1971-20 June 1972). Stream Fish Population and Environmental Study. Project F-25-5. 22 pp.
- Florida Game and Fresh Water Fish Commission. 1972-1973. Annual Progress Report for Investigations Project as Required by Federal Aid in Fish Restoration, Dingell-Johnson Project F-25-6, Stream Investigations. Upper Apalachicola River Study (Study I, Job 1); St. Johns River Study (Study III, Job 3). 136 pp.
- Florida Game and Fresh Water Fish Commission. 1973. Job Progress Report, Research Project Segment. Upper Apalachicola River Study (1 July 1972-30 June 1973). Stream Fish Population and Environmental Study. Project No. F-25-6. 29 pp.
- Florida Game and Fresh Water Fish Commission. 1973-1974. Annual Progress Report for Investigations Project as Required by Federal Aid in Fish Restoration Dingell-Johnson Project F-25-7 Stream Investigations. Upper Apalachicola River Study. Job Nos. 1 & 2. 29 pp.
- Florida Game and Fresh Water Fish Commission. 1974-1975. Final Job Completion Report for Investigations Project as Required by Federal Aid in Fish Restoration Dingell-Johnson Project F-25. Stream Investigations. Part I - Upper Apalachicola River Study. 79 pp.
- Florida State Board of Health. 1964. Survey of Chattahoochee-Flint-Apalachicola River System, June 29, 1964 - July 10, 1964. Bureau of Sanitary Engineering, Jacksonville, Florida.
- Gulf Power Company. 1976. Personal Communication. Center Manager.
- Harkness, W.J.K. and J.R. Dymond. 1961. The Lake Sturgeon (Acipenser fulvescens). The History of its Fishery and Problems of Conservation. Ontario Department of Lands and Forests.
- Huff, James A. 1975. Life History of Gulf of Mexico Sturgeon, Acipenser oxyrhynchus desotoi, in Suwannee River, Florida. Florida Department of Natural Resources, Marine Research Laboratory, St. Petersburg, Florida. Florida Marine Research Publication No. 16. 32 pp.
- Laurence, Geoffrey C. and Ralph W. Yerger. 1966. Life History Studies of the Alabama Shad, Alosa alabamae, in the Apalachicola River, Florida. Department of Biol. Science. Florida State University. Tallahassee, Florida. 26 pp.

- Massmann, W.H. 1952. Characteristics of Spawning Areas of Shad, Alosa sapidissima (Wilson) in Some Virginia Streams. Transactions of the American Fisheries Society. Vol. 81. pp. 78-93.
- Mills, James G., Jr. 1972. Biology of the Alabama Shad in Northwest Florida. Florida Department of Natural Resources Marine Research Laboratory. Technical Series No. 68. 24 pp.
- Mills, James G., Jr. 1971. Final Progress Report. Biology of the Alabama Shad in Northwest Florida. Florida Department of Natural Resources. Project No: Florida AFS-3. Project Period: 1/1/68 - 5/1/71. 26 pp.
- McErlean, Andrew J. 1961. Striped Bass in Florida. Florida State Board of Conservation, Marine Laboratory Maritime Base, Bayboro Harbor, St. Petersburg, Florida. FSBCML No: 61-19. 6 pp.
- Pearcy, W.G. 1962. Bulletin of the Bingham Oceanographic Collection. Vol. 18. No. 1. pp. 5-78.
- Raney, Edward C. and William S. Woolcott. 1955. Races of the Striped Bass, Roccus saxatilis (Walbaum), in Southeastern United States. Journal of Wildlife Management, Vol. 19, No. 4. pp. 444-450.
- Raney, Edward C. 1952. The Life History of the Striped Bass, Roccus saxatilis (Walbaum). Bulletin of the Bingham Oceanographic Collection. Vol. 14, No. 1. pp. 5-97.
- Schaaf, W.E. and G.R. Huntsman. 1972. Transactions of the American Fishery Society. No. 101. pp. 290-297.
- Southward, A.J. and N. Demir. 1974. Seasonal Changes in Dimensions and Viability of the Developing Eggs of the Cornish Pilchard (Sardina pilchardus Walbaum) Off Plymouth. In: The Early Life History of Fish, J.H.S. Blaxter, Ed., Springer-Verlag. New York.
- Stevenson, J.C. 1962. Journal of Fish. Res. Bd. Canada. Vol. 19, No. 5. pp. 735-810.
- Suttkus, R. 1976. Tulane University. Personal Communication.
- U.S. Army Corps of Engineers, Mobile District. 1975. Fact Sheet, Apalachicola River Trip, 23 May 1975. 24 pp.
- U.S. Army Corps of Engineers, Mobile District. 1975. Apalachicola, Chattahoochee and Flint Rivers, Alabama, Florida and Georgia (Operation and Maintenance). Draft Environmental Statement. 76 pp.
- U.S. Environmental Protection Agency. 1973. Development Document for Proposed Best Technology Available for Minimizing Environmental Impact of Cooling Water Intake Structures. Washington, D.C.

U.S. Fish and Wildlife Service. 1976. Copy of file of James Barkuloo, Fisheries Division, Panama City, FL. F-10-R. Anadromous Fish Study. Quarterly Progress Reports (1959-1964) for Investigations Project as Required by Federal Aid in Fish and Wildlife Restoration Acts and Job Completion Report for Research Project Segment (1964) for Life History Studies (F-10-R-6, Job 1-B).

U.S. Fish and Wildlife Service, 1976. Personal Communication (W.T. Talley).

U.S.G.S. 1976. Personal Communication (Roger Chermonak)

Walburg, Charles H. 1960. Abundance and Life History of Shad, St. Johns River, Florida. Fishery Bulletin of the Fish and Wildlife Service. U.S.D.I. Vol. 60. No. 177. pp. 487-501.

Wolfe, John C. 1969. Biological Studies of the Skipjack Herring, Alosa chrysochloris, in the Apalachicola River, Florida. M.S. Thesis. Florida State University. Tallahassee, Florida.

Yerger, Ralph W. 1974. The Fishes of the Apalachicola National Forest. Florida State University, Department of Biological Science; Tallahassee, Florida. Prepared under contract No. 1006-R8-73, U.S.D.A., Forest Service, Atlanta Georgia. 39 pp.

APPENDIX A

PROBABILITY OF OCCURRENCE CURVES FOR VARIOUS UPPER APALACHICOLA RIVER  
DISCHARGES

Source: U.S.G.S., 1976

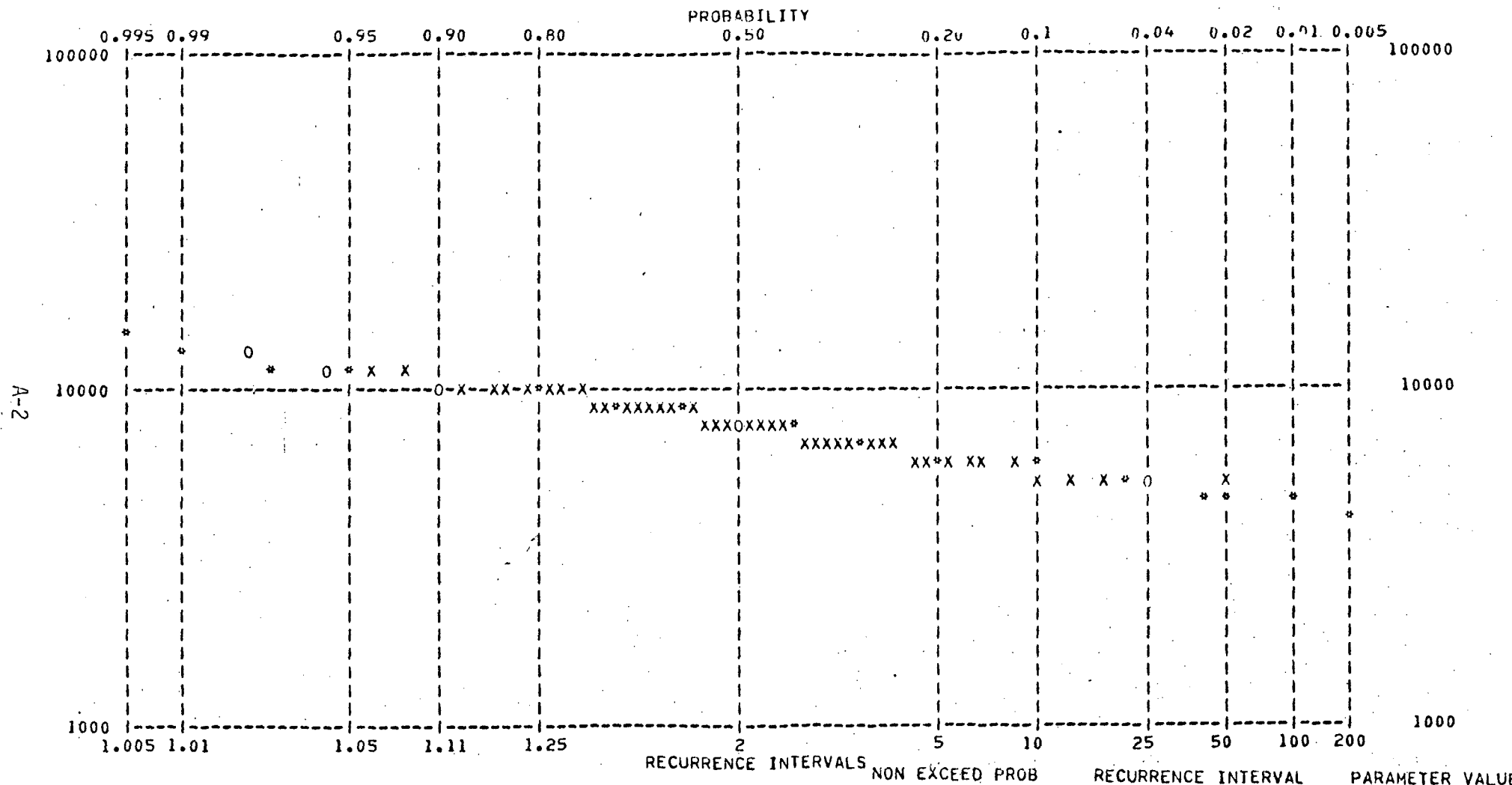
APALACHICOLA RIVER AT CHAITAHOOCHEE FLA

N = 47

STATION 02356000

1929-1975, 12 MON PERIOD ENDING SEPTEMBER 30

1 DAY LOW VALUE



MEAN = 7967.020

THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT

- X - AN INPUT DATA VALUE
- \* - A CALCULATED VALUE
- O - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
- 2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
- 3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
- A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
- B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

|        |        |           |
|--------|--------|-----------|
| 0.0100 | 100.00 | 4426.848  |
| 0.0200 | 50.00  | 4741.375  |
| 0.0500 | 20.00  | 5249.266  |
| 0.1000 | 10.00  | 5739.133  |
| 0.2000 | 5.00   | 6384.320  |
| 0.5000 | 2.00   | 7792.074  |
| 0.8000 | 1.25   | 9454.395  |
| 0.9000 | 1.11   | 10435.648 |
| 0.9600 | 1.04   | 11574.270 |
| 0.9800 | 1.02   | 12363.270 |
| 0.9900 | 1.01   | 12110.500 |

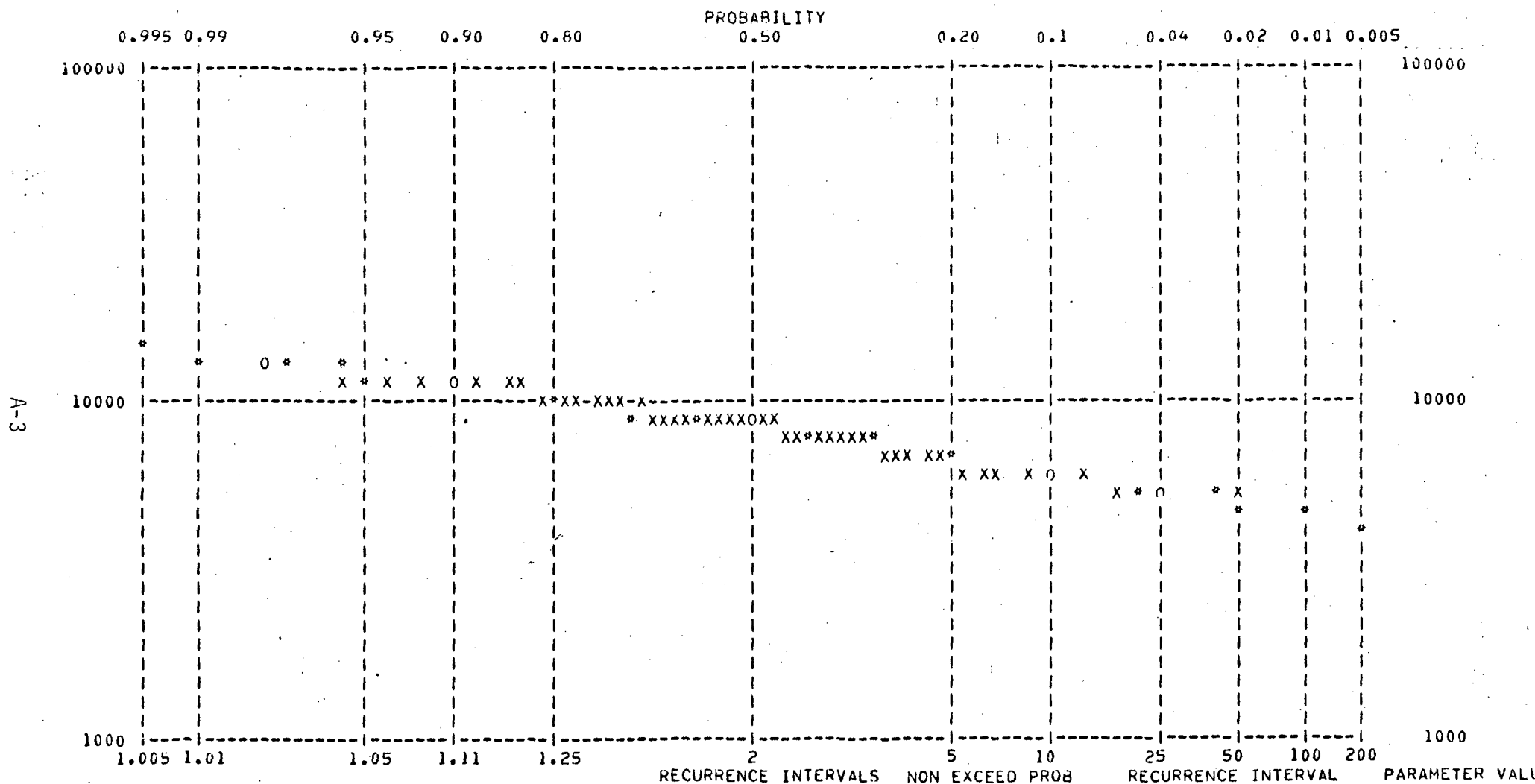
APALACHICOLA RIVER AT CHATTAHOOCHEE FLA

N = 47

STATION 0235000

1929-1975, 12 MON PERIOD ENDING SEPTEMBER 30

7 DAY LOW VALUE



THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT

- X - AN INPUT DATA VALUE
- \* - A CALCULATED VALUE
- O - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
- 2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
- 3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
- A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
- B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

MEAN = 8418.082

|        |        |           |
|--------|--------|-----------|
| 0.0100 | 100.00 | 4601.020  |
| 0.0200 | 50.00  | 4947.793  |
| 0.0500 | 20.00  | 5506.059  |
| 0.1000 | 10.00  | 6042.086  |
| 0.2000 | 5.00   | 6743.895  |
| 0.5000 | 2.00   | 8256.422  |
| 0.8000 | 1.25   | 10006.395 |
| 0.9000 | 1.11   | 11020.203 |
| 0.9500 | 1.04   | 12178.645 |
| 0.9800 | 1.02   | 12970.133 |
| 0.9900 | 1.01   | 13711.258 |

APALACHICOLA RIVER AT CHATTAHOOCHEE FLA

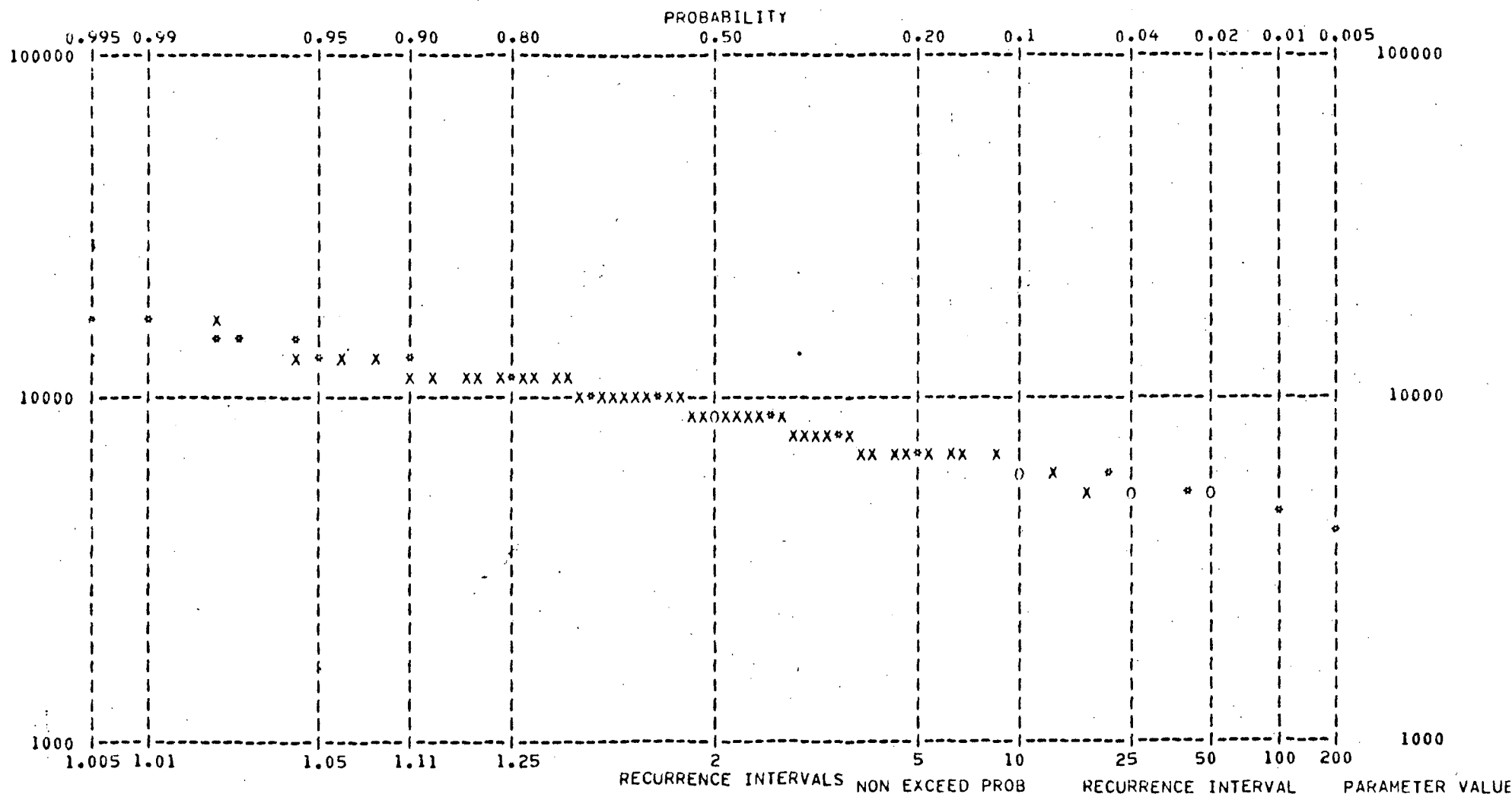
N = 47

STATION 0235P000

1929-1975, 12 MON PERIOD ENDING SEPTEMBER 30

30 DAY LOW VALUE

A-4



THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT

- X - AN INPUT DATA VALUE
- \* - A CALCULATED VALUE
- O - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
- 2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
- 3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
- A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
- B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

MEAN = 9190.848

|        |        |           |
|--------|--------|-----------|
| 0.0100 | 100.00 | 4687.113  |
| 0.0200 | 50.00  | 5079.625  |
| 0.0500 | 20.00  | 5718.063  |
| 0.1000 | 10.00  | 6338.113  |
| 0.2000 | 5.00   | 7159.570  |
| 0.5000 | 2.00   | 8963.320  |
| 0.8000 | 1.25   | 11100.176 |
| 0.9000 | 1.11   | 12359.875 |
| 0.9600 | 1.04   | 13617.109 |
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| 0.9900 | 1.01   | 15772.020 |

APALACHICOLA RIVER AT CHATTAHOOCHEE FLA

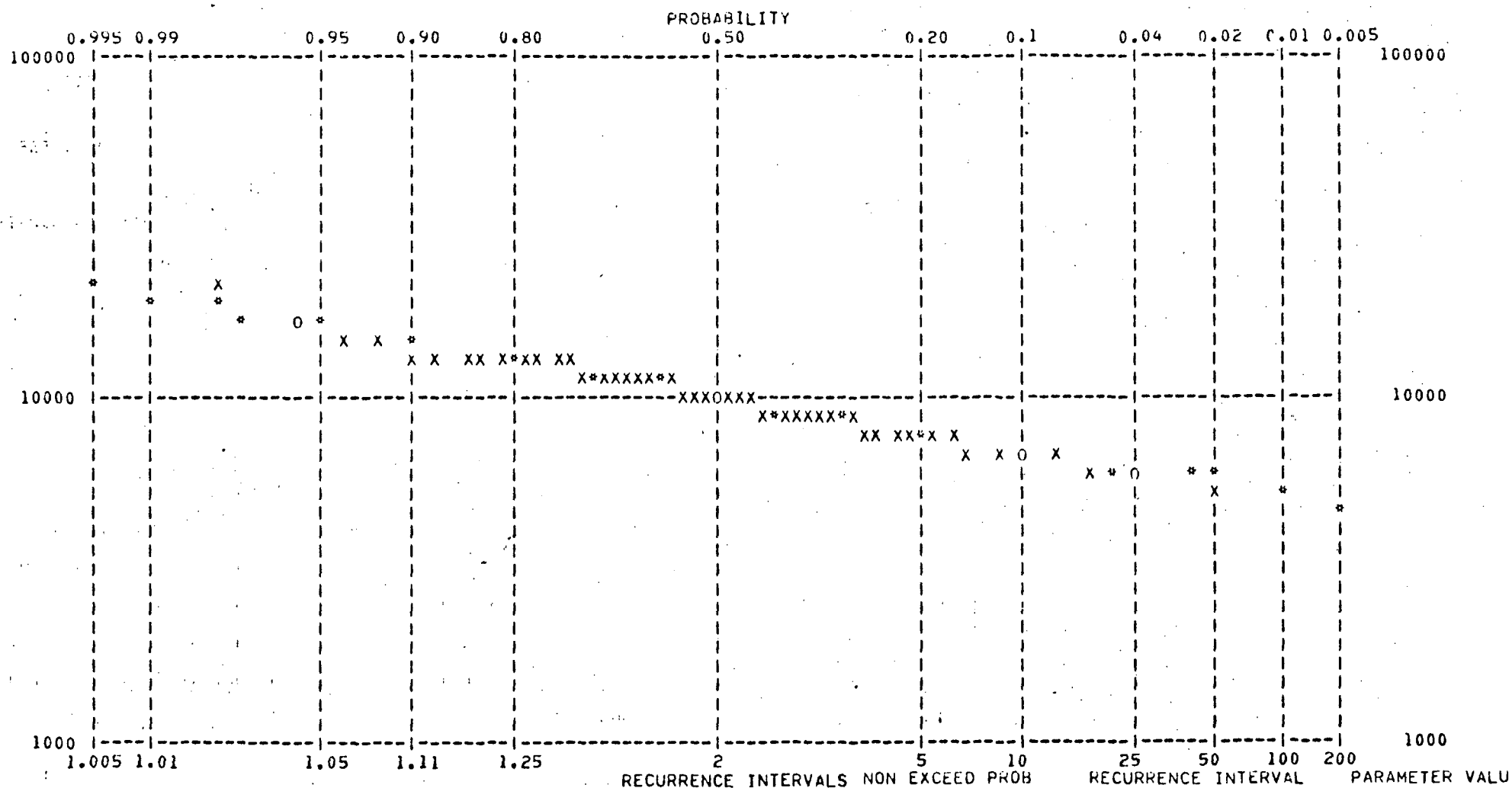
N = 47

STATION 0235+000

1929-1975. 12 MON PERIOD ENDING SEPTEMBER 30

60 DAY LOW VALUE

A-5



MEAN = 10442.340

THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT

- X - AN INPUT DATA VALUE
- O - A CALCULATED VALUE
- 0 - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
- 2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
- 3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
- A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
- B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

|        |        |           |
|--------|--------|-----------|
| 0.0100 | 100.00 | 5220.902  |
| 0.0200 | 50.00  | 5625.414  |
| 0.0500 | 20.00  | 6296.496  |
| 0.1000 | 10.00  | 6965.020  |
| 0.2000 | 5.00   | 7878.016  |
| 0.5000 | 2.00   | 10001.621 |
| 0.8000 | 1.25   | 12748.414 |
| 0.9000 | 1.11   | 14495.871 |
| 0.9600 | 1.04   | 16644.344 |
| 0.9800 | 1.02   | 18211.000 |
| 0.9900 | 1.01   | 19754.832 |

APALACHICOLA RIVER AT CHATTAHOOCHEE FLA

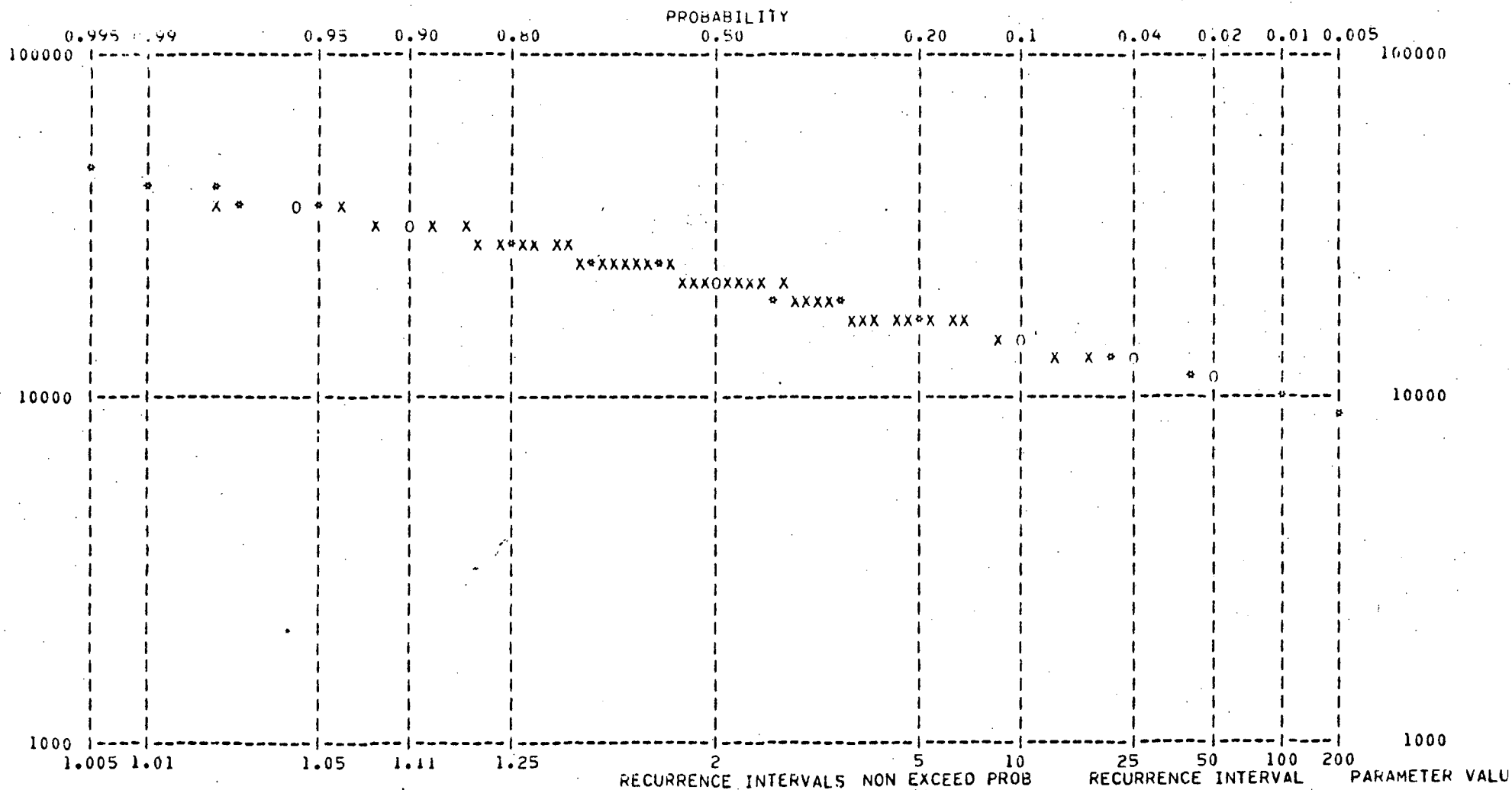
N = 47

STATION 02358000

1929-1975, 12 MON PERIOD ENDING SEPTEMBER 30

365 DAY LOW VALUE

A-6



MEAN = 22334.039

THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT

- x - AN INPUT DATA VALUE
- \* - A CALCULATED VALUE
- 0 - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
- 2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
- 3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
- A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
- B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

|        |        |           |
|--------|--------|-----------|
| 0.0100 | 100.00 | 10141.371 |
| 0.0200 | 50.00  | 11148.035 |
| 0.0500 | 20.00  | 12809.652 |
| 0.1000 | 10.00  | 14448.934 |
| 0.2000 | 5.00   | 16654.332 |
| 0.5000 | 2.00   | 21607.852 |
| 0.8000 | 1.25   | 27628.090 |
| 0.9000 | 1.11   | 31236.227 |
| 0.9600 | 1.04   | 35453.219 |
| 0.9800 | 1.02   | 38386.934 |
| 0.9900 | 1.01   | 41169.383 |

APPENDIX B

STORET WATER QUALITY DATA SUMMARY  
FOR THE UPPER APALACHICOLA RIVER

| PARAMETER   | TEMP     | CENT     | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | HE | DATE  | END DATE |
|-------------|----------|----------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| 00010 WATER | TEMP     | CENT     | 2304   | 16.8359 | 52.3812  | 7.23749  | .429883  | .150781  | 30.0000 | .000000 | 62 | 01/01 | 72/09/30 |
| 00058 FLOW  | RATE     | GPM      | 2304   | 7526.04 | 1648559  | 1283.96  | .170603  | 26.7492  | 8000.00 | 4000.00 | 62 | 01/01 | 72/09/30 |
| 74008 POWER | PLT LOAD | MEGAWATT | 2304   | 50.2370 | 771.456  | 27.7751  | .552882  | .578648  | 101.000 | 15.0000 | 62 | 01/01 | 72/09/30 |

STORET DATE 76/03/11

31011102  
 30 40 08.0 084 53 13.0 1  
 SCHOTZ POWER PT OUTFALL  
 12 FLORIDA  
 SOUTH-EAST  
 APALACHICOLA  
 21FLA 02424220  
 0000 CLASS 00

| PARAMETER   | TEMP     | CENT     | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | HE | DATE  | END DATE |
|-------------|----------|----------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| 00010 WATER | TEMP     | CENT     | 2304   | 21.6797 | 71.9930  | 8.48487  | .391374  | .176768  | 40.0000 | .000000 | 62 | 01/01 | 72/09/30 |
| 00058 FLOW  | RATE     | GPM      | 2304   | 7526.04 | 1648559  | 1283.96  | .170603  | 26.7492  | 8000.00 | 4000.00 | 62 | 01/01 | 72/09/30 |
| 74008 POWER | PLT LOAD | MEGAWATT | 2304   | 50.2370 | 771.456  | 27.7751  | .552882  | .578648  | 101.000 | 15.0000 | 62 | 01/01 | 72/09/30 |

STORET DATE 76/03/11

31010009  
 30 40 10.0 084 52 54.0 1  
 APALACHICOL R AR GULF PO INT CAN  
 12 FLORIDA  
 SOUTH-EAST  
 APALACHICOLA  
 21FLA 02111103  
 0020 CLASS 00

1312A1 1211A1  
 30 42 00.0 084 51 30.0 4  
 APALACHICOLA RIVER  
 13 7.5 CHATTahooCHE  
 O/SEMINOLE LAKE  
 US 90 BRDG BELO JIM WOODRUFF DAM  
 11EPALES 02111204  
 0000 CLASS 00

| PARAMETER      | TOTAL   | MG/L   | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | HE | DATE  | END DATE |
|----------------|---------|--------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| 00610 NH3-N    | TOTAL   | MG/L   | 14     | .061954 | .001420  | .037687  | .608206  | .010072  | .150000 | .023000 | 73 | 03/10 | 74/02/24 |
| 00615 NO2-N    | TOTAL   | MG/L   | 14     | .009571 | .000036  | .006173  | .644977  | .001650  | .023000 | .002000 | 73 | 03/10 | 74/02/24 |
| 00620 NO3-N    | TOTAL   | MG/L   | 14     | .241857 | .014090  | .118703  | .490798  | .031725  | .500000 | .024000 | 73 | 03/10 | 74/02/24 |
| 00625 TOT KJFL | N       | MG/L   | 14     | .931428 | .712936  | .844355  | .906517  | .225563  | 2.65000 | .100000 | 73 | 03/10 | 74/02/24 |
| 00630 NO2&NO3  | N-TOTAL | MG/L   | 14     | .250571 | .014970  | .122351  | .468289  | .032700  | .520000 | .028000 | 73 | 03/10 | 74/02/24 |
| 00665 PHOS-TOT |         | MG/L P | 14     | .068571 | .002067  | .045465  | .663026  | .012151  | .205000 | .030000 | 73 | 03/10 | 74/02/24 |
| 00671 PHOS-DIS | ORTHO   | MG/L P | 14     | .022214 | .000274  | .016563  | .745604  | .004427  | .068000 | .005000 | 73 | 03/10 | 74/02/24 |

STORET DATE 76/03/11

02358000

30 42 03.0 084 51 33.0 2

APALACHICOLA RIVER AT CHATTAHOOC

12 FLORIDA

112WPD

02111204

0000 CLASS 00

| PARAMETER       | IDENT.   | NUMBER   | NUMBER | MEAN     | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM  | MINIMUM | RE | DATE  | END DATE |
|-----------------|----------|----------|--------|----------|----------|----------|----------|----------|----------|---------|----|-------|----------|
| 00008 LAB       | IDENT.   | NUMBER   | 2      | 376980   | .282E+12 | 531656   | 1.41030  | 375938   | 752917   | 1042.00 | 73 | 11/28 | 75/03/26 |
| 00010 WATER     | TEMP     | CENT     | 125    | 20.4791  | 39.6858  | 6.29966  | .307615  | .563459  | 31.0000  | 8.00000 | 60 | 10/12 | 75/11/19 |
| 00060 STREAM    | FLOW     | CFS      | 89     | 23091.4  | .314E+09 | 17740.0  | .768254  | 1880.44  | 102000   | 719.000 | 64 | 07/03 | 72/09/19 |
| 00061 STREAM    | FLOW     | INST-CFS | 26     | 28360.7  | .332E+09 | 18244.5  | .643302  | 3578.04  | 79799.8  | 10300.9 | 72 | 11/27 | 75/11/19 |
| 00065 STREAM    | STAGE    | FEET     | 108    | 8.81202  | 35.7054  | 5.97540  | .678096  | .574983  | 25.0000  | .880000 | 60 | 10/12 | 75/11/19 |
| 00070 TURN      | JKSN     | JTU      | 38     | 17.4551  | 108.181  | 10.4010  | .595870  | 1.68726  | 50.0000  | 4.00000 | 70 | 05/08 | 75/11/19 |
| 00080 COLOR     | PT-CO    | UNITS    | 104    | 15.9903  | 703.733  | 26.5280  | 1.65900  | 2.60128  | 240.000  | .000000 | 24 | 10/29 | 75/11/19 |
| 00095 CONDUCTVY | AT 25C   | MICROMHO | 120    | 87.3087  | 371.622  | 19.2775  | .220797  | 1.75979  | 125.000  | 38.0000 | 52 | 05/21 | 75/11/19 |
| 00300 DO        |          | MG/L     | 39     | 8.15895  | 2.26438  | 1.50479  | .184434  | .240959  | 11.0000  | 5.70000 | 67 | 05/08 | 75/11/19 |
| 00301 DO        | SATUR    | PERCENT  | 26     | 90.7094  | 236.477  | 15.3778  | .169528  | 1.01584  | 113.000  | 38.0999 | 67 | 05/08 | 75/11/19 |
| 00310 BOD       | 5 DAY    | MG/L     | 24     | 1.32499  | .420221  | .648245  | .489243  | .132322  | 2.90000  | .000000 | 70 | 05/08 | 75/11/19 |
| 00400 PH        |          | SU       | 121    | 6.93049  | .144108  | .379616  | .054775  | .034511  | 8.20000  | 5.90000 | 52 | 05/21 | 75/11/19 |
| 00405 CO2       |          | MG/L     | 19     | 3.24210  | 3.86258  | 1.96534  | .606195  | .450881  | 8.10000  | .800000 | 72 | 11/27 | 75/11/19 |
| 00410 T ALK     | CAC03    | MG/L     | 114    | 35.8947  | 1688.73  | 41.0941  | 1.14485  | 3.84882  | 460.000  | 10.0000 | 24 | 10/27 | 75/11/19 |
| 00440 HCO3 ION  | HCO3     | MG/L     | 114    | 39.3156  | 126.251  | 11.2361  | .285793  | 1.05236  | 64.0000  | 12.0000 | 24 | 10/29 | 75/11/19 |
| 00445 CO3 ION   | CO3      | MG/L     | 96     | .885E-07 | .366E-13 | .191E-06 | 2.16702  | .195E-07 | .499E-06 | .000000 | 24 | 10/29 | 75/11/03 |
| 00515 RESIDUE   | DISS-105 | C MG/L   | 50     | 58.7998  | 207.339  | 14.3993  | .244886  | 2.03637  | 100.0000 | 40.0000 | 64 | 10/28 | 75/03/26 |
| 00530 RESIDUE   | TOT NFLT | MG/L     | 31     | 17.4515  | 288.791  | 16.9938  | .973772  | 3.05218  | 79.0000  | 5.00000 | 65 | 07/01 | 75/03/26 |
| 00600 TOTAL N   | N        | MG/L     | 18     | .635716  | .021546  | .146767  | .250537  | .034540  | 1.00000  | .479999 | 73 | 01/25 | 75/11/19 |
| 00605 ORG N     | N        | MG/L     | 37     | .356675  | .031504  | .177766  | .448452  | .024228  | .740000  | .030000 | 70 | 05/05 | 75/11/19 |
| 00608 NH3-N     | DISS     | MG/L     | 8      | .042750  | .001260  | .035504  | .830492  | .012552  | .110000  | .000000 | 71 | 07/22 | 72/09/19 |
| 00610 NH3-N     | TOTAL    | MG/L     | 26     | .054230  | .000881  | .029688  | .547447  | .005822  | .110000  | .000000 | 71 | 11/08 | 75/11/19 |
| 00613 NO2-N     | DISS     | MG/L     | 5      | .033000  | .000495  | .029920  | .906653  | .012215  | .080000  | .005000 | 71 | 11/08 | 72/09/19 |
| 00615 NO2-N     | TOTAL    | MG/L     | 25     | .021760  | .000292  | .017089  | .765327  | .003418  | .080000  | .007000 | 72 | 01/03 | 75/11/19 |
| 00618 NO3-N     | DISS     | MG/L     | 5      | .185000  | .006390  | .091597  | .495118  | .037394  | .300000  | .040000 | 71 | 11/08 | 72/09/19 |
| 00620 NO3-N     | TOTAL    | MG/L     | 27     | .213333  | .007838  | .088535  | .415010  | .017039  | .420000  | .040000 | 71 | 11/08 | 75/11/19 |
| 00625 TOT NJFL  | N        | MG/L     | 18     | .396160  | .012452  | .111590  | .281679  | .026302  | .659999  | .200000 | 73 | 01/26 | 75/11/19 |
| 00630 NO2&NO3   | N-TOTAL  | MG/L     | 18     | .240605  | .007753  | .086223  | .366670  | .020794  | .459999  | .120000 | 73 | 01/26 | 75/11/19 |
| 00650 T PO4     | PO4      | MG/L     | 27     | .184148  | .047812  | .218659  | 1.18741  | .042081  | .790000  | .002000 | 61 | 04/22 | 71/02/15 |
| 00660 ORTHOP04  | PO4      | MG/L     | 29     | .265172  | 1.13594  | 1.06581  | 4.01930  | .197415  | 5.80000  | .000000 | 52 | 05/21 | 72/01/03 |
| 00665 PHOS-TOT  |          | MG/L P   | 27     | .041518  | .000494  | .022236  | .535560  | .004279  | .110000  | .000000 | 71 | 11/08 | 75/11/19 |
| 00680 T ORG C   | C        | MG/L     | 19     | 3.92104  | 7.36441  | 2.71448  | .692286  | .622745  | 9.99999  | .000000 | 70 | 05/08 | 75/11/19 |
| 00685 T. INORG  | C        | MG/L     | 18     | 7.69443  | 8.00406  | 2.82915  | .367684  | .666636  | 12.0000  | 3.00000 | 72 | 04/25 | 75/11/19 |
| 00690 T-CARBON  | C        | MG/L     | 18     | 11.7222  | 7.03602  | 2.65255  | .226284  | .625212  | 16.0000  | 7.99999 | 72 | 04/25 | 75/11/19 |
| 00900 TOT HARD  | CAC03    | MG/L     | 107    | 30.7569  | .779564  | 6.82929  | .287067  | .853560  | 48.0000  | 14.0000 | 24 | 10/29 | 75/11/19 |
| 00902 NC HARD   | CAC03    | MG/L     | 107    | .612144  | 2.10523  | 1.45094  | 2.37024  | .140268  | 9.00000  | .000000 | 24 | 10/29 | 75/11/19 |
| 00915 CALCIUM   | CA+DISS  | MG/L     | 107    | 10.5644  | 12.0957  | 3.47789  | .329209  | .336221  | 17.0000  | 3.20000 | 24 | 10/29 | 75/11/19 |
| 00925 MAGNESIUM | MG+DISS  | MG/L     | 107    | 1.05233  | .048563  | .220370  | .209411  | .021304  | 1.90000  | .400000 | 24 | 10/29 | 75/11/19 |
| 00930 SODIUM    | NA+DISS  | MG/L     | 106    | 4.66222  | 1.72866  | 1.31479  | .282009  | .127703  | 7.90000  | 1.50000 | 52 | 05/21 | 75/11/19 |

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APALACHICOLA RIVER AT CHATTAHOOC

12 FLORIDA

112WPD

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| PARAMETER                     | NUMBER | MEAN    | VARIANCE | STAN. DEV. | COEFF. VAR. | STANDARD | ER. MAXIMUM | MINIMUM  | FE | DATE  | END DATE |
|-------------------------------|--------|---------|----------|------------|-------------|----------|-------------|----------|----|-------|----------|
| 00931 SODIUM ADSORPTION RATIO | 107    | .376632 | .015960  | .126334    | .335431     | .012213  | .700000     | .100000  | 24 | 10/29 | 75/11/19 |
| 00932 PERCENT SODIUM %        | 107    | 24.4486 | 56.7217  | 7.53138    | .308050     | .728056  | 41.0000     | 3.00000  | 24 | 10/29 | 75/11/19 |
| 00933 NA+K                    | 1      | 6.30000 |          |            |             |          | 6.30000     | 6.30000  | 24 | 10/29 | 24/10/29 |
| 00935 POTASSIUM K+DISS        | 106    | 1.25754 | .086477  | .294070    | .233846     | .028563  | 2.40000     | .300000  | 52 | 05/21 | 75/11/19 |
| 00940 CHLORIDE CL             | 109    | 3.68067 | 1.25952  | 1.12228    | .304913     | .107495  | 10.00000    | 1.50000  | 24 | 10/29 | 75/11/19 |
| 00945 SULFATE SO4-TOT         | 108    | 4.27217 | 2.95713  | 1.71963    | .402519     | .165472  | 9.20000     | .499E-06 | 24 | 10/29 | 75/11/19 |
| 00950 FLUORIDE F+DISS         | 107    | .148548 | .004786  | .069178    | .465542     | .006688  | .500000     | .000000  | 52 | 05/21 | 75/11/19 |
| 00955 SILICA DISSOLVED        | 113    | 7.11761 | 2.04154  | 1.42882    | .200745     | .134412  | 12.0000     | 3.70000  | 24 | 10/29 | 75/11/19 |
| 01000 ARSENIC AS+DISS         | 12     | 2.08333 | 10.8106  | 3.28795    | 1.57822     | .949149  | 10.0000     | .000000  | 70 | 05/08 | 75/11/19 |
| 01001 ARSENIC AS+SUSP         | 8      | .750000 | 1.92857  | 1.38873    | 1.85164     | .490990  | 4.00000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01002 ARSENIC AS+TOT          | 12     | 3.99999 | 13.6364  | 3.69275    | .923188     | 1.06600  | 10.0000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01025 CADMIUM CU+DISS         | 10     | .900000 | .766667  | .675595    | .972884     | .276888  | 2.00000     | .000000  | 71 | 04/27 | 75/11/19 |
| 01026 CADMIUM CU+SUSP         | 8      | .250000 | .500000  | .707107    | 2.82843     | .250000  | 2.00000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01027 CADMIUM CU+TOT          | 12     | .749999 | .749999  | .866025    | 1.15470     | .250000  | 2.00000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01030 CHROMIUM CR+DISS        | 8      | .750000 | 1.92857  | 1.38873    | 1.85164     | .490990  | 4.00000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01031 CHROMIUM CR+SUSP        | 8      | 7.37500 | 49.4107  | 7.02927    | .953122     | 2.48522  | 20.0000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01032 CHROMIUM HEX-VAL        | 3      | .000000 | .000000  | .000000    |             | .000000  | .000000     | .000000  | 71 | 04/27 | 72/04/25 |
| 01034 CHROMIUM CR+TOT         | 11     | 6.63636 | 29.6546  | 5.44560    | .630544     | 1.64191  | 20.0000     | .000000  | 70 | 05/08 | 75/11/19 |
| 01035 COBALT CO+DISS          | 10     | 2.30000 | 19.3444  | 4.39823    | 1.91228     | 1.39084  | 12.0000     | .000000  | 71 | 04/27 | 75/11/19 |
| 01036 COBALT CO+SUSP          | 8      | .375000 | 1.12500  | 1.06066    | 2.82843     | .375000  | 3.00000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01037 COBALT CO+TOTAL         | 10     | 2.20000 | 14.4000  | 3.78473    | 1.72488     | 1.20000  | 12.0000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01040 COPPER CU+DISS          | 17     | 5.17058 | 40.0696  | 6.33006    | 1.27424     | 1.53526  | 20.0000     | .000000  | 52 | 05/21 | 75/11/19 |
| 01041 COPPER CU+SUSP          | 8      | 3.75000 | 11.9286  | 3.45378    | .921007     | 1.22109  | 8.00000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01042 COPPER CU+TOT           | 10     | 6.30000 | 28.6778  | 5.35516    | .850026     | 1.69345  | 14.0000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01045 IRON FE+TOT             | 12     | 744.166 | 518264   | 719.905    | .967398     | 207.819  | 2800.00     | .89.9999 | 52 | 05/21 | 75/11/19 |
| 01046 IRON FE+DISS            | 88     | 60.4543 | 11264.1  | 106.133    | 1.75559     | 11.3138  | 610.000     | .000000  | 24 | 10/29 | 75/11/19 |
| 01049 LEAD PB+DISS            | 16     | 5.62499 | 32.1166  | 5.66715    | 1.00749     | 1.41679  | 20.0000     | .000000  | 70 | 05/08 | 75/11/19 |
| 01050 LEAD PB+SUSP            | 8      | 9.00000 | 87.1428  | 9.33503    | 1.03723     | 3.30043  | 26.0000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01051 LEAD PB+TOT             | 9      | 13.8889 | 73.8612  | 8.59425    | .618786     | 2.86475  | 26.0000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01054 MANGNESE MN+SUSP        | 8      | 61.3750 | 1640.84  | 40.5073    | .659996     | 14.3215  | 130.000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01055 MANGNESE MN             | 11     | 83.1818 | 991.369  | 31.4860    | .378520     | 9.49339  | 150.000     | 40.0000  | 60 | 10/12 | 75/11/19 |
| 01056 MANGNESE MN+DISS        | 26     | 19.0000 | 632.399  | 25.1475    | 1.32356     | 4.93184  | 79.9999     | .000000  | 52 | 05/21 | 75/11/19 |
| 01065 NICKEL NI+DISS          | 2      | .000000 | .000000  | .000000    |             | .000000  | .000000     | .000000  | 65 | 05/03 | 66/06/03 |
| 01080 STRONTIUM SR+DISS       | 31     | 58.0644 | 1376.14  | 37.0963    | .638882     | 6.66289  | 140.000     | .000000  | 66 | 05/03 | 75/11/19 |
| 01090 ZINC ZN+DISS            | 17     | 33.0588 | 4537.16  | 67.3585    | 2.03754     | 16.3368  | 270.000     | .000000  | 52 | 05/21 | 75/11/19 |
| 01091 ZINC ZN+SUSP            | 8      | 43.7500 | 8541.07  | 92.4179    | 2.11241     | 32.6746  | 270.000     | .000000  | 74 | 02/01 | 75/11/19 |
| 01092 ZINC ZN+TOT             | 10     | 51.6999 | 12913.1  | 113.637    | 2.19801     | 35.9351  | 370.000     | .000000  | 72 | 04/25 | 75/11/19 |
| 01105 ALUMINUM AL+TOT         | 3      | 69.9999 | 12700.0  | 112.694    | 1.60992     | 65.0640  | 200.000     | .000000  | 70 | 05/08 | 73/10/03 |
| 01130 LITHIUM LI+DISS         | 3      | 35.0000 | 3174.99  | 56.3471    | 1.60992     | 32.5320  | 100.0000    | .000000  | 52 | 05/21 | 66/06/03 |
| 01145 SELENIUM SE+DISS        | 8      | 1.50000 | 8.00000  | 2.82843    | 1.88562     | 1.00000  | 7.00000     | .000000  | 74 | 02/01 | 75/11/19 |

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 APALACHICOLA RIVER AT CHATTAHOOC  
 12 FLORIDA

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| PARAMETER                        | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | RE | DATE  | END DATE |
|----------------------------------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| 80050 BETA-U AS SR-Y- 90, PC/L   | 50     | 2.92339 | 1.22926  | 1.10872  | .379258  | .156797  | 5.90000 | .400000 | 64 | 10/24 | 75/03/26 |
| 80060 BETA-S AS SR-Y- 90, PC/L   | 30     | 1.18333 | .548339  | .740499  | .625777  | .135196  | 4.00000 | .400000 | 66 | 07/01 | 75/03/26 |
| 80154 SUSP SED CONC MG/L         | 25     | 14.8399 | 35.6409  | 5.97000  | .402293  | 1.19400  | 30.0000 | 4.00000 | 67 | 10/03 | 75/11/19 |
| 80155 SUSP SED DISCHARG TONS/DAY | 25     | 1325.40 | 246250   | 1569.26  | 1.18399  | 313.852  | 6460.00 | 178.000 | 67 | 10/03 | 75/11/19 |

STORE1 DATE 76/03/11

01044 LEAD Pb DISS UG/L 11 6.18182 4.56365 3.04251 .500250 .932425 12.0000 2.00000 62 10/01 69/01/01  
STORE DATE 76/03/11

110057 11033101 057-  
30 42 32.0 084 51 44.0 4  
APALACHICOLA R. AT CHATTAHOOCHEE  
12 FLORIDA  
SOUTHEAST  
APALACHICOLA RIVER  
111067 02111204  
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| INDEX 0331070       |          |        |        |         |          |          |          |          |         |         |    |       |          |
|---------------------|----------|--------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| MILES 0107.30       |          |        |        |         |          |          |          |          |         |         |    |       |          |
| PARAMETER           |          |        | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | BE | DATE  | END DATE |
| 01055 MANGNESE      | MN       | UG/L   | 11     | 1.23636 | .220444  | .469822  | .379841  | .141596  | 2.00000 | .600000 | 62 | 10/01 | 69/01/01 |
| 01060 MOLY          | MO DISS  | UG/L   | 11     | 4.40909 | 8.89094  | 2.98177  | .607397  | .899037  | 11.0000 | 1.00000 | 62 | 10/01 | 69/01/01 |
| 01065 NICKEL        | NI DISS  | UG/L   | 11     | 2.63636 | 1.45455  | 1.20605  | .457467  | .363637  | 5.00000 | 1.00000 | 62 | 10/01 | 69/01/01 |
| 01070 PHOS-TOT      | SPEC     | UG/L P | 11     | 17.2727 | 123.018  | 11.0914  | .642132  | 3.34417  | 45.0000 | 2.00000 | 62 | 10/01 | 69/01/01 |
| 01075 SILVER        | AG DISS  | UG/L   | 11     | .318181 | .023637  | .153742  | .483189  | .046355  | .700000 | .200000 | 62 | 10/01 | 69/01/01 |
| 01080 STRONTIUM     | SR DISS  | UG/L   | 11     | 16.3636 | 39.2547  | 6.26536  | .382883  | 1.88908  | 25.0000 | 4.00000 | 62 | 10/01 | 69/01/01 |
| 01085 VANADIUM      | V DISS   | UG/L   | 11     | 5.18182 | 7.96365  | 2.82199  | .544595  | .850863  | 11.0000 | 1.00000 | 62 | 10/01 | 69/01/01 |
| 01090 ZINC          | ZN DISS  | UG/L   | 11     | 32.1273 | 1962.22  | 44.2969  | 1.35352  | 13.3550  | 180.000 | 4.00000 | 62 | 10/01 | 69/01/01 |
| 01105 ALUMINUM      | AL TOT   | UG/L   | 10     | 31.2000 | 3196.40  | 56.5367  | 1.81207  | 17.8785  | 190.000 | 6.00000 | 63 | 04/01 | 69/01/01 |
| 01145 SELENIUM      | SE DISS  | UG/L   | 2      | .010000 | .145E-10 | .000000  | .000000  | .000000  | .010000 | .010000 | 62 | 10/01 | 63/04/01 |
| 01501 ALPHA         | TOTAL    | PC/L   | 59     | .288136 | .243133  | .493085  | 1.71129  | .064194  | 2.00000 | .000000 | 60 | 03/07 | 69/01/07 |
| 01502 ALPHA-T       | ERROR    | PC/L   | 43     | .441860 | .252492  | .502486  | 1.13720  | .076628  | 1.00000 | .000000 | 61 | 11/27 | 69/01/07 |
| 01503 ALPHA         | DISOLVED | PC/L   | 59     | .050847 | .049094  | .221572  | 4.35758  | .028846  | 1.00000 | .000000 | 60 | 03/07 | 69/01/07 |
| 01504 ALPHA-D       | ERROR    | PC/L   | 43     | .395349 | .244740  | .494712  | 1.25133  | .075443  | 1.00000 | .000000 | 61 | 11/27 | 69/01/07 |
| 01505 ALPHA         | SUSP     | PC/L   | 59     | .237286 | .184103  | .429072  | 1.80823  | .055860  | 1.00000 | .000000 | 60 | 03/07 | 69/01/07 |
| 01506 ALPHA-S       | ERROR    | PC/L   | 43     | .348837 | .232558  | .482243  | 1.38243  | .073541  | 1.00000 | .000000 | 61 | 11/27 | 69/01/07 |
| 03501 BETA          | TOTAL    | PC/L   | 105    | 13.0190 | 270.173  | 16.4359  | 1.26253  | 1.60408  | 74.0000 | .000000 | 59 | 12/14 | 69/01/07 |
| 03502 BETA-T        | ERROR    | PC/L   | 67     | 6.91045 | 11.2949  | 3.36074  | .486335  | .410586  | 18.0000 | 1.00000 | 61 | 10/09 | 69/01/07 |
| 03503 BETA          | DISOLVED | PC/L   | 105    | 7.47619 | 67.8480  | 8.23699  | 1.10176  | .803848  | 32.0000 | .000000 | 59 | 12/14 | 69/01/07 |
| 03504 BETA-D        | ERROR    | PC/L   | 67     | 5.10448 | 5.67776  | 2.38134  | .466519  | .290926  | 12.0000 | 1.00000 | 61 | 10/09 | 69/01/07 |
| 03505 BETA          | SUSP     | PC/L   | 105    | 5.54286 | 90.9044  | 9.53438  | 1.72012  | .930460  | 50.0000 | .000000 | 59 | 12/14 | 69/01/07 |
| 03506 BETA-S        | ERROR    | PC/L   | 67     | 4.66567 | 5.72413  | 2.39251  | .491713  | .292292  | 13.0000 | 1.00000 | 61 | 10/09 | 69/01/07 |
| 13501 SH-90         | TOTAL    | PC/L   | 10     | 1.05000 | .605000  | .777818  | .740779  | .245967  | 2.90000 | .400000 | 60 | 07/01 | 64/07/01 |
| 31503 TOT COLI      | MPLEND   | /100ML | 294    | 523.357 | 2779911  | 1667.31  | 3.18579  | 97.2393  | 20000.0 | 1.00000 | 59 | 12/07 | 68/12/17 |
| 32000 SAMPLE        | SIZE     | LITERS | 25     | 4364.04 | 2271786  | 1507.24  | .345378  | 301.449  | 10825.0 | 3785.00 | 66 | 11/14 | 69/01/09 |
| 32001 SAMPLE        | SIZE     | GAL    | 84     | 3048.12 | 5041346  | 2245.29  | .736616  | 244.982  | 9050.00 | 1000.00 | 60 | 03/11 | 69/01/09 |
| 32003 CCE AND       | CAE      | UG/L   | 83     | 252.880 | 15306.3  | 123.718  | .489239  | 13.5799  | 709.000 | 90.0000 | 60 | 03/11 | 69/01/09 |
| 32004 GAE           |          | UG/L   | 63     | 167.386 | 9680.91  | 98.3916  | .587814  | 10.7999  | 539.000 | 50.0000 | 60 | 03/11 | 69/01/09 |
| 32005 CCE           |          | UG/L   | 85     | 85.7176 | 1125.42  | 33.5473  | .391370  | 3.63872  | 207.000 | 23.0000 | 60 | 03/11 | 69/01/09 |
| 32021 ETHER         | INSOLUBL | UG/L   | 28     | 3.60714 | 7.72884  | 2.78008  | .770715  | .525385  | 11.0000 | .000000 | 60 | 03/11 | 63/09/27 |
| 32022 WATER         | SOLUBLES | UG/L   | 28     | 18.7857 | 63.5825  | 7.97386  | .424464  | 1.50692  | 35.0000 | 5.00000 | 60 | 03/11 | 63/09/27 |
| 32023 STRONG        | ACIDS    | UG/L   | 28     | 7.10714 | 14.9140  | 3.86187  | .543379  | .729825  | 17.0000 | 1.00000 | 60 | 03/11 | 63/09/27 |
| 32024 WEAK          | ACIDS    | UG/L   | 28     | 8.89286 | 13.2344  | 3.64478  | .409855  | .688798  | 20.0000 | 3.00000 | 60 | 03/11 | 63/09/27 |
| 32025 BASES         |          | UG/L   | 28     | 1.32143 | .522488  | .722633  | .547009  | .136603  | 4.00000 | .000000 | 60 | 03/11 | 63/09/27 |
| 32026 NEUTRALS      |          | UG/L   | 28     | 19.0000 | 40.3704  | 6.35377  | .334409  | 1.20075  | 36.0000 | 8.00000 | 60 | 03/11 | 63/09/27 |
| 32027 ALPHA-        | TICS     | UG/L   | 28     | 1.53571 | 1.07275  | 1.03574  | .674433  | .195736  | 4.00000 | .000000 | 60 | 03/11 | 63/09/27 |
| 32028 AROMATIC      |          | UG/L   | 28     | 1.35714 | .534393  | .731022  | .538648  | .138150  | 3.00000 | .000000 | 60 | 03/11 | 63/09/27 |
| 32029 OXYGEN-       | ATES     | UG/L   | 28     | 15.2143 | 25.1377  | 5.01375  | .329542  | .947510  | 28.0000 | 6.00000 | 60 | 03/11 | 63/09/27 |
| 38260 MBAS          |          | MG/L   | 57     | .040702 | .000457  | .021364  | .525023  | .002830  | .130000 | .020000 | 63 | 09/03 | 67/12/06 |
| 39330 ALURIN        | WHL SMPL | UG/L   | 15     | .000000 | .000000  | .000000  | .000000  | .000000  | .000000 | .000000 | 60 | 07/12 | 67/09/29 |
| STORE DATE 76/03/11 |          |        |        |         |          |          |          |          |         |         |    |       |          |

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 APALACHICOLA R. AT CHATTAHOOCHEE  
 12 FLORIDA  
 SOUTHEAST  
 APALACHICOLA RIVER  
 111061 02111204  
 0000 CLASS 00

INDEX 0331070

MILES 0107.30

| PARAMETER                       | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM | MINIMUM | BE | DATE  | END DATE |
|---------------------------------|--------|---------|----------|----------|----------|----------|---------|---------|----|-------|----------|
| 39340 HMC WHL SMPL UG/L         | 15     | .001733 | .000032  | .005663  | 3.76696  | .001462  | .022000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39350 CHLRODANE WHL SMPL UG/L   | 1      | .000000 |          |          |          |          | .000000 | .000000 | 66 | 09/13 | 66/09/13 |
| 39360 DDB WHL SMPL UG/L         | 16     | .044250 | .022122  | .148736  | 3.36127  | .037184  | .600000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39365 DDE WHL SMPL UG/L         | 15     | .000533 | .409E-06 | .000640  | 1.19989  | .000165  | .002000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39370 DDT WHL SMPL UG/L         | 15     | .003667 | .000050  | .007058  | 1.92480  | .001822  | .027000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39380 DIELDRIN WHL SMPL UG/L    | 15     | .009200 | .000051  | .007123  | .774287  | .001839  | .024000 | .001000 | 60 | 07/12 | 67/09/29 |
| 39390 ENDRIN WHL SMPL UG/L      | 15     | .000067 | .666E-07 | .000258  | 3.67298  | .000067  | .001000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39410 HCHLR WHL SMPL UG/L       | 15     | .000000 | .000000  | .000000  |          | .000000  | .000000 | .000000 | 60 | 07/12 | 67/09/29 |
| 39420 HCHLR-EP WHL SMPL UG/L    | 15     | .000000 | .000000  | .000000  |          | .000000  | .000000 | .000000 | 60 | 07/12 | 67/09/29 |
| 60050 ALGAE TOTAL /ML           | 78     | 2580.77 | .174E+08 | 4179.69  | 1.61955  | 473.257  | 32100.0 | .000000 | 61 | 10/04 | 65/07/07 |
| 60100 ALGAE COC BG /ML          | 78     | 57.0513 | .30093.8 | 173.476  | 3.04070  | 19.5422  | 1240.00 | .000000 | 61 | 10/04 | 65/07/07 |
| 60150 ALGAE FIL BG /ML          | 78     | 419.743 | .128E+08 | 3581.13  | 8.53171  | 405.483  | 31640.0 | .000000 | 61 | 10/04 | 65/07/07 |
| 60200 ALGAE COC GRN /ML         | 78     | 479.103 | .312521  | 559.036  | 1.16654  | 63.2984  | 3350.00 | .000000 | 61 | 10/04 | 65/07/07 |
| 60250 ALGAE FIL GRN /ML         | 78     | 1.28205 | .45.0882 | 6.71478  | 5.23753  | .760299  | 40.0000 | .000000 | 61 | 10/04 | 65/07/07 |
| 60300 ALGAE FLAG-GRN /ML        | 78     | 311.923 | .589967  | 768.093  | 2.46245  | 86.9694  | 4470.00 | .000000 | 61 | 10/04 | 65/07/07 |
| 60350 ALGAE FLAG-OTH /ML        | 78     | 69.7436 | .12267.5 | 110.759  | 1.58808  | 12.5409  | 510.000 | .000000 | 61 | 10/04 | 65/07/07 |
| 60390 DIATOMS DOM SPEC * OF TOT | 46     | 39.3695 | .166.196 | 12.4917  | .327453  | 1.90078  | 81.0000 | 17.0000 | 61 | 10/04 | 65/07/07 |
| 60400 DIATOMS CENTRIC /ML       | 78     | 1041.67 | .3779278 | 1944.04  | 1.86627  | 220.119  | 11200.0 | .000000 | 61 | 10/04 | 65/07/07 |
| 60600 DIATOMS PENNATE /ML       | 78     | 242.420 | .75914.1 | 275.534  | 1.13472  | 31.1981  | 1430.00 | .000000 | 61 | 10/04 | 65/07/07 |
| 60820 PROTOZOA TOTAL /ML        | 31     | 2.25806 | .18.0645 | 4.25024  | 1.88225  | .763365  | 10.0000 | .000000 | 61 | 10/04 | 63/02/07 |
| 60850 ROTIFERS TOTAL /LITER     | 39     | 368.128 | .270880  | 520.461  | 1.41380  | 83.3405  | 1910.00 | .000000 | 61 | 10/04 | 63/04/16 |
| 60900 CRSTACEA TOTAL /LITER     | 39     | 5.97436 | .115.552 | 10.7495  | 1.79927  | 1.72130  | 51.0000 | .000000 | 61 | 10/04 | 63/04/16 |
| 60950 NEMATODES TOTAL /LITER    | 39     | .897436 | .11.1997 | 3.34660  | 3.72907  | .535885  | 15.0000 | .000000 | 61 | 10/04 | 63/04/16 |
| 60990 ZOOPLANK OTHER /LITER     | 39     | .102564 | .147098  | .383534  | 3.73946  | .061415  | 2.00000 | .000000 | 61 | 10/04 | 63/04/16 |

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| PARAMETER | LAB       | IDENT.    | NUMBER   | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM  | MINIMUM  | FE      | DATE  | END DATE |          |
|-----------|-----------|-----------|----------|---------|----------|----------|----------|----------|----------|----------|---------|-------|----------|----------|
| 00000     | LAB       | IDENT.    | NUMBER   | 47559.2 | .222E+11 | 149275   | 3.13871  | 29654.9  | 752917   | 1042.00  | 50      | 03/25 | 75/03/26 |          |
| 00010     | WATER     | TEMP      | CENT     | 4903    | 19.4467  | 67.0744  | 8.18990  | .421147  | .116963  | 40.0000  | .000000 | 59    | 12/07    | 75/11/19 |
| 00020     | AIR       | TEMP      | CENT     | 1       | 21.7000  |          |          |          |          | 21.7000  | 21.7000 | 74    | 03/20    | 74/03/20 |
| 00035     | WIND      | VELOCITY  | MPH      | 1       | 5.00000  |          |          |          |          | 5.00000  | 5.00000 | 74    | 05/21    | 74/05/21 |
| 00036     | WIND      | DIR. FROM | NORTH-0  | 1       | 135.000  |          |          |          |          | 135.000  | 135.000 | 74    | 05/21    | 74/05/21 |
| 00050     | FLOW      | RATE      | GPM      | 4605    | 7526.04  | 1648172  | 1263.61  | .170583  | 18.9123  | 8000.00  | 4000.00 | 62    | 01/01    | 72/09/30 |
| 00060     | STREAM    | FLOW      | CFS      | 429     | 25359.7  | .432E+09 | 20804.1  | .820360  | 1004.43  | 147000   | 12.0000 | 59    | 12/07    | 72/09/19 |
| 00061     | STREAM    | FLOW      | INST-CFS | 32      | 23049.5  | .394E+09 | 19665.0  | .861836  | 3511.66  | 79799.8  | 4.81999 | 72    | 11/27    | 75/11/19 |
| 00065     | STREAM    | STAGE     | FEET     | 116     | 8.49076  | .34.7052 | 5.89111  | .693826  | .546976  | 25.6000  | .880000 | 60    | 10/12    | 75/11/19 |
| 00070     | TURB      | USN       | ITU      | 176     | 19.6801  | 270.062  | 15.4336  | .835036  | 1.23873  | 135.000  | .200000 | 59    | 12/07    | 75/11/19 |
| 00074     | TURB      | IPANS     |          | 11      | 69.9091  | .36.2930 | 6.02436  | .066174  | 1.81641  | 78.0000  | 62.0000 | 73    | 06/20    | 73/11/03 |
| 00077     | TRANSP    | SECCHI    | INCHES   | 6       | 27.5333  | 103.398  | 10.1931  | .370208  | 4.16130  | 35.0000  | 8.40000 | 73    | 06/20    | 75/06/25 |
| 00080     | COLOR     | PT-CU     | UNITS    | 267     | 45.9101  | 2152.24  | 46.3923  | 1.01050  | 2.83916  | 240.000  | .000000 | 24    | 10/29    | 75/11/19 |
| 00094     | CNDOCTVY  | FIELD     | MICROMHO | 11      | 67.8182  | 241.969  | 15.5553  | .177131  | 4.69011  | 111.000  | 70.0000 | 73    | 06/20    | 73/11/03 |
| 00095     | CNDOCTVY  | AT 25C    | MICROMHO | 133     | 84.7522  | 503.709  | 22.4435  | .264813  | 1.94609  | 150.000  | 35.0000 | 52    | 05/21    | 75/11/19 |
| 00300     | DO        |           | MG/L     | 169     | 7.65056  | 1.96374  | 1.40134  | .183168  | 1.08115  | 11.2000  | 3.70000 | 60    | 05/16    | 75/11/19 |
| 00301     | DO        | SATUR     | PERCENT  | 32      | 50.3733  | 193.847  | 13.9229  | .154060  | 2.46124  | 113.000  | 38.0999 | 67    | 05/08    | 75/11/19 |
| 00310     | BOD       | 5 DAY     | MG/L     | 50      | 1.40200  | .949182  | .474260  | .694904  | .137781  | 6.10000  | .000000 | 60    | 05/23    | 75/11/19 |
| 00335     | COD       | LOW LEVEL | MG/L     | 4       | 13.7500  | 44.2500  | 6.65207  | .483787  | 3.32603  | 20.0000  | 6.00000 | 61    | 10/10    | 62/04/23 |
| 00340     | COD       | HI LEVEL  | MG/L     | 10      | 15.1000  | 223.656  | 14.4551  | .990405  | 4.72922  | 53.0000  | .000000 | 69    | 04/09    | 75/06/25 |
| 00370     | CL2DMND   | 1 HR      | MG/L     | 2       | 3.70000  | .020004  | .141436  | .038226  | 1.00011  | 2.80000  | 3.60000 | 60    | 05/30    | 60/06/06 |
| 00380     | CL2DMND   | 24 HR     | MG/L     | 2       | 6.40000  | .000000  | .000000  | .000000  | .000000  | 6.40000  | 6.40000 | 60    | 05/30    | 60/06/06 |
| 00400     | PH        |           | SU       | 282     | 7.09710  | .160810  | .401011  | .056503  | .023880  | 8.40000  | 5.89499 | 52    | 05/21    | 75/11/19 |
| 00405     | CO2       |           | MG/L     | 19      | 3.24210  | 3.86258  | 1.96534  | .606195  | .450881  | 8.10000  | .800000 | 72    | 11/27    | 75/11/19 |
| 00410     | T ALK     | CAC03     | MG/L     | 280     | 36.9535  | 758.531  | 27.5414  | .745299  | 1.64592  | 460.000  | 5.00000 | 24    | 10/29    | 75/11/19 |
| 00435     | 1 ACIDITY | CAC03     | MG/L     | 8       | 10.7500  | 53.3571  | 7.30460  | .679497  | 2.58256  | 25.0000  | 2.00000 | 69    | 04/21    | 75/03/12 |
| 00440     | HC03 ION  | HC03      | MG/L     | 118     | 38.4913  | 141.497  | 11.8955  | .309037  | 1.09505  | 64.0000  | 12.0000 | 24    | 10/29    | 75/11/19 |
| 00445     | CO3 ION   | CO3       | MG/L     | 98      | 9.18E-07 | .37E-13  | .194E-06 | 2.11903  | .126E-07 | .499E-06 | .000000 | 24    | 10/29    | 75/11/03 |
| 00515     | RESIDUE   | DISS-105  | MG/L     | 129     | 81.0542  | 6712.25  | 81.9283  | 1.01078  | 7.21349  | 970.000  | 40.0000 | 60    | 05/23    | 75/06/25 |
| 00530     | RESIDUE   | TOT NFLT  | MG/L     | 138     | 31.9927  | 371.470  | 19.2735  | .602435  | 1.84057  | 101.000  | 1.00000 | 59    | 12/14    | 75/03/26 |
| 00600     | TOTAL N   | N         | MG/L     | 24      | .560870  | .026175  | .161787  | .244810  | .033025  | 1.00000  | .430000 | 73    | 01/26    | 75/11/19 |
| 00605     | ORG N     | N         | MG/L     | 59      | .369270  | .032596  | .180542  | .488917  | .023505  | .850000  | .000000 | 70    | 05/08    | 75/11/19 |
| 00608     | NH3-N     | DISS      | MG/L     | 8       | .042750  | .001260  | .035504  | .030492  | .012552  | .110000  | .000000 | 71    | 07/22    | 72/09/19 |
| 00610     | NH3-N     | TOTAL     | MG/L     | 86      | 1.04020  | 7.28163  | 2.69845  | 2.59416  | .290981  | 14.6000  | .000000 | 60    | 05/30    | 75/11/19 |
| 00613     | NO2-N     | DISS      | MG/L     | 6       | .033000  | .000895  | .029220  | .906653  | .012215  | .080000  | .005000 | 71    | 11/08    | 72/09/19 |
| 00615     | NO2-N     | TOTAL     | MG/L     | 65      | .016554  | .000193  | .013490  | .839095  | .001723  | .060000  | .002000 | 72    | 01/03    | 75/11/19 |
| 00618     | NO3-N     | DISS      | MG/L     | 6       | .185600  | .008390  | .091597  | .495118  | .037394  | .300000  | .040000 | 71    | 11/08    | 72/09/19 |
| 00620     | NO3-N     | TOTAL     | MG/L     | 75      | .274173  | .032166  | .179348  | .654143  | .020709  | .950000  | .012000 | 71    | 11/08    | 75/11/19 |
| 00625     | TOTAL N   | N         | MG/L     | 61      | 5.76558  | 118.403  | 10.8813  | 1.86729  | 1.39321  | 35.0000  | 1.00000 | 73    | 01/26    | 75/11/19 |
| 00630     | NO2&NO3   | N-TOTAL   | MG/L     | 82      | .221596  | .012308  | .110939  | .500638  | .012251  | .520000  | .020000 | 64    | 12/09    | 75/11/19 |

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| PARAMETER                    | NUMBER | MEAN    | VARIANCE | STAN. DEV. | COEFF. VAR. | STAND. ER. | MAXIMUM  | MINIMUM  | SE  | DATE  | END DATE |
|------------------------------|--------|---------|----------|------------|-------------|------------|----------|----------|-----|-------|----------|
| 00635 NH3LOPS N-TOTAL MG/L   | 22     | .849998 | .227355  | .773211    | .909662     | .164825    | 3.80000  | .200000  | .64 | 12/09 | 67/12/09 |
| 00636 NH3LOPS N-DISS. MG/L   | 10     | .329999 | .215666  | .464399    | 1.40727     | .146856    | 1.60000  | .100000  | .65 | 07/07 | 66/09/07 |
| 00650 T P04 P04 MG/L         | 24     | .180428 | .046428  | .215473    | 1.19423     | .040720    | .790000  | .002000  | .61 | 09/22 | 71/02/15 |
| 00653 SOLP04-T P04 MG/L      | 11     | .054545 | .014727  | .121356    | 2.22486     | .036590    | .400000  | .000000  | .61 | 11/13 | 62/10/15 |
| 00660 ORTHOP04 P04 MG/L      | 30     | .261333 | 1.09721  | 1.04748    | 4.00822     | .191243    | 5.80000  | .000000  | .52 | 05/21 | 72/01/03 |
| 00665 PHOS-TOT MG/L P        | 90     | 2.71750 | 60.7223  | 7.79245    | 2.86751     | .821397    | 45.0000  | .000000  | .64 | 12/09 | 75/11/19 |
| 00666 PHOS-DIS MG/L P        | 18     | .010556 | .000006  | .002357    | .223299     | .000556    | .020000  | .010000  | .64 | 12/09 | 67/12/06 |
| 00671 PHOS-DIS ORTHO MG/L P  | 37     | 2.23029 | 12.0089  | 3.46539    | 1.55378     | .569707    | 10.2000  | .003000  | .73 | 03/10 | 74/03/21 |
| 00680 T ORG C C MG/L         | 48     | 4.79374 | 21.2925  | 4.61438    | .962564     | .666028    | 31.0000  | .000000  | .65 | 08/03 | 75/11/19 |
| 00681 D ORG C C MG/L         | 15     | 2.52000 | .673158  | .820462    | .325581     | .211842    | 4.30000  | 1.20000  | .65 | 07/07 | 67/12/06 |
| 00685 J. INORG C MG/L        | 24     | 6.31249 | 12.0176  | 3.46664    | .549172     | .707625    | 12.0000  | .999999  | .72 | 04/25 | 75/11/19 |
| 00690 T-CARBON C MG/L        | 24     | 10.2916 | 12.3026  | 3.50750    | .340510     | .715966    | 16.0000  | 3.00000  | .72 | 04/25 | 75/11/19 |
| 00900 TOT HARD CAC03 MG/L    | 247    | 34.9797 | 97.3206  | 9.86512    | .262024     | .627703    | 60.0000  | 5.00000  | .24 | 10/29 | 75/11/19 |
| 00902 NC HARD CAC03 MG/L     | 111    | .653152 | 2.13542  | 1.46131    | 2.23731     | .138701    | 9.00000  | .000000  | .24 | 10/29 | 75/11/19 |
| 00915 CALCIUM CA-DISS MG/L   | 115    | 10.0269 | 15.2116  | 3.90020    | .388975     | .363695    | 17.0000  | 1.00000  | .24 | 10/29 | 75/11/19 |
| 00920 MGNSIUM CAC03 MG/L     | 3      | 13.8667 | 512.303  | 22.6341    | 1.63227     | 13.0678    | 40.0000  | .500000  | .73 | 10/18 | 75/03/12 |
| 00925 MGNSIUM MG-DISS MG/L   | 112    | 1.07321 | .057462  | .239754    | .223399     | .022655    | 1.90000  | .400000  | .24 | 10/29 | 75/11/19 |
| 00930 SODIUM NA-DISS MG/L    | 125    | 4.90396 | 18.9441  | 4.35246    | .887545     | .389298    | 50.0000  | 1.00000  | .52 | 05/21 | 75/11/19 |
| 00931 SODIUM ADSITION. RATIO | 112    | .372318 | .015715  | .125360    | .336702     | .011845    | .700000  | .100000  | .24 | 10/29 | 75/11/19 |
| 00932 PERCENT SODIUM %       | 112    | 24.4911 | 54.3435  | 7.37180    | .301000     | .696570    | 41.0000  | 3.00000  | .24 | 10/29 | 75/11/19 |
| 00933 NA+K MG/L              | 1      | 6.30000 |          |            |             | 6.30000    | 6.30000  | 6.30000  | .24 | 10/29 | 24/10/29 |
| 00935 PTSSTUM K-DISS MG/L    | 125    | 1.20279 | .133167  | .364920    | .303394     | .032639    | 2.40000  | .499E-06 | .52 | 05/21 | 75/11/19 |
| 00940 CHLORIDE CL MG/L       | 259    | 7.41619 | 820.567  | 28.6455    | 3.86257     | 1.77995    | 421.000  | 1.50000  | .24 | 10/29 | 75/11/19 |
| 00945 SULFATE SO4-TOT MG/L   | 144    | 5.85413 | 19.3627  | 4.40030    | .670635     | .366692    | 44.0000  | .000000  | .24 | 10/29 | 75/11/19 |
| 00950 FLUORIDE F-DISS MG/L   | 128    | .149687 | .005694  | .075461    | .504124     | .006670    | .500000  | .000000  | .52 | 05/21 | 75/11/19 |
| 00955 SILICA DISOLVED MG/L   | 118    | 7.11940 | 1.96234  | 1.40083    | .196763     | .128457    | 12.0000  | 3.70000  | .24 | 10/29 | 75/11/19 |
| 01000 ARSENIC AS-DISS UG/L   | 23     | 9.82609 | 129.966  | 11.4004    | 1.16021     | 2.37714    | 38.0000  | .000000  | .62 | 10/01 | 75/11/19 |
| 01001 ARSENIC AS-SUSP UG/L   | 8      | .750000 | 1.92857  | 1.38873    | 1.85164     | .460990    | 4.00000  | .000000  | .74 | 02/01 | 75/11/19 |
| 01002 ARSENIC AS-TOT UG/L    | 12     | 3.99999 | 13.6364  | 3.69275    | .923188     | 1.06600    | 10.00000 | .000000  | .72 | 04/25 | 75/11/19 |
| 01005 BARIUM BA-DISS UG/L    | 11     | 15.9091 | 29.8410  | 5.46726    | .343656     | 1.64844    | 28.0000  | 9.00000  | .62 | 10/01 | 69/01/01 |
| 01010 BERYLLIUM BE-DISS UG/L | 11     | .020000 | .000040  | .006325    | .316231     | .001907    | .030000  | .010000  | .62 | 10/01 | 69/01/01 |
| 01020 BOPON B-DISS UG/L      | 11     | 28.1818 | 153.365  | 12.3841    | .439434     | 3.73393    | 54.0000  | 12.0000  | .62 | 10/01 | 69/01/01 |
| 01022 BORON B-TOT UG/L       | 7      | 55.7143 | 2195.24  | 46.8534    | .840958     | 17.7089    | 120.000  | .000000  | .74 | 02/21 | 75/03/12 |
| 01025 CADMIUM CD-DISS UG/L   | 21     | 2.23809 | 5.79048  | 2.40634    | 1.07517     | .525107    | 10.0000  | .000000  | .62 | 10/01 | 75/11/19 |
| 01026 CADMIUM CD-SUSP UG/L   | 11     | .363636 | .454546  | .674200    | 1.85405     | .203279    | 2.00000  | .000000  | .73 | 10/18 | 75/11/19 |
| 01027 CADMIUM CD-TOT UG/L    | 12     | .749999 | .749999  | .866025    | 1.15470     | .250000    | 2.00000  | .000000  | .72 | 04/25 | 75/11/19 |
| 01030 CHROMIUM CR-DISS UG/L  | 19     | 1.89474 | 8.54386  | 2.92299    | 1.54269     | .670580    | 13.0000  | .000000  | .62 | 10/01 | 75/11/19 |
| 01031 CHROMIUM CR-SUSP UG/L  | 8      | 7.37500 | 49.4107  | 7.02927    | .953122     | 2.48522    | 20.0000  | .000000  | .74 | 02/01 | 75/11/19 |
| 01032 CHROMIUM HEX-VAL UG/L  | 3      | .000000 | .000000  | .000000    | .000000     | .000000    | .000000  | .000000  | .71 | 04/27 | 72/04/25 |
| 01034 CHROMIUM CR-TOT UG/L   | 11     | 8.63636 | 29.6546  | 5.44560    | .630544     | 1.64191    | 20.0000  | .000000  | .70 | 05/08 | 75/11/19 |
| STORET DATE 76/03/11         |        |         |          |            |             |            |          |          |     |       |          |
|                              |        |         |          |            |             |            |          |          |     |       |          |

GROSS

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| PARAMETER      |          |        | NUMBER | MEAN    | VARIANCE | STAN DEV | COEF VAR | STAND ER | MAXIMUM  | MINIMUM | RE | DATE  | END DATE |
|----------------|----------|--------|--------|---------|----------|----------|----------|----------|----------|---------|----|-------|----------|
| 01035 COBALT   | CO.DISS  | UG/L   | 21     | 2.47619 | 9.36191  | 3.05972  | 1.23566  | .667686  | 12.0000  | .000000 | 62 | 10/01 | 75/11/19 |
| 01036 COBALT   | CO.SUSP  | UG/L   | 8      | .375000 | 1.12500  | 1.06065  | 2.82843  | .375000  | 3.00000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01037 COBALT   | CO.TOTAL | UG/L   | 10     | 2.20000 | 14.4000  | 3.79473  | 1.72488  | 1.20000  | 12.0000  | .000000 | 72 | 04/25 | 75/11/19 |
| 01040 COPPER   | CU.DISS  | UG/L   | 31     | 6.10444 | 75.1110  | 8.66666  | 1.41964  | 1.55658  | 44.0000  | .000000 | 52 | 05/21 | 75/11/19 |
| 01041 COPPER   | CU.SUSP  | UG/L   | 8      | 3.75000 | 11.9288  | 3.45378  | .921007  | 1.22109  | 8.00000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01042 COPPER   | CU.TOT   | UG/L   | 10     | 6.30000 | 28.6778  | 5.35516  | .850026  | 1.69345  | 14.0000  | .000000 | 72 | 04/25 | 75/11/19 |
| 01045 IRON     | FE.TOT   | UG/L   | 26     | 473.230 | 507240   | 712.208  | 1.50499  | 139.675  | 2800.00  | 1.00000 | 52 | 05/21 | 75/11/19 |
| 01046 IRON     | FE.DISS  | UG/L   | 92     | 61.6302 | 10895.1  | 104.380  | 1.69364  | 10.8823  | 610.000  | .000000 | 24 | 10/29 | 75/11/19 |
| 01049 LEAD     | PB.DISS  | UG/L   | 27     | 5.45185 | 22.2849  | 4.72068  | .806700  | .908496  | 20.0000  | .000000 | 62 | 10/01 | 75/11/19 |
| 01050 LEAD     | PB.SUSP  | UG/L   | 8      | 9.00000 | 87.1428  | 9.33503  | 1.03723  | 3.30043  | 26.0000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01051 LEAD     | PB.TOT   | UG/L   | 12     | 14.9167 | 83.9016  | 9.15978  | .614063  | 2.64420  | 29.0000  | .000000 | 72 | 04/25 | 75/11/19 |
| 01054 MANGNESE | MN.SUSP  | UG/L   | 8      | 61.3750 | 1640.84  | 40.5073  | .659996  | 14.3215  | 130.000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01055 MANGNESE | MN       | UG/L   | 22     | 42.2091 | 2230.87  | 47.2323  | 1.11901  | 10.0700  | 150.000  | .600000 | 60 | 10/12 | 75/11/19 |
| 01056 MANGNESE | MN.DISS  | UG/L   | 28     | 18.0000 | 600.888  | 24.5130  | 1.36184  | 4.63252  | 74.9999  | .000000 | 52 | 05/21 | 75/11/19 |
| 01050 MOLY     | MO.DISS  | UG/L   | 11     | 4.90909 | 6.89094  | 2.98177  | .607397  | .899037  | 11.0000  | 1.00000 | 62 | 10/01 | 69/01/01 |
| 01065 NICKEL   | NI.DISS  | UG/L   | 13     | 2.23077 | 2.19231  | 1.46064  | .663737  | .410657  | 5.00000  | .000000 | 62 | 10/01 | 69/01/01 |
| 01070 PHOS-TOT | SPEC     | UG/L P | 11     | 17.2727 | 123.018  | 11.0914  | .642132  | 3.34417  | 45.0000  | 2.00000 | 62 | 10/01 | 69/01/01 |
| 01071 SILVER   | AG.DISS  | UG/L   | 11     | .318181 | .023637  | .153742  | .483189  | .046355  | .700000  | .200000 | 62 | 10/01 | 69/01/01 |
| 01072 IRONIUM  | SR.DISS  | UG/L   | 46     | 44.9999 | 1317.51  | 36.2976  | .806614  | 5.35178  | 140.000  | .000000 | 62 | 10/01 | 75/11/19 |
| 01090 VANADIUM | V.DISS   | UG/L   | 11     | 5.18182 | 7.96365  | 2.82199  | .544595  | .850863  | 11.0000  | 1.00000 | 62 | 10/01 | 69/01/01 |
| 01090 ZINC     | ZN.DISS  | UG/L   | 20     | 32.9285 | 3415.46  | 58.4420  | 1.77481  | 11.0445  | 270.000  | .000000 | 52 | 05/21 | 75/11/19 |
| 01091 ZINC     | ZN.SUSP  | UG/L   | 8      | 43.7500 | 8541.07  | 92.4179  | 2.11241  | 32.6746  | 270.000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01092 ZINC     | ZN.TOT   | UG/L   | 13     | 61.3076 | 10290.6  | 101.442  | 1.65464  | 28.1350  | 370.000  | .000000 | 72 | 04/25 | 75/11/19 |
| 01105 ALUMINUM | AL.TOT   | UG/L   | 13     | 40.1538 | 4803.46  | 69.3070  | 1.72604  | 19.2223  | 200.000  | .000000 | 63 | 04/01 | 73/10/03 |
| 01120 LITHIUM  | LI.DISS  | UG/L   | 3      | 35.0000 | 3174.99  | 56.3471  | 1.60992  | 32.5320  | 100.0000 | .000000 | 52 | 05/21 | 66/06/03 |
| 01145 SELENIUM | SE.DISS  | UG/L   | 10     | 1.20200 | 6.61690  | 2.57233  | 2.14004  | .813444  | 7.00000  | .000000 | 62 | 10/01 | 75/11/19 |
| 01146 SELENIUM | SE.SUSP  | UG/L   | 8      | .625000 | 3.12500  | 1.76777  | 2.82843  | .625000  | 5.00000  | .000000 | 74 | 02/01 | 75/11/19 |
| 01147 SELENIUM | SE.TOT   | UG/L   | 8      | 2.12500 | 8.96213  | 2.94702  | 1.41036  | 1.05961  | 6.99999  | .000000 | 74 | 02/01 | 75/11/19 |
| 01501 ALPHA    | TOTAL    | PC/L   | 62     | .298387 | .246063  | .496047  | 1.66243  | .062995  | 2.00000  | .000000 | 60 | 03/07 | 69/01/07 |
| 01502 ALPHA-T  | ERROR    | PC/L   | 43     | .441860 | .252492  | .502486  | 1.13720  | .076628  | 1.00000  | .000000 | 61 | 11/27 | 69/01/07 |
| 01503 ALPHA    | DISOLVED | PC/L   | 61     | .057377 | .049486  | .222455  | 3.87708  | .028482  | 1.00000  | .000000 | 60 | 03/07 | 70/09/02 |
| 01504 ALPHA-D  | ERROR    | PC/L   | 43     | .395349 | .244740  | .494712  | 1.25133  | .075443  | 1.00000  | .000000 | 61 | 11/27 | 69/01/07 |
| 01505 ALPHA    | SUSP     | PC/L   | 59     | .237288 | .184103  | .429072  | 1.80823  | .055860  | 1.00000  | .000000 | 60 | 03/07 | 69/01/07 |
| 01506 ALPHA-S  | ERROR    | PC/L   | 43     | .348837 | .232558  | .482243  | 1.38243  | .073541  | 1.00000  | .000000 | 61 | 11/27 | 69/01/07 |
| 01515 ALPHA-D  | AS U-NAT | PC/L   | 46     | .352173 | .095884  | .309851  | .879258  | .045656  | 1.50000  | .100000 | 64 | 10/28 | 72/09/19 |
| 01516 ALPHA-S  | AS U-NAT | PC/L   | 30     | .513333 | .304642  | .551944  | 1.07522  | .100771  | 2.60000  | .100000 | 66 | 07/01 | 72/09/19 |
| 03501 BETA     | TOTAL    | PC/L   | 108    | 12.7389 | 265.380  | 16.2905  | 1.27000  | 1.56755  | 74.0000  | .000000 | 59 | 12/14 | 69/01/07 |
| 03502 BETA-T   | ERROR    | PC/L   | 67     | 6.91045 | 11.2949  | 3.36079  | .466335  | .410586  | 18.0000  | 1.00000 | 61 | 10/09 | 69/01/07 |
| 03503 BETA     | DISOLVED | PC/L   | 105    | 7.97619 | 67.8480  | 8.23699  | 1.10176  | .803848  | 32.0000  | .000000 | 59 | 12/14 | 69/01/07 |
| 03504 BETA-D   | ERROR    | PC/L   | 67     | 5.10448 | 5.67076  | 2.38134  | .466519  | .290926  | 12.0000  | 1.00000 | 61 | 10/09 | 69/01/07 |

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GROSS

| PARAMETER            |           |           | NUMBER    | MEAN | VARIANCE | STAN. DEV. | COEFF. VAR. | STAND. ER. | MAXIMUM | MINIMUM | PF      | DATE | END DATE |          |
|----------------------|-----------|-----------|-----------|------|----------|------------|-------------|------------|---------|---------|---------|------|----------|----------|
| 03505                | BETA      | SUSP      | PC/L      | 105  | 5.54286  | 90.9044    | 9.53438     | 1.72012    | .930460 | 50.0000 | .000000 | 49   | 12/14    | 69/01/07 |
| 03506                | BETA-S    | ERROR     | PC/L      | 67   | 4.86567  | 5.72413    | 2.39251     | .491713    | .292292 | 13.0000 | 1.00000 | 61   | 10/09    | 69/01/07 |
| 03515                | BETA-D    | AS CS137  | PC/L      | 29   | 3.11379  | 1.06052    | 1.02982     | .330728    | .191232 | 7.40000 | 2.00000 | 65   | 11/14    | 75/03/26 |
| 03516                | BETA-S    | AS CS137  | PC/L      | 29   | 1.40689  | .755674    | .869295     | .617884    | .161424 | 4.60000 | .400000 | 66   | 11/14    | 75/03/26 |
| 07012                | TRITIUM   | IN H2O    | H-3 UNITS | 97   | 105.380  | 2425.04    | 49.2447     | .467305    | 5.00004 | 225.000 | 28.6000 | 64   | 11/28    | 74/12/05 |
| 07013                | TRITIUM   | CI ERROR  | H-3 UNITS | 97   | 8.13799  | 36.6132    | 6.05088     | .743535    | .614374 | 22.0000 | 1.60000 | 64   | 11/28    | 74/12/05 |
| 07017                | TRITIUM   | TOTAL     | H-3 UNITS | 8    | 84.4998  | 458.156    | 21.4046     | .253309    | 7.56766 | 102.000 | 33.3000 | 69   | 01/29    | 69/08/13 |
| 09501                | RA-226    | TOTAL     | PC/L      | 2    | .030000  | .000200    | .014142     | .471404    | .010000 | .040000 | .020000 | 70   | 03/24    | 70/09/02 |
| 09503                | RA-226    | DISSOLVED | PC/L      | 3    | .056667  | .001433    | .037859     | .668108    | .021858 | .100000 | .030000 | 67   | 11/03    | 68/10/23 |
| 09510                | RA-226-D  | PLCHL CI  | PC/L      | 38   | 1.02631  | .000263    | .016225     | .158067    | .002632 | .200000 | .100000 | 64   | 10/28    | 72/09/14 |
| 09511                | RA-226-D  | PAUON MI  | PC/L      | 15   | .065333  | .002912    | .048087     | .736025    | .012416 | .200000 | .020000 | 60   | 10/12    | 75/03/26 |
| 13501                | SR-90     | TOTAL     | PC/L      | 10   | 1.05000  | .405000    | .777818     | .740779    | .245967 | 2.90000 | .400000 | 60   | 07/01    | 64/07/01 |
| 22703                | U-NAT     | DISSOLVED | UG/L      | 40   | .400000  | .171E-06   | .000414     | .001034    | .000065 | .400000 | .400000 | 64   | 10/28    | 69/04/22 |
| 31501                | TOT COLI  | MFIMENDO  | /100ML    | 5    | 228.400  | 53602.7    | 231.522     | 1.01367    | 103.540 | 519.999 | 49.9999 | 74   | 03/12    | 74/11/04 |
| 31503                | TOT COLI  | MFULENDO  | /100ML    | 294  | 523.357  | 2779411    | 1667.31     | 3.18579    | 97.2393 | 20000.0 | 1.00000 | 59   | 12/07    | 68/12/17 |
| 31505                | TOT COLI  | MPN CONE  | /100ML    | 12   | 2450.25  | .444E+08   | 6664.53     | 2.26033    | 1925.04 | 24000.0 | 13.0000 | 69   | 04/21    | 75/01/05 |
| 31614                | FEC COLI  | MPN       | TUHECODE  | 7    | 42.4286  | 3361.62    | 57.9795     | 1.36652    | 21.9142 | 170.000 | 2.00000 | 73   | 10/18    | 75/01/05 |
| 31616                | FEC COLI  | MPN-FCBH  | /100ML    | 11   | 83.9998  | 46607.5    | 215.888     | 2.57010    | 65.0926 | 732.999 | .000000 | 74   | 03/12    | 75/11/19 |
| 31679                | FECSTREP  | MF H-ENT  | /100ML    | 12   | 68.1665  | 12835.8    | 113.309     | 1.66223    | 32.7093 | 399.999 | 2.00000 | 74   | 03/12    | 75/11/19 |
| 32000                | SAMPLE    | SIZE      | LITERS    | 25   | 4364.04  | 2271786    | 1507.24     | .345378    | 301.449 | 10825.0 | 3785.00 | 66   | 11/14    | 69/01/09 |
| 32001                | SAMPLE    | SIZE      | GAL       | 84   | 3048.12  | 5041346    | 2245.29     | .736616    | 244.982 | 9050.00 | 1000.00 | 60   | 03/11    | 69/01/09 |
| 32003                | CCE AND   | CAE       | UG/L      | 83   | 252.880  | 15306.3    | 123.718     | .489239    | 13.5799 | 709.000 | 90.0000 | 60   | 03/11    | 69/01/09 |
| 32004                | CAE       |           | UG/L      | 83   | 167.386  | 9680.91    | 98.3916     | .587814    | 10.7999 | 539.000 | 50.0000 | 60   | 03/11    | 69/01/09 |
| 32005                | CCE       |           | UG/L      | 85   | 85.7176  | 1125.42    | 33.5473     | .391370    | 3.63872 | 207.000 | 23.0000 | 60   | 03/11    | 69/01/09 |
| 32021                | ETHER     | INSOLUBL  | UG/L      | 28   | 3.60714  | 7.72884    | 2.78008     | .770715    | .525385 | 11.0000 | .000000 | 60   | 03/11    | 63/09/27 |
| 32022                | WATER     | SOLUBLES  | UG/L      | 28   | 18.7857  | 63.5825    | 7.97386     | .424464    | 1.50692 | 35.0000 | 5.00000 | 60   | 03/11    | 63/09/27 |
| 32023                | STRONG    | ACIDS     | UG/L      | 28   | 7.10714  | 14.9140    | 3.86187     | .543379    | .729825 | 17.0000 | 1.00000 | 60   | 03/11    | 63/09/27 |
| 32024                | WEAK      | ACIDS     | UG/L      | 28   | 6.89286  | 13.2644    | 3.64476     | .409855    | .688798 | 20.0000 | 3.00000 | 60   | 03/11    | 63/09/27 |
| 32025                | BASES     |           | UG/L      | 26   | 1.32143  | .522498    | .722833     | .547009    | .136603 | 4.00000 | .000000 | 60   | 03/11    | 63/09/27 |
| 32026                | NEUTRALS  |           | UG/L      | 28   | 19.0000  | 40.3704    | 6.35377     | .334409    | 1.20075 | 36.0000 | 8.00000 | 60   | 03/11    | 63/09/27 |
| 32027                | ALIPHA-   | TICS      | UG/L      | 28   | 1.53571  | 1.07275    | 1.03574     | .674433    | .195736 | 4.00000 | .000000 | 60   | 03/11    | 63/09/27 |
| 32028                | AROMATIC  |           | UG/L      | 28   | 1.35714  | .534393    | .731022     | .538548    | .138150 | 3.00000 | .000000 | 60   | 03/11    | 63/09/27 |
| 32029                | OXYGEN-   | ATES      | UG/L      | 28   | 15.2143  | 25.1377    | 5.01375     | .329542    | .947510 | 28.0000 | 6.00000 | 60   | 03/11    | 63/09/27 |
| 32217                | CHLORPHYL | A         | UG/L      | 3    | 9.86666  | .443726    | .666127     | .067513    | .384589 | 19.3000 | 9.10000 | 73   | 06/20    | 73/11/03 |
| 32230                | CHLORPHYL | A         | MG/L      | 2    | .040000  | .003200    | .056569     | 1.41421    | .040000 | .080000 | .000000 | 75   | 01/05    | 75/03/12 |
| 32231                | CHLORPHYL | B         | MG/L      | 3    | .166667  | .083333    | .288675     | 1.73205    | .166667 | .500000 | .000000 | 75   | 01/05    | 75/06/25 |
| 32232                | CHLORPHYL | C         | MG/L      | 2    | .000000  | .000000    | .000000     | .000000    | .000000 | .000000 | .000000 | 75   | 01/05    | 75/03/12 |
| 34260                | MBAS      |           | MG/L      | 58   | .040000  | .000477    | .021845     | .546123    | .002868 | .130000 | .000000 | 63   | 09/03    | 71/11/08 |
| 34330                | ALDRIN    | WHL SMPL  | UG/L      | 15   | .000000  | .000000    | .000000     | .000000    | .000000 | .000000 | .000000 | 60   | 07/12    | 67/09/29 |
| 39340                | BHC       | WHL SMPL  | UG/L      | 15   | .001733  | .000032    | .005663     | 3.26696    | .001462 | .022000 | .000000 | 60   | 07/12    | 67/09/29 |
| STORET DATE 76/03/11 |           |           |           |      |          |            |             |            |         |         |         |      |          |          |

STORET DATE 76/03/11

GROSS

| PARAMETER       | UNIT              | NUMBER | MEAN    | VARIANCE | STAN. DEV. | COEFF. VAR. | STAND. ER. | MAXIMUM | MINIMUM  | BE | DATE  | END DATE |
|-----------------|-------------------|--------|---------|----------|------------|-------------|------------|---------|----------|----|-------|----------|
| 39350 CHLORDANE | WHL SMPL UG/L     | 1      | .000000 |          |            |             |            | .000000 | .000000  | 55 | 09/13 | 66/09/13 |
| 39360 DDT       | WHL SMPL UG/L     | 15     | .044250 | .022122  | .148736    | 3.36127     | .037184    | .500000 | .000000  | 60 | 07/12 | 67/09/29 |
| 39365 DDE       | WHL SMPL UG/L     | 15     | .000533 | .409E-06 | .000640    | 1.19989     | .000165    | .002000 | .000000  | 60 | 07/12 | 67/09/29 |
| 39370 DDT       | WHL SMPL UG/L     | 15     | .003667 | .000050  | .007058    | 1.92480     | .001822    | .027000 | .000000  | 60 | 07/12 | 67/09/29 |
| 39380 DIELDORIN | WHL SMPL UG/L     | 15     | .009200 | .000051  | .007123    | .774287     | .001839    | .024000 | .001000  | 60 | 07/12 | 67/09/29 |
| 39390 ENDORIN   | WHL SMPL UG/L     | 15     | .000067 | .666E-07 | .000258    | 3.87298     | .000067    | .001000 | .000000  | 60 | 07/12 | 67/09/29 |
| 39410 HCHLR     | WHL SMPL UG/L     | 15     | .000000 | .000000  | .000000    |             | .000000    | .000000 | .000000  | 60 | 07/12 | 67/09/29 |
| 39420 HCHLR-EP  | WHL SMPL UG/L     | 15     | .000000 | .000000  | .000000    |             | .000000    | .000000 | .000000  | 60 | 07/12 | 67/09/29 |
| 50051 FLOW      | RATE INST MGD     | 12     | .223000 | .002243  | .047359    | .212371     | .013671    | .296000 | .150000  | 73 | 04/18 | 74/03/21 |
| 50053 CONDUIT   | FLOW-MGD MONTHLY  | 12     | .224416 | .002226  | .047185    | .210256     | .013621    | .280000 | .152000  | 73 | 04/18 | 74/03/21 |
| 60050 ALGAE     | TOTAL /ML         | 87     | 3116.67 | .194E+08 | 4410.02    | 1.41498     | 472.804    | 32100.0 | .000000  | 61 | 10/04 | 75/11/19 |
| 60100 ALGAE     | CUC BG /ML        | 78     | 57.0513 | .30093E  | 173.476    | 3.04070     | 19.6422    | 1240.00 | .000000  | 61 | 10/04 | 65/07/07 |
| 60150 ALGAE     | FIL BG /ML        | 78     | 419.743 | .128E+08 | 3581.13    | 8.53171     | 405.483    | 31640.0 | .000000  | 61 | 10/04 | 65/07/07 |
| 60200 ALGAE     | CUC GRN /ML       | 78     | 479.103 | .312521  | 559.036    | 1.16684     | 63.2944    | 3350.00 | .000000  | 61 | 10/04 | 65/07/07 |
| 60250 ALGAE     | FIL GRN /ML       | 78     | 1.28205 | .45.0882 | 6.71478    | 5.23753     | .760299    | 40.0000 | .000000  | 61 | 10/04 | 65/07/07 |
| 60300 ALGAE     | FLAG-GRN /ML      | 78     | 311.923 | .589967  | 768.093    | 2.46245     | 86.9694    | 4470.00 | .000000  | 61 | 10/04 | 65/07/07 |
| 60350 ALGAE     | FLAG-UTH /ML      | 78     | 69.7436 | .122675  | 110.759    | 1.58808     | 12.5409    | 510.000 | .000000  | 61 | 10/04 | 65/07/07 |
| 60390 DIATOMS   | DOM SPEC % OF TOT | 46     | 39.3895 | .166.196 | 12.8917    | .327453     | 1.90078    | 81.0000 | .17.0000 | 61 | 10/04 | 65/07/07 |
| 60400 DIATOMS   | CENTRIC /ML       | 78     | 1041.67 | .377927E | 1944.04    | 1.86627     | 220.119    | 11200.0 | .000000  | 61 | 10/04 | 65/07/07 |
| 60600 DIATOMS   | PENNATE /ML       | 78     | 242.820 | .75819E  | 275.534    | 1.13472     | 31.1981    | 1430.00 | .000000  | 61 | 10/04 | 65/07/07 |
| 60820 PROTOZOA  | TOTAL /ML         | 31     | 2.25806 | .18.0645 | 4.25024    | 1.88225     | .763365    | 10.0000 | .000000  | 61 | 10/04 | 63/02/07 |
| 60850 ROTIFERS  | TOTAL /LITER      | 39     | 368.128 | .270880  | 520.461    | 1.41380     | 83.3405    | 1910.00 | .000000  | 61 | 10/04 | 63/04/16 |
| 60900 CRUSTACEA | TOTAL /LITER      | 39     | 5.47436 | .115.552 | 10.7495    | 1.79927     | 1.72130    | 51.0000 | .000000  | 61 | 10/04 | 63/04/16 |
| 60950 NEMATOES  | TOTAL /LITER      | 39     | .847436 | .11.1997 | 3.34660    | 3.72907     | .535845    | 15.0000 | .000000  | 61 | 10/04 | 63/04/16 |
| 60990 ZOOPLANK  | OTHER /LITER      | 39     | .102564 | .147098  | .383534    | 3.73946     | .061415    | 2.00000 | .000000  | 61 | 10/04 | 63/04/16 |
| 61450 BECK      | BIOLOGIC INDEX    | 26     | 9.34615 | .66.2354 | 8.13851    | .870787     | 1.59509    | 27.0000 | .000000  | 60 | 11/30 | 69/04/09 |
| 70299 RES-SUSP  | AT 180 C MG/L     | 2      | 13.0000 | .2.00024 | 1.41430    | .108792     | 1.00006    | 14.0000 | 12.0000  | 73 | 06/22 | 73/10/03 |
| 70300 RESIDUE   | DISS-180 C MG/L   | 86     | 56.5427 | .153.377 | 12.3646    | .219030     | 1.33546    | 83.0000 | 24.0000  | 24 | 10/29 | 75/11/19 |
| 70301 DISS SOL  | SUM MG/L          | 110    | 51.8631 | .108.398 | 10.4115    | .200749     | .992694    | 73.0000 | 25.0000  | 24 | 10/29 | 75/11/19 |
| 70302 DISS SOL  | TONS/DAY          | 89     | 3124.67 | .4281870 | 2069.27    | .662235     | 219.342    | 12400.0 | .600000  | 64 | 07/03 | 75/11/19 |
| 70303 DISS SOL  | TONS PER ACRE-FT  | 112    | .074553 | .000281  | .016761    | .224813     | .001584    | .110000 | .030000  | 24 | 10/29 | 75/11/19 |
| 70507 PHOS-T    | ORTH0 MG/L P      | 40     | .050950 | .006457  | .080358    | 1.57720     | .012706    | .449999 | .007000  | 72 | 01/03 | 75/11/19 |
| 71846 AMMONIA   | DISS-NH4 MG/L     | 13     | .052308 | .000436  | .020876    | .399141     | .005791    | .090000 | .010000  | 70 | 05/08 | 72/01/03 |
| 71850 NITRATE   | TOT-N03 MG/L      | 3      | .566667 | .173333  | .416333    | .734705     | .240370    | .900000 | .100000  | 65 | 05/08 | 67/03/28 |
| 71851 NITRATE   | DISS-N03 MG/L     | 91     | .566699 | .359935  | .599946    | 1.05867     | .062891    | 2.90000 | .000000  | 24 | 10/29 | 72/06/20 |
| 71856 NITRITE   | DISS-N02 MG/L     | 18     | .030000 | .000518  | .022752    | .758387     | .005363    | .060000 | .000000  | 69 | 06/12 | 72/01/03 |
| 71886 TOTAL P   | AS P04 MG/L       | 23     | .093478 | .003142  | .056053    | .599634     | .011688    | .240000 | .000000  | 71 | 04/01 | 75/06/25 |
| 71887 TOTAL N   | AS N03 MG/L       | 24     | 2.91666 | .518880  | .720319    | .246967     | .147035    | 4.40000 | 1.90000  | 73 | 01/26 | 75/11/19 |
| 71890 MERCURY   | HG DISS UG/L      | 8      | .025000 | .002143  | .046291    | 1.85164     | .016366    | .100000 | .000000  | 74 | 02/01 | 75/11/19 |
| 71895 MERCURY   | HG SUSP UG/L      | 7      | .042857 | .006190  | .078660    | 1.83586     | .029738    | .200000 | .000000  | 74 | 02/01 | 75/11/19 |

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GROSS

APPENDIX C  
FLORIDA STATE WATER QUALITY STANDARDS

FAC 17-3

POLLUTION OF WATERS

- 1.0 Minimum Conditions: All waters shall be free from:
  - 1.1 Settleable Substances
  - 1.2 Floating Substances
  - 1.3 Deleterious Substances
  - 1.4 Toxic Substances
- 2.0 Quality Degrading Substances
  - 2.1 Sulfates
  - 2.2 Sulfides
  - 2.3 Nickel 0.002
  - 2.4 Aluminum
  - 2.5 Free Mineral Acids
  - 2.6 Nitrates 0.27
  - 2.7 Phosphates 0.18
  - 2.8 Potassium 1.20
  - 2.9 Others 1.2
- 3.0 Specific Materials/Concentrations
  - 3.1 Fluorides (1.4-1.6 mg/l F<sup>-</sup>,  
Public drinking waters) --
  - 3.2 Fluorides (10.0 mg/l F<sup>-</sup>,  
elsewhere) 5.05
  - 3.3 Chlorides (250 mg/l Cl<sup>-</sup> fresh,  
10%† others)
  - 3.4 Turbidity (50 JTU†) 19
  - 3.5 Dissolved Oxygen
    - Cl I (4† and 5 mg/l)
    - Cl II (" " " " )
    - Cl III (" " " " )
    - Cl IV (4† without prior info.)
    - Cl V (" " " " " )
  - 3.6 BOD Meet DO Levels and No Nuisance 7.1
  - 3.7 Dissolved Solids ≤ 500 mg/l mo. av.  
or 1000 mg/l

|      |                                                                |        |
|------|----------------------------------------------------------------|--------|
| 3.8  | Specific Conductance $\leq$ 500 $\mu$ mhos/cm<br>or 100% incr. | 84     |
| 3.9  | Radiation <1000 $\mu$ curies                                   |        |
| 3.10 | Cyanide/Cyanates None Detectable                               |        |
| 3.11 | Copper $\leq$ 0.5 mg/l                                         | 0.006  |
| 3.12 | Zinc $\leq$ 1.0 mg/l                                           | 0.06   |
| 3.13 | Chromium <sup>(+6)</sup> $\leq$ 0.5 mg/l                       | 0      |
| 3.14 | Chromium <sup>(7)</sup> $\leq$ 1.0 mg/l effluent               |        |
| 3.15 | Chromium $\leq$ 0.05 mg/l after mixing                         | 0.009  |
| 3.16 | Phenolics $\leq$ 0.001 mg/l                                    | --     |
| 3.17 | Lead $\leq$ 0.05 mg/l                                          | 0.015  |
| 3.18 | Iron $\leq$ 0.30 mg/l                                          | 0.473  |
| 3.19 | Arsenic $\leq$ 0.05 mg/l                                       | 0.004  |
| 3.20 | Oils & Grease $\leq$ 15.0 mg/l, no vis. taste,<br>odor         | --     |
| 3.21 | pH $\pm$ 1 unit normal $\geq$ 6 $\leq$ 8.5                     | 7.1    |
| 3.22 | Detergents $\leq$ 0.5 mg/l                                     | --     |
| 3.23 | Mercury - None Detectable                                      | 0.0001 |
| 4.0  | Heat Thorough Study                                            |        |
| 4.1  | Freshwater Stream $\leq$ 5°F if ambient<br>(90°F max.)         | 52.7   |
| 4.2  | Freshwater Stream $\leq$ 3°F if ambient<br>(92°F max.)         | --     |