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KAY IVEY
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Alabama Department of Environmental Management
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JUL 2 3 2020

MS SUSAN B COMENSKY
VP ENVIRONMENTAL AFFAIRS
ALABAMA POWER COMPANY
BARRY STEAM ELECTRIC PLANT
POST OFFICE BOX 2641 BIN 12N-0830
BIRMINGHAM ALABAMA 35291

RE: DRAFT PERMIT
NPDES PERMIT NUMBER AL0002879

Dear Ms. Comensky:

Transmitted herein is a draft of the referenced permit.

We would appreciate your comments on the permit within **30 days** of the date of this letter. Please direct any comments of a technical or administrative nature to the undersigned.

By copy of this letter and the draft permit, we are also requesting comments within the same time frame from EPA.

Our records indicate that you are currently utilizing the Department's web-based electronic environmental (E2) reporting system for submittal of discharge monitoring reports (DMRs). Your E2 DMRs will automatically update on the effective date of this permit, if issued.

The Alabama Department of Environmental Management encourages you to voluntarily consider pollution prevention practices and alternatives at your facility. Pollution Prevention may assist you in complying with effluent limitations, and possibly reduce or eliminate monitoring requirements.

If you have questions regarding this permit or monitoring requirements, please contact Theo Pinson by e-mail at **tpinson@adem.alabama.gov** or by phone at **(334) 274-4202.**

Sincerely,

Scott Ramsey, Chief
Industrial Section
Industrial/Municipal Branch
Water Division

Enclosure: Draft Permit

pc via website:
Montgomery Field Office
EPA Region IV
U.S. Fish & Wildlife Service
AL Historical Commission
Advisory Council on Historic Preservation
Department of Conservation and Natural Resources

ADEM
Alabama Department of Environmental Management

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

PERMITTEE:	ALABAMA POWER COMPANY BARRY STEAM ELECTRIC PLANT
FACILITY LOCATION:	15300 HIGHWAY 43 NORTH BUCKS, AL 36512
PERMIT NUMBER:	AL0002879
RECEIVING WATERS:	001: MOBILE RIVER 002: MOBILE RIVER 003: MOBILE RIVER 004: MOBILE RIVER 010: MOBILE RIVER 011: MOBILE RIVER 012: MOBILE RIVER 013: MOBILE RIVER 019: MOBILE RIVER 020: MOBILE RIVER 021: MOBILE RIVER

*In accordance with and subject to the provisions of the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§1251-1388 (the "FWPCA"), the Alabama Water Pollution Control Act, as amended, **Code of Alabama 1975**, §§ 22-22-1 to 22-22-14 (the "AWPCA"), the Alabama Environmental Management Act, as amended, **Code of Alabama 1975**, §§22-22A-1 to 22-22A-17, and rules and regulations adopted thereunder, and subject further to the terms and conditions set forth in this permit, the Permittee is hereby authorized to discharge into the above-named receiving waters.*

ISSUANCE DATE:

EFFECTIVE DATE:

EXPIRATION DATE:

Draft

Alabama Department of Environmental Management

INDUSTRIAL SECTION
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT
TABLE OF CONTENTS

PART I DISCHARGE LIMITATIONS, CONDITIONS, AND REQUIREMENTS

A. DISCHARGE LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0011: Once through cooling water, cooling tower blowdown, and fire protection system waters 3/ 6/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Temperature, Water Deg. Fahrenheit	-	-	-	108.0 F	112.0 F 4/	Continuous 5/	Recorder	April - November
Temperature, Water Deg. Fahrenheit	-	-	-	84.5 F	94.5 F 4/	Continuous 5/	Recorder	December - March
Temperature, Water Deg. Fahrenheit Intake from Stream	-	-	-	REPORT F	REPORT F 4/	Continuous 5/	Recorder	-
pH	-	-	6.0 S.U.	-	8.5 S.U.	Monthly	Grab	-
Zinc Total Recoverable 8/	-	-	-	-	REPORT mg/l	Monthly	Grab	-
Copper Total Recoverable 8/	-	-	-	-	REPORT mg/l	Monthly	Grab	-
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Calculated 7/	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Not withstanding the provisions of Part III.H.9, here and after "Daily Maximum" as it applies to temperature means the maximum daily average value.

5/ "Continuous" as it applies to temperature shall mean either a minimum of one grab sample taken every 4 hours or a recorded measurement taken at least every 15 minutes.

6/ The temperature and pH samples shall be collected at either the south bridge in the discharge canal or after comingling of all wastewaters immediately after discharge into the canal. The zinc, copper, and chlorine samples shall be collected as applicable after comingling of all wastewaters immediately after discharge into the canal.

7/ Flow is to be calculated using pump logs and hours of operation or alternative methods specifically approved by the Department.

8/ Monitoring for zinc and/or copper is not applicable unless cooling water additives containing zinc and/or copper are used during the monitoring period in either the once through cooling system or the cooling tower system. To certify no process addition, *9 should be reported for zinc and/or copper.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0011 (continued): Once through cooling water, cooling tower blowdown, and fire protection system waters 3/ 4/ 5/ 6/ 7/ 8/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Chlorine, Total Residual 9/ 10/	-	-	-	0.03 mg/l	0.04 mg/l	Daily	Grab	-
Chlorination Duration 9/	-	120.0 min/day	-	-	-	Daily	Measured	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Not withstanding the provisions of Part III.H.9, here and after "Daily Maximum" as it applies to temperature means the maximum daily average value.

5/ "Continuous" as it applies to temperature shall mean either a minimum of one grab sample taken every 4 hours or a recorded measurement taken at least every 15 minutes.

6/ The temperature and pH samples shall be collected at either the south bridge in the discharge canal or after comingling of all wastewaters immediately after discharge into the canal. The zinc, copper, and chlorine samples shall be collected as applicable after comingling of all wastewaters immediately after discharge into the canal.

7/ Flow is to be calculated using pump logs and hours of operation or alternative methods specifically approved by the Department.

8/ Monitoring for zinc and/or copper is not applicable unless cooling water additives containing zinc and/or copper are used during the monitoring period in either the once through cooling system or the cooling tower system. To certify no process addition, *9 should be reported for zinc and/or copper.

9/ Total residual chlorine may not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the permitting authority that discharge for more than two hours is required for macroinvertebrate control. Simultaneous multi-unit chlorination is permitted. Sampling is required only during chlorination.

10/ A measurement of Total Residual Chlorine below 0.05 mg/L shall be considered in compliance with the permit limitations and should be reported as NODI=B or *B on the discharge monitoring report.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN01A1: Internal outfall to DSN001 for cooling tower blowdown 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Totalizer	-
Chlorine, Free Available	-	-	-	0.2 mg/l	0.5 mg/l	2X Monthly 5/	Grab	-
Chlorination Duration 4/	-	120.0 min/day	-	-	-	Daily	Measured	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day and not more than one unit may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the Department that the units in a particular location cannot operate at or below this level of chlorination.

5/ Twice per month monitoring shall be conducted so that two samples are collected in the same month at least 10 days apart.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN01AY: Internal outfall to DSN001 for cooling tower blowdown 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Chromium, Total (As Cr) 4/	-	-	-	0.2 mg/l	0.2 mg/l	Annually	Composite	-
Zinc, Total (As Zn) 4/	-	-	-	1.0 mg/l	1.0 mg/l	Annually	Composite	-
Priority Pollutants Total Effluent 5/ 6/	-	-	-	-	0 ug/l	Annually	Grab	-
Annual Certification Statement 5/	-	-	-	-	0 Yes=0; No=1	Annually	Not Applicable	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Monitoring and limitations for chromium and/or zinc are not applicable unless maintenance chemicals containing chromium and/or zinc are added to the cooling tower. *9 should be reported for both chromium and/or zinc to certify the non-use of maintenance chemicals containing either chromium and/or zinc.

5/ Priority Pollutants, except Zinc and Chromium, as defined by Appendix A of 40 CFR Part 423. Monitoring and limitations are not applicable unless maintenance chemicals containing any priority pollutants are added to the tower. A certification eDMR is now required to be submitted electronically instead of a separate statement if the Permittee is certifying the non-use of priority pollutants. To submit a certification statement, the certification statement parameter code should be marked "0" if maintenance chemicals containing any priority pollutants are not added to the tower during the monitoring period and the priority pollutants parameter code should be marked "*9". Alternately, compliance with these limitations may be determined by engineering calculations which demonstrate that the regulated pollutants added to the system for cooling tower maintenance are not detectable in the final discharge. Should the Permittee elect to demonstrate compliance by engineering calculations, "*9" should be marked for both the priority pollutants and the certification statement parameter code. The engineering calculations shall be made available to the Department upon request.

6/ 0 ug/l is defined as "Below Detectable Amount". "Detectable Amount" is defined as detectable using the lowest level MDL method listed in 40 CFR Part 136.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0021: Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation 3/ 5/ 6/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/ 4/	Sample Type	Seasonal
Turbidity	-	-	-	REPORT NTU	REPORT NTU	2X Monthly	Measured	-
pH	-	-	6.0 S.U.	-	9.0 S.U.	2X Monthly	Grab	-
Solids, Total Suspended	-	-	-	19.0 mg/l	58.8 mg/l	2X Monthly	Grab	-
Oil & Grease	-	-	-	9.0 mg/l	13.0 mg/l	2X Monthly	Grab	-
Nitrogen, Organic Total (As N)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	April - October
Nitrogen, Ammonia Total (As N)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	-
Nitrogen, Kjeldahl Total (As N)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	April - October
Nitrite Plus Nitrate Total 1 Det. (As N)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	April - October

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THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Twice per month monitoring shall be conducted so that two samples are collected in the same month at least 10 days apart.

5/ Following the Permittee's submission of notification of completion of dewatering activities, the Permittee may submit a request to the Water Division to discontinue all monitoring requirements applicable to Outfall DSN0021 and Outfall DSN002T (Permit Pages 5, 6, 7, & 8). Monitoring may be discontinued after the Permittee receives written confirmation from the Water Division that the aforementioned monitoring requirements are no longer applicable. Once the Permittee receives approval, the requirements of Outfall DSN021S will become applicable. After monitoring is no longer applicable, *9 should be reported on the eDMR.

6/ See Part IV.G for Ash Pond Dewatering Plan Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0021 (continued): Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation 3/ 5/ 6/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/ 4/**	**Sample Type**	**Seasonal**
Phosphorus, Total (As P)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	April - October
Cadmium, Total (As Cd) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Chromium, Total (As Cr) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Copper, Total (As Cu) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Lead, Total (As Pb) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Nickel, Total (As Ni) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Zinc, Total (As Zn) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Selenium, Total (As Se) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Twice per month monitoring shall be conducted so that two samples are collected in the same month at least 10 days apart.

5/ Following the Permittee's submission of notification of completion of dewatering activities, the Permittee may submit a request to the Water Division to discontinue all monitoring requirements applicable to Outfall DSN0021 and Outfall DSN002T (Permit Pages 5, 6, 7, & 8). Monitoring may be discontinued after the Permittee receives written confirmation from the Water Division that the aforementioned monitoring requirements are no longer applicable. Once the Permittee receives approval, the requirements of Outfall DSN021S will become applicable. After monitoring is no longer applicable, *9 should be reported on the eDMR.

6/ See Part IV.G for Ash Pond Dewatering Plan Requirements.

7/ For the purpose of demonstration of compliance with this parameter, "Total" and "Total Recoverable" shall be considered equivalent.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0021 (continued): Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation 3/ 5/ 6/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/ 4/	Sample Type	Seasonal
Arsenic, Trivalent Dissolved	-	-	-	145.2 ug/l	REPORT ug/l	2X Monthly	Grab	-
Flow, In Conduit or Thru Treatment Plant 8/	REPORT MGD	REPORT MGD	-	-	-	Daily	Calculated	-
Chlorine, Total Residual	-	-	-	0.7 mg/l	1.0 mg/l	2X Monthly	Grab	-
E. Coli	-	-	-	REPORT col/100mL	REPORT col/100mL	2X Monthly	Grab	-
Solids, Total Dissolved	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
Mercury Total Recoverable 7/ 9/	-	-	-	0.012 ug/l	2.4 ug/l	2X Monthly	Grab	-
Iron, Total (As Fe) 7/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-
BOD, Carbonaceous 05 Day, 20C	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	-
Hydrazine 10/	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Twice per month monitoring shall be conducted so that two samples are collected in the same month at least 10 days apart.

5/ Following the Permittee's submission of notification of completion of dewatering activities, the Permittee may submit a request to the Water Division to discontinue all monitoring requirements applicable to Outfall DSN0021 and Outfall DSN002T (Permit Pages 5, 6, 7, & 8). Monitoring may be discontinued after the Permittee receives written confirmation from the Water Division that the aforementioned monitoring requirements are no longer applicable. Once the Permittee receives approval, the requirements of Outfall DSN021S will become applicable. After monitoring is no longer applicable, *9 should be reported on the eDMR.

6/ See Part IV.G for Ash Pond Dewatering Plan Requirements.

7/ For the purpose of demonstration of compliance with this parameter, "Total" and "Total Recoverable" shall be considered equivalent.

8/ Flow is to be calculated from the daily recorded measurements of the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system.

9/ EPA Methods 245.7, 1631E, 1669, or alternative methods specifically approved by the Department, shall be used for the analysis of this parameter.

10/ Hydrazine monitoring is only required when boiler wastewater discharge occurs during the monitoring period. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN002T: Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation 3/ 4/ 5/ 6/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Toxicity, Ceriodaphnia Chronic	-	0 pass(0)/fail(1)	-	-	-	Quarterly	Composite	-
Toxicity, Pimephales Chronic	-	0 pass(0)/fail(1)	-	-	-	Quarterly	Composite	-

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THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.D for Chronic Effluent Toxicity Limitations and Biomonitoring Requirements.

5/ Following the Permittee's submission of notification of completion of dewatering activities, the Permittee may submit a request to the Water Division to discontinue all monitoring requirements applicable to Outfall DSN0021 and Outfall DSN002T (Permit Pages 5, 6, 7, & 8). Monitoring may be discontinued after the Permittee receives written confirmation from the Water Division that the aforementioned monitoring requirements are no longer applicable. Once the Permittee receives approval, the requirements of Outfall DSN021S will become applicable. After monitoring is no longer applicable, *9 should be reported on the eDMR.

6/ See Part IV.G for Ash Pond Dewatering Plan Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN02A1:
DSN03A1: Internal outfall to the low volume wastewater system for sanitary wastewaters 3/ 5/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/ 4/	Sample Type	Seasonal
Solids, Total Suspended	-	-	-	30.0 mg/l	45.0 mg/l	2X Monthly	Composite	-
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	2X Monthly	Instantaneous	-
BOD, Carbonaceous 05 Day, 20C	-	-	-	25.0 mg/l	40.0 mg/l	2X Monthly	Composite	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Twice per month monitoring shall be conducted so that two samples are collected in the same month at least 10 days apart.

5/ The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in final discharge location for the low volume wastewater system. The Permittee shall report monitoring results on the internal outfall eDMR which corresponds with the outfall utilized by the low volume wastewater system. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN02BY:
DSN03BY: Internal outfall to the low volume wastewater system for pretreated chemical metal cleaning wastes 3/ 7/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum 5/	Monthly Average 5/	Daily Maximum 5/	Measurement Frequency 2/	Sample Type	Seasonal
pH	-	-	6.0 S.U.	-	10.5 S.U.	Daily	Grab	-
Copper, Total (As Cu)	-	-	-	1.0 mg/l	1.0 mg/l	Daily	Composite 6/	-
Iron, Total (As Fe)	-	-	-	1.0 mg/l	1.0 mg/l	Daily	Composite 6/	-
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Daily	Instantaneous	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Chemical metal cleaning wastes means any wastewater resulting from chemical metal cleaning as defined and interpreted by EPA in 40 CFR Part 423.

5/ If more than one sampling event occurs during the annual reporting period, the greatest monthly average recorded during the annual monitoring period should be reported as the monthly average. The greatest daily maximum recorded during the annual monitoring period should be reported as the daily maximum. The smallest daily minimum recorded during the annual monitoring period should be reported as the daily minimum.

6/ Sample shall be taken using equal volume aliquots taken at 15 minute intervals over the time of the discharge.

7/ The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in final discharge location for the low volume wastewater system. The Permittee shall report monitoring results on the internal outfall eDMR which corresponds with the outfall utilized by the low volume wastewater system. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN02C1:
DSN03C1: Internal outfall to the low volume wastewater system for cooling tower blowdown from the Carbon Capture Process 3/ 5/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type**	**Seasonal**
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Monthly	Calculated	-
Chlorine, Free Available	-	-	-	0.2 mg/l	0.5 mg/l	Monthly	Grab	-
Chlorination Duration 4/	-	120.0 min/day	-	-	-	Daily	Measured	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day and not more than one unit may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the Department that the units in a particular location cannot operate at or below this level of chlorination.

5/ The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in final discharge location for the low volume wastewater system. The Permittee shall report monitoring results on the internal outfall eDMR which corresponds with the outfall utilized by the low volume wastewater system. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN02CY:
DSN03CY: Internal outfall to the low volume wastewater system for cooling tower blowdown from the Carbon Capture Process 3/ 7/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type**	**Seasonal**
Chromium, Total (As Cr) 4/	-	-	-	0.2 mg/l	0.2 mg/l	Annually	Composite	-
Zinc, Total (As Zn) 4/	-	-	-	1.0 mg/l	1.0 mg/l	Annually	Composite	-
Priority Pollutants Total Effluent 5/ 6/	-	-	-	-	0 ug/l	Annually	Grab	-
Annual Certification Statement 5/	-	-	-	-	0 Yes=0; No=1	Annually	Not Applicable	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Monitoring and limitations for chromium and/or zinc are not applicable unless maintenance chemicals containing chromium and/or zinc are added to the cooling tower. *9 should be reported for both chromium and/or zinc to certify the non-use of maintenance chemicals containing either chromium and/or zinc.

5/ Priority Pollutants, except Zinc and Chromium, as defined by Appendix A of 40 CFR Part 423. Monitoring and limitations are not applicable unless maintenance chemicals containing any priority pollutants are added to the tower. A certification eDMR is now required to be submitted electronically instead of a separate statement if the Permittee is certifying the non-use of priority pollutants. To submit a certification statement, the certification statement parameter code should be marked "0" if maintenance chemicals containing any priority pollutants are not added to the tower during the monitoring period and the priority pollutants parameter code should be marked "*9". Alternately, compliance with these limitations may be determined by engineering calculations which demonstrate that the regulated pollutants added to the system for cooling tower maintenance are not detectable in the final discharge. Should the Permittee elect to demonstrate compliance by engineering calculations, "*9" should be marked for both the priority pollutants and the certification statement parameter code. The engineering calculations shall be made available to the Department upon request.

6/ 0 ug/l is defined as "Below Detectable Amount". "Detectable Amount" is defined as detectable using the lowest level MDL method listed in 40 CFR Part 136.

7/ The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in final discharge location for the low volume wastewater system. The Permittee shall report monitoring results on the internal outfall eDMR which corresponds with the outfall utilized by the low volume wastewater system. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

Beginning as soon as possible but no later than December 31, 2023 and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN02E1:
DSN03E1: Internal outfall to the low volume wastewater system for FGD Wastewaters which may include bottom ash transport waters utilized in the FGD scrubber 3/ 4/ 5/ 7/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Nitrite Plus Nitrate Total 1 Det. (As N)	-	-	-	4.4 mg/l	17.0 mg/l	Monthly	Grab	-
Arsenic, Total (As As)	-	-	-	8 ug/l	11 ug/l	Monthly	Grab	-
Selenium, Total (As Se)	-	-	-	12 ug/l	23 ug/l	Monthly	Grab	-
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Monthly	Instantaneous	-
Mercury, Total (As Hg) 6/	-	-	-	356 ng/l	788 ng/l	Monthly	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ If monitoring is not required during the monitoring period, *9 should be reported on the eDMR.

5/ Should EPA promulgate new effluent limitation guidelines that affect the above noted limitations, the Department may reopen the permit to incorporate the requirements of a promulgated final rule.

6/ EPA Methods 245.7, 1631E, 1669, or alternative methods specifically approved by the Department, shall be used for the analysis of this parameter.

7/ The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in final discharge location for the low volume wastewater system. The Permittee shall report monitoring results on the internal outfall eDMR which corresponds with the outfall utilized by the low volume wastewater system. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0031: Discharges from the low volume wastewater system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
pH	-	-	6.0 S.U.	-	9.0 S.U.	Monthly	Grab	-
Solids, Total Suspended	-	-	-	27.0 mg/l	70.3 mg/l	Monthly	Composite	-
Oil & Grease	-	-	-	-	15.0 mg/l	Monthly	Grab	-
Nitrogen, Ammonia Total (As N)	-	-	-	-	REPORT mg/l	Monthly	Composite	-
Nitrogen, Kjeldahl Total (As N)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	April - October
Nitrite Plus Nitrate Total 1 Det. (As N)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	April - October
Phosphorus, Total (As P)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	April - October
Arsenic, Trivalent Dissolved	-	-	-	-	REPORT ug/l	Monthly	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0031 (continued): Discharges from the low volume wastewater system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type**	**Seasonal**
Flow, In Conduit or Thru Treatment Plant 5/	REPORT MGD	REPORT MGD	-	-	-	Daily	Recorder	-
Chlorine, Total Residual	-	-	-	-	1.0 mg/l	Monthly	Grab	-
E. Coli	-	-	-	-	REPORT col/100mL	Monthly	Grab	-
BOD, Carbonaceous 05 Day, 20C	-	-	-	-	REPORT mg/l	Monthly	Composite	-
Hydrazine 4/	-	-	-	-	REPORT mg/l	Monthly	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ Hydrazine monitoring is only required when boiler wastewater discharge occurs during the monitoring period. If monitoring is not applicable during the monitoring period, *9 should be reported on the eDMR.

5/ Flow is to be reported from the daily recorded measurements of the low volume wastewater (LVWW) system.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN003T: Discharges from the low volume wastewater system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation 3/ 4/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type	Seasonal
Toxicity, Ceriodaphnia Acute	-	0 pass(0)/fail(1)	-	-	-	Annually	Composite	-
Toxicity, Pimephales Acute	-	0 pass(0)/fail(1)	-	-	-	Annually	Composite	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.E for Acute Toxicity Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN003Q: Discharges from the low volume wastewater system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type**	**Seasonal**
Mercury Total Recoverable 4/ 5/	-	-	-	0.012 ug/l	2.4 ug/l	Quarterly	Composite	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ For the purpose of demonstration of compliance with this parameter, "Total" and "Total Recoverable" shall be considered equivalent.

5/ EPA Methods 245.7, 1631E, 1669, or alternative methods specifically approved by the Department, shall be used for the analysis of this parameter.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN0041: Discharges from Lagoon A including coal pile runoff, low volume wastewaters, concrete truck washout wastewaters, carwash wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					**MONITORING REQUIREMENTS 1/**		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type 4/**	**Seasonal**
pH	-	-	6.0 S.U.	-	9.0 S.U.	Monthly	Grab	-
Solids, Total Suspended	-	-	-	25.0 mg/l	50.0 mg/l	Monthly	Grab	-
Oil & Grease	-	-	-	-	15.0 mg/l	Monthly	Grab	-
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Monthly	Instantaneous	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN010S: Stormwater runoff associated with electric power generation and fire protection system waters 3/ 5/

DSN011S: Intake screen backwash and fire protection system waters 3/ 5/

DSN012S: Intake screen backwash and fire protection system waters 3/ 5/

DSN013S: Stormwater runoff associated with electric power generation, stormwater runoff from the administrative building and parking lot, and fire protection system waters 3/ 5/

DSN019S: Stormwater runoff associated with electric power generation and fire protection system waters 3/ 5/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type 4/	Seasonal
pH	-	-	REPORT S.U.	-	REPORT S.U.	Semi-Annually	Grab	-
Solids, Total Suspended	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Oil & Grease	-	-	-	-	15.0 mg/l	Semi-Annually	Grab	-
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Semi-Annually	Estimate	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.B for Stormwater Measurement and Sampling Requirements.

5/ Monitoring is only required at Outfall DSN010S. Monitoring is not required at Outfalls DSN011S, DSN012S, DSN013S, and DSN019S.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN020S:
DSN021S: Stormwater runoff from the closed ash pond footprint and fire protection system waters 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type 4/	Seasonal
Turbidity	-	-	-	-	REPORT NTU	Semi-Annually	Measured	-
BOD, 5-Day (20 Deg. C)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
pH	-	-	REPORT S.U.	-	REPORT S.U.	Semi-Annually	Grab	-
Solids, Total Suspended	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Oil & Grease	-	-	-	-	15.0 mg/l	Semi-Annually	Grab	-
Nitrogen, Organic Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Nitrogen, Ammonia Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Nitrogen, Kjeldahl Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-

THERE SHALL BE NO DISCHARGE OF POLYCHLORINATED BIPHENYL COMPOUNDS SUCH AS THOSE COMMONLY USED IN TRANSFORMER FLUID.

THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.B for Stormwater Measurement and Sampling Requirements.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN020S (continued):
DSN021S (continued): Stormwater runoff from the closed ash pond footprint and fire protection system waters 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	**Monthly Average**	**Daily Maximum**	**Daily Minimum**	**Monthly Average**	**Daily Maximum**	**Measurement Frequency 2/**	**Sample Type 4/**	**Seasonal**
Nitrite Plus Nitrate Total 1 Det. (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Phosphorus, Total (As P)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Arsenic, Total Recoverable 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Cadmium, Total (As Cd) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Chromium, Total (As Cr) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Copper, Total (As Cu) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Lead, Total (As Pb) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Nickel, Total (As Ni) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-

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2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.B for Stormwater Measurement and Sampling Requirements.

5/ For the purpose of demonstration of compliance with this parameter, "Total" and "Total Recoverable" shall be considered equivalent.

During the period beginning on the effective date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from the following point source(s) outfall(s), described more fully in the permittee's application:

DSN020S (continued):
DSN021S (continued): Stormwater runoff from the closed ash pond footprint and fire protection system waters 3/

Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS 1/		
EFFLUENT CHARACTERISTIC	Monthly Average	Daily Maximum	Daily Minimum	Monthly Average	Daily Maximum	Measurement Frequency 2/	Sample Type 4/	Seasonal
Zinc, Total (As Zn) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Selenium, Total (As Se) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Semi-Annually	Estimate	-
Solids, Total Dissolved	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Mercury, Total (As Hg) 5/ 6/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-
Iron, Total (As Fe) 5/	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	-

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THE DISCHARGE SHALL HAVE NO SHEEN, AND THERE SHALL BE NO DISCHARGE OF VISIBLE OIL, FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

1/ Samples collected to comply with the monitoring requirements specified above shall be collected at the following location: At the nearest accessible location just prior to discharge and after final treatment. Unless otherwise specified, composite samples shall be time composite samples collected using automatic sampling equipment or a minimum of eight (8) equal volume grab samples collected over equal time intervals. All composite samples shall be collected for the total period of discharge not to exceed 24 hours.

2/ If only one sampling event occurs during a month, the sample result shall be reported on the discharge monitoring report as both the monthly average and daily maximum value for all parameters with a monthly average limitation.

3/ See Part IV.A for Best Management Practices (BMP) Plan Requirements.

4/ See Part IV.B for Stormwater Measurement and Sampling Requirements.

5/ For the purpose of demonstration of compliance with this parameter, "Total" and "Total Recoverable" shall be considered equivalent.

6/ EPA Methods 245.7, 1631E, 1669, or alternative methods specifically approved by the Department, shall be used for the analysis of this parameter.

B. DISCHARGE MONITORING AND RECORD KEEPING REQUIREMENTS

1. Representative Sampling

   Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge and shall be in accordance with the provisions of this permit.

2. Test Procedures

   For the purpose of reporting and compliance, permittees shall use one of the following procedures:

   a. For parameters with an EPA established Minimum Level (ML), report the measured value if the analytical result is at or above the ML and report "0" for values below the ML. Test procedures for the analysis of pollutants shall conform to 40 CFR Part 136 and guidelines published pursuant to Section 304(h) of the FWPCA, 33 U.S.C. Section 1314(h). If more than one method for analysis of a substance is approved for use, a method having a minimum level lower than the permit limit shall be used. If the minimum level of all methods is higher than the permit limit, the method having the lowest minimum level shall be used and a report of less than the minimum level shall be reported as zero and will constitute compliance; however, should EPA approve a method with a lower minimum level during the term of this permit the permittee shall use the newly approved method.

   b. For pollutants parameters without an established ML, an interim ML may be utilized. The interim ML shall be calculated as 3.18 times the Method Detection Level (MDL) calculated pursuant to 40 CFR Part 136, Appendix B.

      Permittees may develop an effluent matrix-specific ML, where an effluent matrix prevents attainment of the established ML. However, a matrix specific ML shall be based upon proper laboratory method and technique. Matrix-specific MLs must be approved by the Department, and may be developed by the permittee during permit issuance, reissuance, modification, or during compliance schedule.

      In either case the measured value should be reported if the analytical result is at or above the ML and "0" reported for values below the ML.

   c. For parameters without an EPA established ML, interim ML, or matrix-specific ML, a report of less than the detection limit shall constitute compliance if the detection limit of all analytical methods is higher than the permit limit using the most sensitive EPA approved method. For the purpose of calculating a monthly average, "0" shall be used for values reported less than the detection limit.

      The Minimum Level utilized for procedures A and B above shall be reported on the permittee's DMR. When an EPA approved test procedure for analysis of a pollutant does not exist, the Director shall approve the procedure to be used.

3. Recording of Results

   For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

   a. The facility name and location, point source number, date, time and exact place of sampling;

   b. The name(s) of person(s) who obtained the samples or measurements;

   c. The dates and times the analyses were performed;

   d. The name(s) of the person(s) who performed the analyses;

   e. The analytical techniques or methods used, including source of method and method number; and

   f. The results of all required analyses.

4. Records Retention and Production

   The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the above reports or the application for this permit, for a period of at least three years from the date of the sample measurement, report or application. This period may be extended by request of the Director at any time. If litigation or other enforcement action, under the AWPCA and/or the FWPCA, is ongoing which involves any of the above records, the records shall be kept until the litigation is resolved. Upon the written request of the Director or his designee, the permittee shall provide the Director with a copy of any record required to be retained by this paragraph. Copies of these records shall not be submitted unless requested.

All records required to be kept for a period of three years shall be kept at the permitted facility or an alternate location approved by the Department in writing and shall be available for inspection.

5. Monitoring Equipment and Instrumentation

All equipment and instrumentation used to determine compliance with the requirements of this permit shall be installed, maintained, and calibrated in accordance with the manufacturer's instructions or, in the absence of manufacturer's instructions, in accordance with accepted practices. The permittee shall develop and maintain quality assurance procedures to ensure proper operation and maintenance of all equipment and instrumentation. The quality assurance procedures shall include the proper use, maintenance, and installation, when appropriate, of monitoring equipment at the plant site.

C. DISCHARGE REPORTING REQUIREMENTS

1. Reporting of Monitoring Requirements

a. The permittee shall conduct the required monitoring in accordance with the following schedule:

MONITORING REQUIRED MORE FREQUENTLY THAN MONTHLY AND MONTHLY shall be conducted during the first full month following the effective date of coverage under this permit and every month thereafter.

QUARTERLY MONITORING shall be conducted at least once during each calendar quarter. Calendar quarters are the periods of January through March, April through June, July through September, and October through December. The permittee shall conduct the quarterly monitoring during the first complete calendar quarter following the effective date of this permit and is then required to monitor once during each quarter thereafter. Quarterly monitoring may be done anytime during the quarter, unless restricted elsewhere in this permit, but it should be submitted with the last DMR due for the quarter, i.e., (March, June, September and December DMR's).

SEMIANNUAL MONITORING shall be conducted at least once during the period of January through June and at least once during the period of July through December. The permittee shall conduct the semiannual monitoring during the first complete calendar semiannual period following the effective date of this permit and is then required to monitor once during each semiannual period thereafter. Semiannual monitoring may be done anytime during the semiannual period, unless restricted elsewhere in this permit, but it should be submitted with the last DMR for the month of the semiannual period, i.e. (June and December DMR's).

ANNUAL MONITORING shall be conducted at least once during the period of January through December. The permittee shall conduct the annual monitoring during the first complete calendar annual period following the effective date of this permit and is then required to monitor once during each annual period thereafter. Annual monitoring may be done anytime during the year, unless restricted elsewhere in this permit, but it should be submitted with the December DMR.

b. The permittee shall submit discharge monitoring reports (DMRs) on the forms provided by the Department and in accordance with the following schedule:

REPORTS OF MORE FREQUENTLY THAN MONTHLY AND MONTHLY TESTING shall be submitted on a **quarterly** basis. The first report is due on the **28th day of (MONTH, YEAR).** The reports shall be submitted so that they are received by the Department no later than the 28th day of the month following the reporting period.

REPORTS OF QUARTERLY TESTING shall be submitted on a **quarterly** basis. The first report is due on the **28th day of [Month, Year].** The reports shall be submitted so that they are received by the Department no later than the 28th day of the month following the reporting period.

REPORTS OF SEMIANNUAL TESTING shall be submitted on a semiannual basis. The reports are due on the 28th day of JANUARY and the 28th day of JULY. The reports shall be submitted so that they are received by the Department no later than the 28th day of the month following the reporting period.

REPORTS OF ANNUAL TESTING shall be submitted on an annual basis. The first report is due on the 28th day of JANUARY. The reports shall be submitted so that they are received by the Department no later than the 28th day of the month following the reporting period.

c. Except as allowed by Provision I.C.1.c.(1) or (2), the permittee shall submit all Discharge Monitoring Reports (DMRs) required by Provision I.C.1.b by utilizing the Department's web-based Electronic Environmental (E2) Reporting System.

(1) If the permittee is unable to complete the electronic submittal of DMR data due to technical problems originating with the Department's E2 Reporting system (this could include entry/submittal issues with an entire set of DMRs or individual parameters), the permittee is not relieved of their obligation to submit DMR data to the Department by the date specified in Provision I.C.1.b, unless otherwise directed by the Department.

If the E2 Reporting System is down on the 28th day of the month in which the DMR is due or is down for an extended period of time, as determined by the Department, when a DMR is required to be submitted, the permittee may submit the data in an alternate manner and format acceptable to the Department. Preapproved alternate acceptable methods include faxing, e-mailing, mailing, or hand-delivery of data such that they are received by the required reporting date. Within 5 calendar days of the E2 Reporting System resuming operation, the permittee shall enter the data into the E2 Reporting System, unless an alternate timeframe is approved by the Department. An attachment should be included with the E2 DMR submittal verifying the original submittal date (date of the fax, copy of the dated e-mail, or hand-delivery stamped date), if applicable.

(2) The permittee may submit a request to the Department for a temporary electronic reporting waiver for DMR submittals. The waiver request should include the permit number; permittee name; facility/site name; facility address; name, address, and contact information for the responsible official or duly authorized representative; a detailed statement regarding the basis for requesting such a waiver; and the duration for which the waiver is requested. Approved electronic reporting waivers are not transferrable.

Permittees with an approved electronic reporting waiver for DMRs may submit hard copy DMRs for the period that the approved electronic reporting waiver request is effective. The permittee shall submit the Department-approved DMR forms to the address listed in Provision I.C.1.e.

(3) If a permittee is allowed to submit a hard copy DMR, the DMR must be legible and bear an original signature. Photo and electronic copies of the signature are not acceptable and shall not satisfy the reporting requirements of this permit.

(4) If the permittee, using approved analytical methods as specified in Provision I.B.2, monitors any discharge from a point source for a limited substance identified in Provision I.A. of this permit more frequently than required by this permit, the results of such monitoring shall be included in the calculation and reporting of values on the DMR and the increased frequency shall be indicated on the DMR.

(5) In the event no discharge from a point source identified in Provision I.A. of this permit and described more fully in the permittee's application occurs during a monitoring period, the permittee shall report "No Discharge" for such period on the appropriate DMR.

d. All reports and forms required to be submitted by this permit, the AWPCA and the Department's Rules, shall be electronically signed (or, if allowed by the Department, traditionally signed) by a "responsible official" of the permittee as defined in ADEM Administrative Code Rule 335-6-6-.09 or a "duly authorized representative" of such official as defined in ADEM Administrative Code Rule 335-6-6-.09 and shall bear the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

e. Discharge Monitoring Reports required by this permit, the AWPCA, and the Department's Rules that are being submitted in hard copy shall be addressed to:

Alabama Department of Environmental Management
Permits and Services Division
Environmental Data Section
Post Office Box 301463
Montgomery, Alabama 36130-1463

Certified and Registered Mail containing Discharge Monitoring Reports shall be addressed to:

Alabama Department of Environmental Management
Permits and Services Division
Environmental Data Section
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2400

f. All other correspondence and reports required to be submitted by this permit, the AWPCA, and the Department's Rules shall be addressed to:

Alabama Department of Environmental Management
Water Division
Post Office Box 301463
Montgomery, Alabama 36130-1463

Certified and Registered Mail shall be addressed to:

Alabama Department of Environmental Management
Water Division
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2400

g. If this permit is a re-issuance, then the permittee shall continue to submit DMRs in accordance with the requirements of their previous permit until such time as DMRs are due as discussed in Part I.C.1.b above.

2. Noncompliance Notification

a. 24-Hour Noncompliance Reporting

The permittee shall report to the Director, within 24-hours of becoming aware of the noncompliance, any noncompliance which may endanger health or the environment. This shall include but is not limited to the following circumstances:

(1) does not comply with any daily minimum or maximum discharge limitation for an effluent characteristic specified in Provision I. A. of this permit which is denoted by an "(X)";

(2) threatens human health or welfare, fish or aquatic life, or water quality standards;

(3) does not comply with an applicable toxic pollutant effluent standard or prohibition established under Section 307(a) of the FWPCA, 33 U.S.C. Section 1317(a);

(4) contains a quantity of a hazardous substance which has been determined may be harmful to public health or welfare under Section 311(b)(4) of the FWPCA, 33 U.S.C. Section 1321(b)(4);

(5) exceeds any discharge limitation for an effluent characteristic as a result of an unanticipated bypass or upset; and

(6) is an unpermitted direct or indirect discharge of a pollutant to a water of the state (unpermitted discharges properly reported to the Department under any other requirement are not required to be reported under this provision).

The permittee shall orally report the occurrence and circumstances of such discharge to the Director within 24-hours after the permittee becomes aware of the occurrence of such discharge. In addition to the oral report, the permittee shall submit to the Director or Designee a written report as provided in Part I.C.2.c no later than five (5) days after becoming aware of the occurrence of such discharge.

b. If for any reason, the permittee's discharge does not comply with any limitation of this permit, the permittee shall submit to the Director or Designee a written report as provided in Part I.C.2.c below, such report shall be submitted with the next Discharge Monitoring Report required to be submitted by Part I.C.1 of this permit after becoming aware of the occurrence of such noncompliance.

c. Any written report required to be submitted to the Director or Designee by Part I.C.2 a. or b. shall be submitted using a Noncompliance Notification Form (ADEM Form 421) available on the Department's website (http://adem.alabama.gov/DeptForms/Form421.pdf) and include the following information:

(1) A description of the discharge and cause of noncompliance;

(2) The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue; and

(3) A description of the steps taken and/or being taken to reduce or eliminate the noncomplying discharge and to prevent its recurrence.

D. OTHER REPORTING AND NOTIFICATION REQUIREMENTS

1. Anticipated Noncompliance

   The permittee shall give the Director written advance notice of any planned changes or other circumstances regarding a facility which may result in noncompliance with permit requirements.

2. Termination of Discharge

   The permittee shall notify the Director, in writing, when all discharges from any point source(s) identified in Provision I. A. of this permit have permanently ceased. This notification shall serve as sufficient cause for instituting procedures for modification or termination of the permit.

3. Updating Information

   a. The permittee shall inform the Director of any change in the permittee's mailing address, telephone number or in the permittee's designation of a facility contact or office having the authority and responsibility to prevent and abate violations of the AWPCA, the Department's Rules, and the terms and conditions of this permit, in writing, no later than ten (10) days after such change. Upon request of the Director or his designee, the permittee shall furnish the Director with an update of any information provided in the permit application.

   b. If the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information with a written explanation for the mistake and/or omission.

4. Duty to Provide Information

   The permittee shall furnish to the Director, within a reasonable time, any information which the Director or his designee may request to determine whether cause exists for modifying, revoking and re-issuing, suspending, or terminating this permit, in whole or in part, or to determine compliance with this permit.

5. Cooling Water and Boiler Water Additives

   a. The permittee shall notify the Director in writing not later than thirty (30) days prior to instituting the use of any biocide corrosion inhibitor or chemical additive in a cooling or boiler system, not identified in the application for this permit, from which discharge is allowed by this permit. Notification is not required for additives that do not contain a heavy metal(s) as an active ingredient and that pass through a wastewater treatment system prior to discharge nor is notification required for additives that should not reasonably be expected to cause the cooling water or boiler water to exhibit toxicity as determined by analysis of manufacturer's data or testing by the permittee. Such notification shall include:

      (1) name and general composition of biocide or chemical;

      (2) 96-hour median tolerance limit data for organisms representative of the biota of the waterway into which the discharge will ultimately reach;

      (2) quantities to be used;

      (3) frequencies of use;

      (4) proposed discharge concentrations; and

      (6) EPA registration number, if applicable.

   b. The use of a biocide or additive containing tributyl tin, tributyl tin oxide, zinc, chromium or related compounds in cooling or boiler system(s), from which a discharge regulated by this permit occurs, is prohibited except as exempted below. The use of a biocide or additive containing zinc, chromium or related compounds may be used in special circumstances if (1) the permit contains limits for these substances, or (2) the applicant demonstrates during the application process that the use of zinc, chromium or related compounds as a biocide or additive will not pose a reasonable potential to violate the applicable State water quality standards for these substances. The use of any additive, not identified in this permit or in the application for this permit or not exempted from notification under this permit is prohibited, prior to a determination by the Department that permit modification to control discharge of the additive is not required or prior to issuance of a permit modification controlling discharge of the additive.

6. Permit Issued Based On Estimated Characteristics

   a. If this permit was issued based on estimates of the characteristics of a process discharge reported on an EPA NPDES Application Form 2D (EPA Form 3510-2D), the permittee shall complete and submit an EPA NPDES Application Form 2C (EPA Form 3510-2C) no later than two years after the date that discharge begins. Sampling required for completion of the Form 2C shall occur when a discharge(s) from the process(s) causing the new or increased discharge is occurring. If this permit was issued based on estimates concerning the composition of a stormwater discharge(s), the permittee shall perform the sampling required by EPA NPDES Application Form 2F (EPA Form 3510-2F) no later than one year after the industrial activity generating the stormwater discharge has been fully initiated.

   b. This permit shall be reopened if required to address any new information resulting from the completion and submittal of the Form 2C and or 2F.

E. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the discharge limitations specified in Provision I. A. in accordance with the following schedule:

COMPLIANCE SHALL BE ATTAINED ON THE EFFECTIVE DATE OF THIS PERMIT

2. **Effluent Guideline Limitations Compliance**

   a) There shall be no discharge of pollutants in fly ash transport water generated at the facility on and/or after the effective date of this permit.

   b) Beginning as soon as possible but no later than December 31, 2023, the Permittee shall demonstrate compliance with the FGD ELGs through the monitoring requirements proposed for internal Outfalls DSN02E1 or DSN03E1 for FGD wastewater generated at the facility on and/or after that date.

   c) Beginning as soon as possible but no later than December 31, 2023, there shall be no discharge of pollutants in bottom ash transport water generated at the facility on and/or after that date, subject to the following exceptions:

      i. Low volume, short duration discharges of wastewater from minor leaks (e.g., leaks from valve packing, pipe flanges, or piping) or minor maintenance events (e.g., replacement of valves or pipe sections) are specifically excluded from the definition of "transport water" and may continue to be discharged through Outfalls DSN0021 or DSN0031 subject to the effluent limitations applicable to such discharges through those respective outfalls.

      ii. Bottom ash transport water may be utilized in the FGD scrubber system and discharged through Outfall DSN0021 or DSN0031 and/or DSN02E1 or DSN03E1 (as applicable) subject to the effluent limitations applicable to such discharges through those respective Outfalls.

3. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

PART II OTHER REQUIREMENTS, RESPONSIBILITIES, AND DUTIES

A. OPERATIONAL AND MANAGEMENT REQUIREMENTS

1. Facilities Operation and Maintenance

   The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of the permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities only when necessary to achieve compliance with the conditions of the permit.

2. Best Management Practices

   a. Dilution water shall not be added to achieve compliance with discharge limitations except when the Director or his designee has granted prior written authorization for dilution to meet water quality requirements.

   b. The permittee shall prepare, implement, and maintain a Spill Prevention, Control and Countermeasures (SPCC) Plan in accordance with 40 C.F.R. Section 112 if required thereby.

   c. The permittee shall prepare, submit for approval and implement a Best Management Practices (BMP) Plan for containment of any or all process liquids or solids, in a manner such that these materials do not present a significant potential for discharge, if so required by the Director or his designee. When submitted and approved, the BMP Plan shall become a part of this permit and all requirements of the BMP Plan shall become requirements of this permit.

3. Spill Prevention, Control, and Management

   The permittee shall provide spill prevention, control, and/or management sufficient to prevent any spills of pollutants from entering a water of the state or a publicly or privately owned treatment works. Any containment system used to implement this requirement shall be constructed of materials compatible with the substance(s) contained and which shall prevent the contamination of groundwater and such containment system shall be capable of retaining a volume equal to 110 percent of the capacity of the largest tank for which containment is provided.

B. OTHER RESPONSIBILITIES

1. Duty to Mitigate Adverse Impacts

   The permittee shall promptly take all reasonable steps to mitigate and minimize or prevent any adverse impact on human health or the environment resulting from noncompliance with any discharge limitation specified in Provision I. A. of this permit, including such accelerated or additional monitoring of the discharge and/or the receiving waterbody as necessary to determine the nature and impact of the noncomplying discharge.

2. Right of Entry and Inspection

   The permittee shall allow the Director, or an authorized representative, upon the presentation of proper credentials and other documents as may be required by law to:

   a. enter upon the permittee's premises where a regulated facility or activity or point source is located or conducted, or where records must be kept under the conditions of the permit;

   b. have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

   c. inspect any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under the permit; and

   d. sample or monitor, for the purposes of assuring permit compliance or as otherwise authorized by the AWPCA, any substances or parameters at any location.

C. BYPASS AND UPSET

1. Bypass

   a. Any bypass is prohibited except as provided in b. and c. below:

   b. A bypass is not prohibited if:

      (1) It does not cause any discharge limitation specified in Provision I. A. of this permit to be exceeded;

(2) It enters the same receiving stream as the permitted outfall; and

(3) It is necessary for essential maintenance of a treatment or control facility or system to assure efficient operation of such facility or system.

c. A bypass is not prohibited and need not meet the discharge limitations specified in Provision I. A. of this permit if:

(1) It is unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime (this condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance); and

(3) The permittee submits a written request for authorization to bypass to the Director at least ten (10) days prior to the anticipated bypass (if possible), the permittee is granted such authorization, and the permittee complies with any conditions imposed by the Director to minimize any adverse impact on human health or the environment resulting from the bypass.

d. The permittee has the burden of establishing that each of the conditions of Provision II.C.1.b. or c. have been met to qualify for an exception to the general prohibition against bypassing contained in a. and an exemption, where applicable, from the discharge limitations specified in Provision I. A. of this permit.

2. Upset

a. A discharge which results from an upset need not meet the discharge limitations specified in Provision I. A. of this permit if:

(1) No later than 24-hours after becoming aware of the occurrence of the upset, the permittee orally reports the occurrence and circumstances of the upset to the Director or his designee; and

(2) No later than five (5) days after becoming aware of the occurrence of the upset, the permittee furnishes the Director with evidence, including properly signed, contemporaneous operating logs, or other relevant evidence, demonstrating that (i) an upset occurred; (ii) the permittee can identify the specific cause(s) of the upset; (iii) the permittee's facility was being properly operated at the time of the upset; and (iv) the permittee promptly took all reasonable steps to minimize any adverse impact on human health or the environment resulting from the upset.

b. The permittee has the burden of establishing that each of the conditions of Provision II. C.2.a. of this permit have been met to qualify for an exemption from the discharge limitations specified in Provision I.A. of this permit.

D. DUTY TO COMPLY WITH PERMIT, RULES, AND STATUTES

1. Duty to Comply

a. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the AWPCA and the FWPCA and is grounds for enforcement action, for permit termination, revocation and reissuance, suspension, modification; or denial of a permit renewal application.

b. The necessity to halt or reduce production or other activities in order to maintain compliance with the conditions of the permit shall not be a defense for a permittee in an enforcement action.

c. The discharge of a pollutant from a source not specifically identified in the permit application for this permit and not specifically included in the description of an outfall in this permit is not authorized and shall constitute noncompliance with this permit.

d. The permittee shall take all reasonable steps, including cessation of production or other activities, to minimize or prevent any violation of this permit or to minimize or prevent any adverse impact of any permit violation.

e. Nothing in this permit shall be construed to preclude and negate the permittee's responsibility or liability to apply for, obtain, or comply with other ADEM, Federal, State, or Local Government permits, certifications, licenses, or other approvals.

2. Removed Substances

Solids, sludges, filter backwash, or any other pollutant or other waste removed in the course of treatment or control of wastewaters shall be disposed of in a manner that complies with all applicable Department Rules.

3. Loss or Failure of Treatment Facilities

Upon the loss or failure of any treatment facilities, including but not limited to the loss or failure of the primary source of power of the treatment facility, the permittee shall, where necessary to maintain compliance with the discharge limitations specified in Provision I. A. of this permit, or any other terms or conditions of this permit, cease, reduce, or otherwise control production and/or all discharges until treatment is restored. If control of discharge during loss or failure of the primary source of power is to be accomplished by means of alternate power sources, standby generators, or retention of inadequately treated effluent, the permittee must furnish to the Director within six months a certification that such control mechanisms have been installed.

4. Compliance with Statutes and Rules

a. This permit has been issued under ADEM Administrative Code, Chapter 335-6-6. All provisions of this chapter, that are applicable to this permit, are hereby made a part of this permit. A copy of this chapter may be obtained for a small charge from the Office of General Counsel, Alabama Department of Environmental Management, 1400 Coliseum Blvd., Montgomery, AL 36130.

b. This permit does not authorize the noncompliance with or violation of any Laws of the State of Alabama or the United States of America or any regulations or rules implementing such laws. FWPCA, 33 U.S.C. Section 1319, and Code of Alabama 1975, Section 22-22-14.

E. PERMIT TRANSFER, MODIFICATION, SUSPENSION, REVOCATION, AND REISSUANCE

1. Duty to Reapply or Notify of Intent to Cease Discharge

a. If the permittee intends to continue to discharge beyond the expiration date of this permit, the permittee shall file a complete permit application for reissuance of this permit at least 180 days prior to its expiration. If the permittee does not intend to continue discharge beyond the expiration of this permit, the permittee shall submit written notification of this intent which shall be signed by an individual meeting the signatory requirements for a permit application as set forth in ADEM Administrative Code Rule 335-6-6-.09.

b. Failure of the permittee to apply for reissuance at least 180 days prior to permit expiration will void the automatic continuation of the expiring permit provided by ADEM Administrative Code Rule 335-6-6-.06 and should the permit not be reissued for any reason any discharge after expiration of this permit will be an unpermitted discharge.

2. Change in Discharge

a. The permittee shall apply for a permit modification at least 180 days in advance of any facility expansion, production increase, process change, or other action that could result in the discharge of additional pollutants or increase the quantity of a discharged pollutant such that existing permit limitations would be exceeded or that could result in an additional discharge point. This requirement applies to pollutants that are or that are not subject to discharge limitations in this permit. No new or increased discharge may begin until the Director has authorized it by issuance of a permit modification or a reissued permit.

b. The permittee shall notify the Director as soon as it is known or there is reason to believe:

(1) That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis, of any toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following notification levels:

(a) one hundred micrograms per liter;

(b) two hundred micrograms per liter for acrolein and acrylonitrile; five hundred micrograms per liter for 2,4-dinitrophenol and for 2-methyl-4,6-dini-trophenol; and one milligram per liter for antimony;

(c) five times the maximum concentration value reported for that pollutant in the permit application; or

(2) That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

(a) five hundred micrograms per liter;

(b) one milligram per liter for antimony;

(c) ten times the maximum concentration value reported for that pollutant in the permit application.

3. Transfer of Permit

This permit may not be transferred or the name of the permittee changed without notice to the Director and subsequent modification or revocation and reissuance of the permit to identify the new permittee and to incorporate any other changes as may be required under the FWPCA or AWPCA. In the case of a change in name, ownership or control of the permittee's premises only, a request for permit modification in a format acceptable to the Director is required at least 30 days prior to the change. In the case of a change in name, ownership or control of the permittee's premises accompanied by a change or proposed change in effluent characteristics, a complete permit application is required to be submitted to the Director at least 180 days prior to the change. Whenever the Director is notified of a change in name, ownership or control, he may decide not to modify the existing permit and require the submission of a new permit application.

4. Permit Modification and Revocation

a. This permit may be modified or revoked and reissued, in whole or in part, during its term for cause, including but not limited to, the following:

(1) If cause for termination under Provision II. E. 5. of this permit exists, the Director may choose to revoke and reissue this permit instead of terminating the permit;

(2) If a request to transfer this permit has been received, the Director may decide to revoke and reissue or to modify the permit; or

(3) If modification or revocation and reissuance is requested by the permittee and cause exists, the Director may grant the request.

b. This permit may be modified during its term for cause, including but not limited to, the following:

(1) If cause for termination under Provision II. E. 5. of this permit exists, the Director may choose to modify this permit instead of terminating this permit;

(2) There are material and substantial alterations or additions to the facility or activity generating wastewater which occurred after permit issuance which justify the application of permit conditions that are different or absent in the existing permit;

(3) The Director has received new information that was not available at the time of permit issuance and that would have justified the application of different permit conditions at the time of issuance;

(4) A new or revised requirement(s) of any applicable standard or limitation is promulgated under Sections 301(b)(2)(C), (D), (E), and (F), and 307(a)(2) of the FWPCA;

(5) Errors in calculation of discharge limitations or typographical or clerical errors were made;

(6) To the extent allowed by ADEM Administrative Code, Rule 335-6-6-.17, when the standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision after the permit was issued;

(7) To the extent allowed by ADEM Administrative Code, Rule 335-6-6-.17, permits may be modified to change compliance schedules;

(8) To agree with a granted variance under 30l(c), 30l(g), 30l(h), 30l(k), or 3l6(a) of the FWPCA or for fundamentally different factors;

(9) To incorporate an applicable 307(a) FWPCA toxic effluent standard or prohibition;

(10) When required by the reopener conditions in this permit;

(11) When required under 40 CFR 403.8(e) (compliance schedule for development of pretreatment program);

(12) Upon failure of the state to notify, as required by Section 402(b)(3) of the FWPCA, another state whose waters may be affected by a discharge permitted by this permit;

(13) When required to correct technical mistakes, such as errors in calculation, or mistaken interpretations of law made in determining permit conditions; or

(14) When requested by the permittee and the Director determines that the modification has cause and will not result in a violation of federal or state law, regulations or rules.

5. Permit Termination

This permit may be terminated during its term for cause, including but not limited to, the following:

a. Violation of any term or condition of this permit;

b. The permittee's misrepresentation or failure to disclose fully all relevant facts in the permit application or during the permit issuance process or the permittee's misrepresentation of any relevant facts at any time;

c. Materially false or inaccurate statements or information in the permit application or the permit;

d. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;

e. The permittee's discharge threatens human life or welfare or the maintenance of water quality standards;

f. Permanent closure of the facility generating the wastewater permitted to be discharged by this permit or permanent cessation of wastewater discharge;

g. New or revised requirements of any applicable standard or limitation that is promulgated under Sections 301(b)(2)(C), (D), (E), and (F), and 307(a)(2) of the FWPCA that the Director determines cannot be complied with by the permittee; or

h. Any other cause allowed by the ADEM Administrative Code, Chapter 335-6-6.

6. Permit Suspension

This permit may be suspended during its term for noncompliance until the permittee has taken action(s) necessary to achieve compliance.

7. Request for Permit Action Does Not Stay Any Permit Requirement

The filing of a request by the permittee for modification, suspension or revocation of this permit, in whole or in part, does not stay any permit term or condition.

F. COMPLIANCE WITH TOXIC POLLUTANT STANDARD OR PROHIBITION

If any applicable effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the FWPCA, 33 U.S.C. Section 1317(a), for a toxic pollutant discharged by the permittee and such standard or prohibition is more stringent than any discharge limitation on the pollutant specified in Provision I. A. of this permit, or controls a pollutant not limited in Provision I. A. of this permit, this permit shall be modified to conform to the toxic pollutant effluent standard or prohibition and the permittee shall be notified of such modification. If this permit has not been modified to conform to the toxic pollutant effluent standard or prohibition before the effective date of such standard or prohibition, the permittee shall attain compliance with the requirements of the standard or prohibition within the time period required by the standard or prohibition and shall continue to comply with the standard or prohibition until this permit is modified or reissued.

G. DISCHARGE OF WASTEWATER GENERATED BY OTHERS

The discharge of wastewater, generated by any process, facility, or by any other means not under the operational control of the permittee or not identified in the application for this permit or not identified specifically in the description of an outfall in this permit is not authorized by this permit.

PART III OTHER PERMIT CONDITIONS

A. CIVIL AND CRIMINAL LIABILITY

1. Tampering

Any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained or performed under the permit shall, upon conviction, be subject to penalties as provided by the AWPCA.

2. False Statements

Any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be subject to penalties as provided by the AWPCA.

3. Permit Enforcement

a. Any NPDES permit issued or reissued by the Department is a permit for the purpose of the AWPCA and the FWPCA and as such any terms, conditions, or limitations of the permit are enforceable under state and federal law.

b. Any person required to have a NPDES permit pursuant to ADEM Administrative Code Chapter 335-6-6 and who discharges pollutants without said permit, who violates the conditions of said permit, who discharges pollutants in a manner not authorized by the permit, or who violates applicable orders of the Department or any applicable rule or standard of the Department, is subject to any one or combination of the following enforcement actions under applicable state statutes.

(1) An administrative order requiring abatement, compliance, mitigation, cessation, clean-up, and/or penalties;

(2) An action for damages;

(3) An action for injunctive relief; or

(4) An action for penalties.

c. If the permittee is not in compliance with the conditions of an expiring or expired permit the Director may choose to do any or all of the following provided the permittee has made a timely and complete application for reissuance of the permit:

(1) initiate enforcement action based upon the permit which has been continued;

(2) issue a notice of intent to deny the permit reissuance. If the permit is denied, the owner or operator would then be required to cease the activities authorized by the continued permit or be subject to enforcement action for operating without a permit;

(3) reissue the new permit with appropriate conditions; or

(4) take other actions authorized by these rules and AWPCA.

4. Relief from Liability

Except as provided in Provision II.C.1 (Bypass) and Provision II.C.2 (Upset), nothing in this permit shall be construed to relieve the permittee of civil or criminal liability under the AWPCA or FWPCA for noncompliance with any term or condition of this permit.

B. OIL AND HAZARDOUS SUBSTANCE LIABILITY

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject under Section 311 of the FWPCA, 33 U.S.C. Section 1321.

C. PROPERTY AND OTHER RIGHTS

This permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to persons or property or invasion of other private rights, trespass, or any infringement of federal, state, or local laws or regulations, nor does it authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any waters of the state or of the United States.

D. AVAILABILITY OF REPORTS

Except for data determined to be confidential under Code of Alabama 1975, Section 22-22-9(c), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. Effluent data shall not be considered confidential.

E. EXPIRATION OF PERMITS FOR NEW OR INCREASED DISCHARGES

1. If this permit was issued for a new discharger or new source, this permit shall expire eighteen months after the issuance date if construction of the facility has not begun during the eighteen-month period.

2. If this permit was issued or modified to allow the discharge of increased quantities of pollutants to accommodate the modification of an existing facility and if construction of this modification has not begun during the eighteen month period after issuance of this permit or permit modification, this permit shall be modified to reduce the quantities of pollutants allowed to be discharged to those levels that would have been allowed if the modification of the facility had not been planned.

3. Construction has begun when the owner or operator has:

   a. begun, or caused to begin as part of a continuous on-site construction program:

      (1) any placement, assembly, or installation of facilities or equipment; or

      (2) significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities which is necessary for the placement, assembly, or installation of new source facilities or equipment; or

   b. entered into a binding contractual obligation for the purpose of placement, assembly, or installation of facilities or equipment which are intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under the paragraph. The entering into a lease with the State of Alabama for exploration and production of hydrocarbons shall also be considered beginning construction.

F. COMPLIANCE WITH WATER QUALITY STANDARDS

1. On the basis of the permittee's application, plans, or other available information, the Department has determined that compliance with the terms and conditions of this permit should assure compliance with the applicable water quality standards.

2. Compliance with permit terms and conditions notwithstanding, if the permittee's discharge(s) from point sources identified in Provision I. A. of this permit cause or contribute to a condition in contravention of state water quality standards, the Department may require abatement action to be taken by the permittee in emergency situations or modify the permit pursuant to the Department's Rules, or both.

3. If the Department determines, on the basis of a notice provided pursuant to this permit or any investigation, inspection or sampling, that a modification of this permit is necessary to assure maintenance of water quality standards or compliance with other provisions of the AWPCA or FWPCA, the Department may require such modification and, in cases of emergency, the Director may prohibit the discharge until the permit has been modified.

G. GROUNDWATER

Unless specifically authorized under this permit, this permit does not authorize the discharge of pollutants to groundwater. Should a threat of groundwater contamination occur, the Director may require groundwater monitoring to properly assess the degree of the problem and the Director may require that the Permittee undertake measures to abate any such discharge and/or contamination.

H. DEFINITIONS

1. Average monthly discharge limitation - means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month (zero discharge days shall not be included in the number of "daily discharges" measured and a less than detectable test result shall be treated as a concentration of zero if the most sensitive EPA approved method was used).

2. Average weekly discharge limitation - means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week (zero discharge days shall not be included in the number of "daily discharges" measured and a less than detectable test result shall be treated as a concentration of zero if the most sensitive EPA approved method was used).

3. Arithmetic Mean – means the summation of the individual values of any set of values divided by the number of individual values.

4. AWPCA - means the Alabama Water Pollution Control Act.

5. BOD – means the five-day measure of the pollutant parameter biochemical oxygen demand.

6. Bypass - means the intentional diversion of waste streams from any portion of a treatment facility.

7. CBOD – means the five-day measure of the pollutant parameter carbonaceous biochemical oxygen demand.

8. Daily discharge - means the discharge of a pollutant measured during any consecutive 24-hour period in accordance with the sample type and analytical methodology specified by the discharge permit.

9. Daily maximum - means the highest value of any individual sample result obtained during a day.

10. Daily minimum - means the lowest value of any individual sample result obtained during a day.

11. Day - means any consecutive 24-hour period.

12. Department - means the Alabama Department of Environmental Management.

13. Dewatering – means discharges of wastewater from the ash pond from a surface water elevation below which gravity discharges via the overflow discharge structure cannot occur.

14. Director - means the Director of the Department.

15. Discharge - means "[t]he addition, introduction, leaking, spilling or emitting of any sewage, industrial waste, pollutant or other wastes into waters of the state". Code of Alabama 1975, Section 22-22-1(b)(8).

16. Discharge Monitoring Report (DMR) - means the form approved by the Director to accomplish reporting requirements of an NPDES permit.

17. DO – means dissolved oxygen.

18. 8HC – means 8-hour composite sample, including any of the following:

    a. The mixing of at least 5 equal volume samples collected at constant time intervals of not more than 2 hours over a period of not less than 8 hours between the hours of 6:00 a.m. and 6:00 p.m. If the sampling period exceeds 8 hours, sampling may be conducted beyond the 6:00 a.m. to 6:00 p.m. period.

    b. A sample continuously collected at a constant rate over period of not less than 8 hours between the hours of 6:00 a.m. and 6:00 p.m. If the sampling period exceeds 8 hours, sampling may be conducted beyond the 6:00 a.m. to 6:00 p.m. period.

19. EPA - means the United States Environmental Protection Agency.

20. FC – means the pollutant parameter fecal coliform.

21. Flow – means the total volume of discharge in a 24-hour period.

22. FWPCA - means the Federal Water Pollution Control Act.

23. Geometric Mean – means the Nth root of the product of the individual values of any set of values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered one (1).

24. Grab Sample – means a single influent or effluent portion which is not a composite sample. The sample(s) shall be collected at the period(s) most representative of the discharge.

25. Indirect Discharger – means a nondomestic discharger who discharges pollutants to a publicly owned treatment works or a privately owned treatment facility operated by another person.

26. Industrial User – means those industries identified in the Standard Industrial Classification manual, Bureau of the Budget 1967, as amended and supplemented, under the category "Division D – Manufacturing" and such other classes of significant waste producers as, by regulation, the Director deems appropriate.

27. MGD – means million gallons per day.

28. Monthly Average – means, other than for fecal coliform bacteria, the arithmetic mean of the entire composite or grab samples taken for the daily discharges collected in one month period. The monthly average for fecal coliform bacteria is the geometric mean of daily discharge samples collected in a one month period. The monthly average for flow is the arithmetic mean of all flow measurements taken in a one month period.

29. New Discharger – means a person, owning or operating any building, structure, facility or installation:

    a. from which there is or may be a discharge of pollutants;

    b. that did not commence the discharge of pollutants prior to August 13, 1979, and which is not a new source; and

    c. which has never received a final effective NPDES permit for dischargers at that site.

30. NH3-N – means the pollutant parameter ammonia, measured as nitrogen.

31. Permit application - means forms and additional information that is required by ADEM Administrative Code Rule 335-6-6-.08 and applicable permit fees.

32. Point source - means "any discernible, confined and discrete conveyance, including but not limited to any pipe, channel, ditch, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, . . . from which pollutants are or may be discharged." Section 502(14) of the FWPCA, 33 U.S.C. Section 1362(14).

33. Pollutant - includes for purposes of this permit, but is not limited to, those pollutants specified in Code of Alabama 1975, Section 22-22-1(b)(3) and those effluent characteristics specified in Provision I. A. of this permit.

34. Privately Owned Treatment Works – means any devices or system which is used to treat wastes from any facility whose operator is not the operator of the treatment works, and which is not a "POTW".

35. Publicly Owned Treatment Works – means a wastewater collection and treatment facility owned by the State, municipality, regional entity composed of two or more municipalities, or another entity created by the State or local authority for the purpose of collecting and treating municipal wastewater.

36. Receiving Stream – means the "waters" receiving a "discharge" from a "point source".

37. Severe property damage - means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

38. Significant Source – means a source which discharges 0.025 MGD or more to a POTW or greater than five percent of the treatment work's capacity, or a source which is a primary industry as defined by the U.S. EPA or which discharges a priority or toxic pollutant.

39. Solvent – means any virgin, used or spent organic solvent(s) identified in the F-Listed wastes (F001 through F005) specified in 40 CFR 261.31 that is used for the purpose of solubilizing other materials.

40. TKN – means the pollutant parameter Total Kjeldahl Nitrogen.

41. TON – means the pollutant parameter Total Organic Nitrogen.

42. TRC – means Total Residual Chlorine.

43. TSS – means the pollutant parameter Total Suspended Solids.

44. 24HC – means 24-hour composite sample, including any of the following:

    a. the mixing of at least 12 equal volume samples collected at constant time intervals of not more than 2 hours over a period of 24 hours;

    b. a sample collected over a consecutive 24-hour period using an automatic sampler composite to one sample. As a minimum, samples shall be collected hourly and each shall be no more than one twenty-fourth (1/24) of the total sample volume collected; or

    c. a sample collected over a consecutive 24-hour period using an automatic composite sampler composited proportional to flow.

45. Upset - means an exceptional incident in which there is an unintentional and temporary noncompliance with technology-based permit discharge limitations because of factors beyond the reasonable control of the permittee. An upset does not include

noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

46. Waters - means "[a]ll waters of any river, stream, watercourse, pond, lake, coastal, ground or surface water, wholly or partially within the state, natural or artificial. This does not include waters which are entirely confined and retained completely upon the property of a single individual, partnership or corporation unless such waters are used in interstate commerce." Code of Alabama 1975, Section 22-22-1(b)(2). Waters "include all navigable waters" as defined in Section 502(7) of the FWPCA, 22 U.S.C. Section 1362(7), which are within the State of Alabama.

47. Week - means the period beginning at twelve midnight Saturday and ending at twelve midnight the following Saturday.

48. Weekly (7-day and calendar week) Average – is the arithmetic mean of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. The calendar week is defined as beginning on Sunday and ending on Saturday. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for the calendar week shall be included in the data for the month that contains the Saturday.

I. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART IV ADDITIONAL REQUIREMENTS, CONDITIONS, AND LIMITATIONS

A. BEST MANAGEMENT PRACTICES (BMP) PLAN REQUIREMENTS

1. BMP Plan

The permittee shall develop and implement a Best Management Practices (BMP) Plan which prevents, or minimizes the potential for, the release of pollutants from ancillary activities, including material storage areas; plant site runoff; in-plant transfer, process and material handling areas; loading and unloading operations, and sludge and waste disposal areas, to the waters of the State through plant site runoff; spillage or leaks; sludge or waste disposal; or drainage from raw material storage.

2. Plan Content

The permittee shall prepare and implement a best management practices (BMP) plan, which shall:

a. Establish specific objectives for the control of pollutants:

(1) Each facility component or system shall be examined for its potential for causing a release of significant amounts of pollutants to waters of the State due to equipment failure, improper operation, natural phenomena such as rain or snowfall, etc.

(2) Where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g. precipitation), or circumstances to result in significant amounts of pollutants reaching surface waters, the plan should include a prediction of the direction, rate of flow, and total quantity of pollutants which could be discharged from the facility as a result of each condition or circumstance.

b. Establish specific best management practices to meet the objectives identified under paragraph a. of this section, addressing each component or system capable of causing a release of significant amounts of pollutants to the waters of the State, and identifying specific preventative or remedial measures to be implemented;

c. Establish a program to identify and repair leaking equipment items and damaged containment structures, which may contribute to contaminated stormwater runoff. This program must include regular visual inspections of equipment, containment structures and of the facility in general to ensure that the BMP is continually implemented and effective;

d. Prevent the spillage or loss of fluids, oil, grease, gasoline, etc. from vehicle and equipment maintenance activities and thereby prevent the contamination of stormwater from these substances;

e. Prevent or minimize stormwater contact with material stored on site;

f. Designate by position or name the person or persons responsible for the day to day implementation of the BMP;

g. Provide for routine inspections, on days during which the facility is manned, of any structures that function to prevent stormwater pollution or to remove pollutants from stormwater and of the facility in general to ensure that the BMP is continually implemented and effective;

h. Provide for the use and disposal of any material used to absorb spilled fluids that could contaminate stormwater;

i. Develop a solvent management plan, if solvents are used on site. The solvent management plan shall include as a minimum lists of the solvents on site; the disposal method of solvents used instead of dumping, such as reclamation, contract hauling; and the procedures for assuring that solvents do not routinely spill or leak into the stormwater;

j. Provide for the disposal of all used oils, hydraulic fluids, solvent degreasing material, etc. in accordance with good management practices and any applicable state or federal regulations;

k. Include a diagram of the facility showing the locations where stormwater exits the facility, the locations of any structure or other mechanisms intended to prevent pollution of stormwater or to remove pollutants from stormwater, the locations of any collection and handling systems;

l. Provide control sufficient to prevent or control pollution of stormwater by soil particles to the degree required to maintain compliance with the water quality standard for turbidity applicable to the waterbody(s) receiving discharge(s) under this permit;

m. Provide spill prevention, control, and/or management sufficient to prevent or minimize contaminated stormwater runoff. Any containment system used to implement this requirement shall be constructed of materials compatible with the substance(s) contained and shall prevent the contamination of groundwater. The containment system shall also be capable of retaining a volume equal to 110 percent of the capacity of the largest tank for which containment is provided;

n. Provide and maintain curbing, diking or other means of isolating process areas to the extent necessary to allow segregation and collection for treatment of contaminated stormwater from process areas;

o. Be reviewed by plant engineering staff and the plant manager; and

p. Bear the signature of the plant manager.

3. Compliance Schedule

The permittee shall have reviewed (and revised if necessary) and fully implemented the BMP plan as soon as practicable but no later than six months after the effective date of this permit.

4. Department Review

a. When requested by the Director or his designee, the permittee shall make the BMP available for Department review.

b. The Director or his designee may notify the permittee at any time that the BMP is deficient and require correction of the deficiency.

c. The permittee shall correct any BMP deficiency identified by the Director or his designee within 30 days of receipt of notification and shall certify to the Department that the correction has been made and implemented.

5. Administrative Procedures

a. A copy of the BMP shall be maintained at the facility and shall be available for inspection by representatives of the Department.

b. A log of the routine inspection required above shall be maintained at the facility and shall be available for inspection by representatives of the Department. The log shall contain records of all inspections performed for the last three years and each entry shall be signed by the person performing the inspection.

c. The permittee shall provide training for any personnel required to implement the BMP and shall retain documentation of such training at the facility. This documentation shall be available for inspection by representatives of the Department. Training shall be performed prior to the date that implementation of the BMP is required.

d. BMP Plan Modification. The permittee shall amend the BMP plan whenever there is a change in the facility or change in operation of the facility which materially increases the potential for the ancillary activities to result in a discharge of significant amounts of pollutants.

e. BMP Plan Review. The permittee shall complete a review and evaluation of the BMP plan at least once every three years from the date of preparation of the BMP plan. Documentation of the BMP Plan review and evaluation shall be signed and dated by the Plant Manager.

B. STORMWATER FLOW MEASUREMENT AND SAMPLING REQUIREMENTS

1. Stormwater Flow Measurement

a. All stormwater samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches.

b. The total volume of stormwater discharged for the event must be monitored, including the date and duration (in hours) and rainfall (in inches) for storm event(s) sampled. The duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event must be a minimum of 72 hours. This information must be recorded as part of the sampling procedure and records retained according to Part I.B. of this permit.

c. The volume may be measured using flow measuring devices, or estimated based on a modification of the Rational Method using total depth of rainfall, the size of the drainage area serving a stormwater outfall, and an estimate of the runoff coefficient of the drainage area. This information must be recorded as part of the sampling procedure and records retained according to Part I.B. of this permit.

2. Stormwater Sampling

a. A grab sample, if required by this permit, shall be taken during the first thirty minutes of the discharge (or as soon thereafter as practicable); and a flow-weighted composite sample, if required by this permit, shall be taken for the entire event or for the first three hours of the event.

b. All test procedures will be in accordance with part I.B. of this permit.

C. COOLING WATER INTAKE STRUCTURE (CWIS) REQUIREMENTS

1. The cooling water intake structures used by the permittee has been evaluated using available information. At this time, the Department has determined that the cooling water intake structures represent the interim best technology available (BTA) to minimize adverse environmental impact in accordance with Section 316(b) of the Federal Clean Water Act (33 U.S.C. section 1326).

2. The Permittee is required to operate and maintain each CWIS in a manner that minimizes impingement and entrainment levels. Documentation detailing the steps that have and are being taken to minimize the impingement and entrainment levels shall be maintained on site and made available upon request.

3. Nothing in this Permit authorizes take for the purposes of a facility compliance with the Endangered Species Act. Under the Endangered Species Act, take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct, of endangered or threatened species.

4. The Permittee shall submit the information for each CWIS as required by 40 CFR 122.21(r) by June 30, 2024.

5. The Permittee must keep records of all submissions that are part of the permit application pertaining to each CWIS until the subsequent permit is issued to the Permittee.

6. The Permittee's permit application must contain readily available information, at the time of permit application development, in identifying all Federally-listed threatened and endangered species and/or designated critical habitat that are or may be present in the action area.

7. The Permittee must conduct weekly visual inspections or employ remote monitoring devices during the period each cooling water intake structure is in operation. This condition is only applicable if control technologies are being employed to comply with final BTA standards for impingement mortality.

8. The Permittee is required to submit an Annual Certification to the Department no later than January 28th of each year. The Annual Certification shall detail if any changes have been made to impact the operation of each CWIS structure.

D. EFFLUENT TOXICITY LIMITATIONS AND BIOMONITORING REQUIREMENTS – DSN002T

1. The permittee shall perform short-term chronic toxicity tests on the wastewater discharges required to be tested for chronic toxicity by Part I of this permit.

a. Test Requirements

(1) The samples shall be diluted using appropriate control water, to the Instream Waste Concentration (IWC) which is 2 % effluent. The IWC is the actual concentration of effluent, after mixing, in the receiving stream during a 7-day, 10-year flow period.

(2) Any test result that shows a statistically significant reduction in survival, growth, or reproduction between the control and the test at the 95% confidence level indicate chronic toxicity and constitute noncompliance with this permit.

b. General Test Requirements

(1) A minimum of three (3) composite samples shall be obtained for use in the above biomonitoring tests and collected every other day so that the laboratory receives water samples on the first, third, and fifth day of the seven-day test period. The holding time for each composite sample shall not exceed 36 hours. The control water shall be a water prepared in the laboratory in accordance with the EPA procedure described in EPA 821-R-02-013 or the most current edition or another control water selected by the permittee and approved by the Department.

(2) Effluent toxicity tests in which the control survival is less than 80%, P. promelas dry weight per surviving control organism is less than 0.25 mg, Ceriodaphnia number of young per surviving control organism is less than 15, Ceriodaphnia reproduction where less than 60% of surviving control females produce three broods or in which the other requirements of the EPA Test Procedure are not met shall be unacceptable and the permittee shall rerun the tests as soon as practical within the monitoring period.

(3) In the event of an invalid test, upon subsequent completion of a valid test, the results of all tests, valid and invalid, are reported with an explanation of the tests performed and results.

c. Reporting Requirements

(1) The permittee shall notify the Department in writing within 48 hours after toxicity has been demonstrated by the scheduled test(s).

(2) Biomonitoring test results obtained during each monitoring period shall be summarized and reported using the appropriate Discharge Monitoring Report (DMR) form approved by the Department. In accordance with Section 2 of this part, an effluent toxicity report containing the information in Section 2 shall be included with the DMR. Two copies of the test results must be submitted to the Department no later than 28 days after the month in which the tests were performed.

d. Additional Testing Requirements

(1) If chronic toxicity is indicated (noncompliance with permit limit), the permittee shall perform two additional valid chronic toxicity tests in accordance with these procedures to determine the extent and duration of the toxic condition. The toxicity tests shall run consecutively beginning on the first calendar week following the date on which the permittee became aware of the permit noncompliance and the results of these tests shall be submitted no later than 28 days following the month in which the tests were performed.

(2) After evaluation of the results of the follow-up tests, the Department will determine if additional action is appropriate and may require additional testing and/or toxicity reduction measures. The permittee may be required to perform a Toxicity Identification Evaluation (TIE) and/or a Toxicity Reduction Evaluation (TRE). The TIE/TRE shall be performed in accordance with the most recent protocols/guidance outlined by EPA (e.g., EPA/600/2-88/062, EPA/600/R-92/080, EPA/600/R-91-003, EPA/600/R-92/081, EPA/833/B-99/022 and/or EPA/600/6-91/005F, etc.)

e. Test Methods

(1) The tests shall be performed in accordance with the latest edition of the "EPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms". The Larval Survival and Growth Test, Methods 1000.0, shall be used for the fathead minnow (*Pimephales promelas*) test and the Survival and Reproduction Test, Method 1002.0, shall be used for the cladoceran (*Ceriodaphnia dubia*) test.

2. Effluent Toxicity Testing Reports

The following information shall be submitted with each discharge monitoring report unless otherwise directed by the Department. The Department may at any time suspend or reinstate these requirements or may decrease or increase the frequency of submittals.

a. Introduction

(1) Facility name, location, and county

(2) Permit number

(3) Toxicity testing requirements of permit

(4) Name of receiving water body

(5) Contract laboratory information (if tests are performed under contract)

a) Name of firm
b) Telephone number
c) Address

(6) Objective of test

b. Plant Operation

(1) Discharge Operating schedule (if other than continuous)

(2) Volume of discharge during sample collection to include Mean daily discharge on sample collection dates (MGD, CFS, GPM)

(3) Design flow of treatment facility at time of sampling

c. Source of Effluent and Dilution Water

(1) Effluent samples

(a) Sampling point
(b) Sample collection dates and times (to include composite sample start and finish times)
(c) Sample collection method
(d) Physical and chemical data of undiluted effluent samples (water temperature, pH, alkalinity, hardness, specific conductance, total residual chlorine (if applicable), etc.)
(e) Lapsed time from sample collection to delivery
(f) Lapsed time from sample collection to test initiation
(g) Sample temperature when received at the laboratory

(2) Dilution Water

(a) Source
(b) Collection/preparation date(s) and time(s)
(c) Pretreatment (if applicable)
(d) Physical and chemical characteristics (water temperature, pH, alkalinity, hardness, specific conductance, etc.)

d. Test Conditions

(1) Toxicity test method utilized

(2) End point(s) of test

(3) Deviations from referenced method, if any, and reason(s)

(4) Date and time test started

(5) Date and time test terminated

(6) Type and volume of test chambers

(7) Volume of solution per chamber

(8) Number of organisms per test chamber

(9) Number of replicate test chambers per treatment

(10) Test temperature, pH, and dissolved oxygen as recommended by the method (to include ranges)

(11) Specify if aeration was needed

(12) Feeding frequency, amount, and type of food

(13) Specify if (and how) pH control measures were implemented

(14) Light intensity (mean)

e. Test Organisms

(1) Scientific name

(2) Life stage and age

(3) Source

(4) Disease(s) treatment (if applicable)

f. Quality Assurance

(1) Reference toxicant utilized and source

(2) Date and time of most recent chronic reference toxicant test(s), raw data and current control chart(s). The most recent chronic reference toxicant test shall be conducted within 30 days of the routine.

(3) Dilution water utilized in reference toxicant test

(4) Results of reference toxicant test(s) (NOEC, IC25, PASS/FAIL, etc.), report concentration response relationship and evaluate test sensitivity

(5) Physical and chemical methods utilized

g. Results

(1) Provide raw toxicity data in tabular form, including daily records of affected organisms in each concentration (including controls) and replicate

(2) Provide table of endpoints: NOECs, IC25s, PASS/FAIL, etc. (as required in the applicable NPDES permit)

(3) Indicate statistical methods used to calculate endpoints

(4) Provide all physical and chemical data required by method

(5) Results of test(s) (NOEC, IC25, PASS/FAIL, etc.), report concentration-response relationship (definitive test only), report percent minimum significant difference (PMSD) calculated for sub-lethal endpoints determined by hypothesis testing.

h. Conclusions and Recommendations

(1) Relationship between test endpoints and permit limits

(2) Actions to be taken

1/ Adapted from "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", Fourth Edition, October 2002 (EPA 821-R-02-013), Section 10, Report Preparation

E. ACUTE EFFLUENT TOXICITY LIMITATIONS AND BIOMONITORING REQUIREMENTS (DSN003T)

1. The permittee shall perform 48-hour acute toxicity tests on the wastewater discharges required to be tested for acute toxicity by Part I of this permit.

   a. Test Requirements

      (1) The tests shall be performed using undiluted effluent. Any test where survival in the effluent concentration is less than 90% and statistically lower than the control indicates acute toxicity and constitutes noncompliance with this permit.

   b. General Test Requirements:

      (1) A composite sample shall be obtained for use in above biomonitoring tests. The holding time for each sample shall not exceed 36 hours. The control water shall be a water prepared in the laboratory in accordance with the EPA procedure described in EPA 821-R-02-012 or most current edition or another control water selected by the permittee and approved by the Department.

      Effluent toxicity tests in which the control survival is less than 90% or in which the other requirements of the EPA Test Procedure are not met shall be unacceptable and the permittee shall rerun the tests as soon as practical within the monitoring period.

      In the event of an invalid test, upon subsequent completion of a valid test, the results of all tests, valid and invalid, are reported with an explanation of the tests performed and results.

   c. Reporting Requirements:

      (1) The permittee shall notify the Department in writing within 48 hours after toxicity has been demonstrated by the scheduled test(s).

      (2) Biomonitoring test results obtained during each monitoring period shall be summarized and reported using the appropriate Discharge Monitoring Report (DMR) form approved by the Department. In accordance with Section 2. of this part, an effluent toxicity report containing the information in Section 2. shall be included with the DMR. Two copies of the test results must be submitted to the Department no later than 28 days after the month in which the tests were performed.

   d. Additional Testing Requirements:

      (1) If acute toxicity is indicated (noncompliance with permit limit), the permittee shall perform four additional valid acute toxicity tests in accordance with these procedures to determine the extent and duration of the toxic condition. The toxicity tests shall be performed once per week and shall be performed during the first four calendar weeks following the date on which the permittee became aware of the permit noncompliance and the results of these tests shall be submitted no later than 28 days following the month in which the tests were performed.

      (2) After evaluation of the results of the follow-up tests, the Department will determine if additional action is appropriate and may require additional testing and/or toxicity reduction measures. The permittee may be required to perform a Toxicity Identification Evaluation (TIE) and/or a Toxicity Reduction Evaluation (TRE). The TIE/TRE shall be performed in accordance with the most recent protocols/guidance outlined by EPA (e.g., EPA/600/2-88/062, EPA/600/R-92/080, EPA/600R-92/081, EPA/833/B-99/022 and/or EPA/600/6-91/005F, etc.).

   e. Test Methods:

      (1) The tests shall be performed in accordance with the latest edition of the "EPA Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" and shall be performed using the fathead minnow (*Pimephales promelas*) and the cladoceran (*Ceriodaphnia dubia*).

2. Effluent toxicity testing reports

The following information shall be submitted with each discharge monitoring report unless otherwise directed by the Department. The Department may at any time suspend or reinstate this requirement or may increase or decrease the frequency of submittals.

a. Introduction

(1) Facility Name, location and county

(2) Permit number

(3) Toxicity testing requirements of permit

(4) Name of receiving water body

(5) Contract laboratory information (if tests are performed under contract)

(a) Name of firm

(b) Telephone number

(c) Address

(6) Objective of test

b. Plant Operations

(1) Discharge operating schedule (if other than continuous)

(2) Volume of discharge during sample collection to include Mean daily discharge on sample collection date (MGD, CFS, GPM)

(3) Design flow of treatment facility at time of sampling

c. Source of Effluent and Dilution Water

(1) Effluent samples

(a) Sampling point

(b) Sample collection dates and times (to include composite sample start and finish times)

(c) Sample collection method

(d) Physical and chemical data of undiluted effluent samples (water temperature, pH, alkalinity, hardness, specific conductance, total residual chlorine (if applicable), etc.)

(e) Sample temperature when received at the laboratory

(f) Lapsed time from sample collection to delivery

(g) Lapsed time from sample collection to test intiation

(2) Dilution Water Samples

(a) Source

(b) Collection date(s) and time(s) (where applicable)

(c) Pretreatment

(d) Physical and chemical characteristics (pH, hardness, water temperature, alkalinity, specific conductance, etc.)

d. Test Conditions

(1) Toxicity test method utilized

(2) End point(s) of test

(3) Deviations from referenced method, if any, and reason(s)

(4) Date and time test started

(5) Date and time test terminated

(6) Type and volume of test chambers

(7) Volume of solution per chamber

(8) Number of organisms per test chamber

(9) Number of replicate test chambers per treatment

(10) Test temperature, pH and dissolved oxygen as recommended by the method (to include ranges)

(11) Feeding frequency, and amount and type of food

(12) Light intensity (mean)

e. Test Organisms

(1) Scientific name

(2) Life stage and age

(3) Source

(4) Disease treatment (if applicable)

f. Quality Assurance

(1) Reference toxicant utilized and source

(2) Date and time of most recent acute reference toxicant test(s), raw data, and current cusum chart(s)

(3) Dilution water utilized in reference toxicant test

(4) Results of reference toxicant test(s) (LC50, etc.), report concentration-response relationship and evaluate test sensitivity. The most recent reference toxicant test shall be conducted within 30-days of the routine.

(5) Physical and chemical methods utilized

g. Results

(1) Provide raw toxicity data in tabular form, including daily records of affected organisms in each concentration (including controls) and replicate

(2) Provide table of endpoints: LC50, NOAEC, Pass/Fail (as required in the applicable NPDES permit)

(3) Indicate statistical methods used to calculate endpoints

(4) Provide all physical and chemical data required by method

(5) Results of test(s) (LC50, NOAEC, Pass/Fail, etc.), report concentration-response relationship (**definitive test only**), report percent minimum significant difference (PMSD).

h. Conclusions and Recommendations

(1) Relationship between test endpoints and permit limits

(2) Action to be taken

1/ Adapted from "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms", Fifth Edition, October 2002 (EPA 821-R-02-012), Section 12, Report Preparation

F. ASH POND SEEP IDENTIFICATION AND CORRECTIVE ACTION

The Permittee shall develop and implement an Ash Pond Seep Identification and Corrective Action Plan within 90 days from the effective date of the Permit. When requested by the Director or his designee, the Permittee shall make the plan available for Department review. The plan shall provide for weekly inspections. If a seep is identified during an inspection, the Permittee must provide corrective action as soon as feasible. A log of the inspections shall be maintained at the facility and shall be available for inspection by representatives of the Department. The log shall contain records of all inspections performed for the last three years and each entry shall be signed by the person performing the inspection. The Permittee shall submit an annual report by January 28th of each year detailing any identified seeps and corrective actions taken during the previous calendar year. The first report is due January 28, 2022 for calendar year 2021.

G. ASH POND DEWATERING PLAN

The Permittee shall perform all ash pond dewatering activities in accordance with an Ash Pond Dewatering Plan approved by the Department. The plan shall be modified, if necessary, as soon as possible subsequent to the receipt of comments from the Department.

H. 316(a) THERMAL VARIANCE CONTINUANCE

A variance request under CWA Section 316(a) for the thermal component of the discharge must be filed with the application for permit renewal in accordance with 40 CFR Part 125.70 Subpart H – Criteria for Determining Alternative Effluent Limitations Under Section 316(a) of the Act and 40 CFR 122.21(m)(6) Subpart B – Permit Application and Special NPDES Program Requirements, Variance Requests by Non-POTWs. The request to continue the variance must be received with the application for renewal of the NPDES permit 180 days prior to permit expiration. At a minimum, the application shall include necessary technical data and relevant information to include data collected within the life of the permit to support the request for a variance continuation.

The Permittee shall conduct a 316(a) study during the permit cycle. A 316(a) study plan shall be submitted to the Department for review within 365 days of the effective date of this permit and shall be revised as soon as practical based upon subsequent receipt of comments. After the study plan has been approved by the Department, the Permittee shall complete the study and submit the results to the Department 365 days prior to the expiration date of this permit.

Lance R. LeFleur
Director

Kay Ivey
Governor

Alabama Department of Environmental Management
adem.alabama.gov
1400 Coliseum Blvd. 36110-2400 ▪ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

FACT SHEET

APPLICATION FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT TO DISCHARGE POLLUTANTS TO WATERS OF THE STATE OF ALABAMA

Date: July 7, 2020 **Prepared By:** Theo Pinson

NPDES Permit No. AL0002879

1. **Name and Address of Applicant:**

   Alabama Power Company
   Post Office Box 2641, Bin 12N-0830
   Birmingham, Alabama 35291

2. **Name and Address of Facility:**

   Barry Steam Electric Plant
   15300 Highway 43 North
   Bucks, Alabama 36512

3. **Description of Applicant's Type of Facility and/or Activity Generating the Discharge:**

   Individual Permit - Standard

4. **Applicant's Receiving Waters**

Receiving Waters	Classification
Mobile River	Fish &Wildlife

   For the Outfall latitude and longitude see the permit application.

5. **Permit Conditions:**

   See attached Rationale and Draft Permit.

6. **PROCEDURES FOR THE FORMULATION OF FINAL DETERMINATIONS**

   a. **Comment Period**

   The Alabama Department of Environmental Management proposes to issue this NPDES permit subject to the limitations and special conditions outlined above. This determination is tentative.

   Interested persons are invited to submit written comments on the draft permit to the following address:

Russell A. Kelly, Chief
Permits and Services Division
Alabama Department of Environmental Management
1400 Coliseum Blvd
(Mailing Address: Post Office Box 301463; Zip 36130-1463)
Montgomery, Alabama 36110-2059
(334) 271-7714

All comments received prior to the closure of the public notice period (see public notice for date) will be considered in the formulation of the final determination with regard to this permit.

b. Public Hearing

A written request for a public hearing may be filed within the public notice period and must state the nature of the issues proposed to be raised in the hearing. A request for a hearing should be filed with the Department at the following address:

Russell A. Kelly, Chief
Permits and Services Division
Alabama Department of Environmental Management
1400 Coliseum Blvd
(Mailing Address: Post Office Box 301463; Zip 36130-1463)
Montgomery, Alabama 36110-2059
(334) 271-7714

The Director shall hold a public hearing whenever it is found, on the basis of hearing requests, that there exists a significant degree of public interest in a permit application or draft permit. The Director may hold a public hearing whenever such a hearing might clarify one or more issues involved in the permit decision. Public notice of such a hearing will be made in accordance with ADEM Admin. Code r. 335-6-6-.21.

c. Issuance of the Permit

All comments received during the public comment period shall be considered in making the final permit decision. At the time that any final permit decision is issued, the Department shall prepare a response to comments in accordance with ADEM Admin. Code r. 335-6-6-.21. **The permit record, including the response to comments, will be available to the public via the eFile System** (http://app.adem.alabama.gov/eFile/) **or an appointment to review the record may be made by writing the Permits and Services Division at the above address.**

Unless a request for a stay of a permit or permit provision is granted by the Environmental Management Commission, the proposed permit contained in the Director's determination shall be issued and effective, and such issuance will be the final administrative action of the Alabama Department of Environmental Management.

d. Appeal Procedures

As allowed under ADEM Admin. Code chap. 335-2-1, any person aggrieved by the Department's final administrative action may file a request for hearing to contest such action. Such requests should be received by the Environmental Management Commission within thirty days of issuance of the permit. Requests should be filed with the Commission at the following address:

Alabama Environmental Management Commission
1400 Coliseum Blvd
(Mailing Address: Post Office Box 301463; Zip 36130-1463)
Montgomery, Alabama 36110-2059

All requests must be in writing and shall contain the information provided in ADEM Admin. Code r. 335-2-1-.04.

ADEM PERMIT RATIONALE

PREPARED DATE: July 7, 2020
PREPARED BY: Theo Pinson

Permittee Name: Alabama Power Company

Facility Name: Barry Steam Electric Plant

Permit Number: AL0002879

PERMIT IS A REISSUANCE DUE TO EXPIRATION

DISCHARGE SERIAL NUMBERS & DESCRIPTIONS:

Outfall	Monitoring Points	Description
DSN001	DSN0011	Once through cooling water, cooling tower blowdown, and fire protection system waters
DSN01A	DSN01A1 DSN01AY	Internal outfall to DSN001 for cooling tower blowdown
DSN002	DSN0021 DSN002T	Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation
DSN003	DSN0031 DSN003Q DSN003T	Discharges from the low volume wastewater system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation
DSN02A DSN03A	DSN02A1 DSN03A1	Internal outfall to the low volume wastewater system for sanitary wastewaters
DSN02B DSN03B	DSN02BY DSN03BY	Internal outfall to the low volume wastewater system for pretreated chemical metal cleaning wastes
DSN02C DSN03C	DSN02C1 DSN02CY DSN03C1 DSN03CY	Internal outfall to the low volume wastewater system for cooling tower blowdown from the Carbon Capture Process
DSN02D DSN03D	No monitoring required	Internal outfall to the low volume wastewater system for coal pile runoff
DSN02E DSN03E	DSN02E1 DSN03E1	Internal outfall to the low volume wastewater system for FGD Wastewaters which may include bottom ash transport waters utilized in the FGD scrubber
DSN02F DSN03F	No monitoring required	Internal outfall to the low volume wastewater system for ash pond landfill leachate collection system
DSN02G DSN03G	No monitoring required	Internal outfall to the low volume wastewater system for RSCC Overflow
DSN02H DSN03H	No monitoring required	Internal outfall to the low volume wastewater system for low volume wastes
DSN004	DSN0041	Discharges from Lagoon A including coal pile runoff, low volume wastewaters, concrete truck washout wastewaters, carwash wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation

DSN04A	No monitoring required	Internal outfall to Lagoon A for low volume wastewaters
DSN010	DSN010S	Stormwater runoff associated with electric power generation and fire protection system waters
DSN011	No monitoring required	Intake screen backwash and fire protection system waters
DSN012	No monitoring required	Intake screen backwash and fire protection system waters
DSN013	No monitoring required	Stormwater runoff associated with electric power generation, stormwater runoff from the administrative building and parking lot, and fire protection system waters
DSN019	No monitoring required	Stormwater runoff associated with electric power generation and fire protection system waters
DSN020	DSN020S	Stormwater runoff from the closed ash pond footprint and fire protection system waters
DSN021	DSN021S	Stormwater runoff from the closed ash pond footprint and fire protection system waters

INDUSTRIAL CATEGORY: 40 CFR Part 423 Steam Electric Power Generating Point Source Category
§423.12 Best Practicable Control Technology Currently Available (BPT)
§423.13 Best Available Technology Economically Achievable (BAT)

MAJOR: Yes

STREAM INFORMATION:

Receiving Stream: Mobile River
Classification: Fish & Wildlife
River Basin: Mobile
7Q10: 2207.53 cfs
7Q2: 3927.61 cfs
1Q10: 1655.65 cfs
Annual Average Flow: 23,277 cfs
303(d) List: Yes
Impairment: Metals (Mercury)
TMDL: No

DISCUSSION:
Alabama Power Company's (APC) Barry Steam Electric Plant produces electricity from gas-fired Units 1 and 2, coal-fired Units 4 and 5, and combined cycle Units 6 and 7. Unit 3 has previously been retired from service. The nameplate rating of each unit is 85 MW, 85 MW, 350 MW, 770 MW, 566 MW, and 566 MW respectively. The gas and coal-fired units are cooled with once-through cooling waters. The combined cycle units are cooled with closed cycle cooling. Gypsum from the Unit 5 scrubber is stored in the gypsum storage pond.

Pursuant to State and Federal Regulations, ADEM Admin Code 335-13-15 and 40 CFR 257.101(a)(1) (CCR Regulations), Alabama Power Company has ceased discharging wastewaters to the ash pond for treatment and has indicated that they have commenced closure activities. The wastewaters have been rerouted through a new wastewater treatment system which is referred to in the permit and rationale as the Low Volume Wastewater System (LVWW). Ash pond closure will necessitate decanting and dewatering activities. The ash pond is proposed to be dewatered utilizing a mechanical treatment system. Pressure relief wells are being evaluated as part of the ash pond closure process. Discharges associated with the pressure relief wells will be treated through a separate treatment system. The effluents from the LVWW, ash pond dewatering treatment system, and pressure relief well treatment system will be combined prior to discharge through the same outfall.

APC has requested a new outfall location to the Mobile River located closer to the plant for the discharge from the LVWW. Initially, the discharges from the LVWW are proposed to be piped to the existing ash pond discharge structure and combine with the effluents from the ash pond dewatering treatment system and the pressure relief well treatment system prior to discharge through Outfall DSN002. The new discharge location is proposed as Outfall DSN003. The transition to Outfall DSN003 for the LVWW discharges is expected to occur during the closure of the ash pond. The discharges associated with ash pond dewatering and the pressure relief wells will continue to discharge through Outfall DSN002 until the completion of the ash pond dewatering activities necessitating those discharges.

ADEM Administrative Rule 335-6-10-.12 requires applicants to new or expanded discharges to Tier II waters demonstrate that the proposed discharge is necessary for important economic or social development in the area in which the waters are located. The application submitted by the facility is not for a new or expanded discharge to a Tier II waterbody; therefore, the economic analysis of the anti-degradation regulations is not applicable.

0011:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Temperature, Water Deg. Fahrenheit	-	-	-	108.0 F	112.0 F	Continuous	Recorder	316(a)
Temperature, Water Deg. Fahrenheit	-	-	-	84.5 F	94.5 F	Continuous	Recorder	316(a)
Temperature, Water Deg. Fahrenheit (Intake)	-	-	-	REPORT F	REPORT F	Continuous	Recorder	BPJ
pH	-	-	6.0 S.U.	-	8.5 S.U.	Monthly	Grab	WQBEL
Zinc Total Recoverable	-	-	-	-	REPORT mg/l	Monthly	Grab	BPJ
Copper Total Recoverable	-	-	-	-	REPORT mg/l	Monthly	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Calculated	BPJ
Chlorine, Total Residual	-	-	-	0.03 mg/l	0.04 mg/l	Daily	Grab	BPJ
Chlorination Duration	-	120.0 min/day	-	-	-	Daily	Measured	ELG

01AY:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Chromium, Total (As Cr)	-	-	-	0.2 mg/l	0.2 mg/l	Annually	Composite	ELG
Zinc, Total (As Zn)	-	-	-	1.0 mg/l	1.0 mg/l	Annually	Composite	ELG
Priority Pollutants Total Effluent	-	-	-	-	0 ug/l	Annually	Grab	ELG
Annual Certification Statement	-	-	-	-	0 Yes=0; No=1	Annually	Not Applicable	ELG

01A1:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Totalizer	BPJ
Chlorine, Free Available	-	-	-	0.2 mg/l	0.5 mg/l	2X Monthly	Grab	ELG
Chlorination Duration	-	120.0 min/day	-	-	-	Daily	Measured	ELG

0021:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Turbidity	-	-	-	REPORT NTU	REPORT NTU	2X Monthly	Measured	BPJ
pH	-	-	6.0 S.U.	-	9.0 S.U.	2X Monthly	Grab	WQBEL/BPJ
Solids, Total Suspended	-	-	-	19.0 mg/l	58.8 mg/l	2X Monthly	Grab	ELG/BPJ
Oil & Grease	-	-	-	9.0 mg/l	13.0 mg/l	2X Monthly	Grab	BPJ
Nitrogen, Organic Total (As N)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Nitrogen, Ammonia Total (As N)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Nitrogen, Kjeldahl Total (As N)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Nitrite Plus Nitrate Total 1 Det. (As N)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Phosphorus, Total (As P)	REPORT lbs/day	REPORT lbs/day	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Cadmium, Total (As Cd)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Chromium, Total (As Cr)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Copper, Total (As Cu)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Lead, Total (As Pb)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Nickel, Total (As Ni)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Zinc, Total (As Zn)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Selenium, Total (As Se)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Arsenic, Trivalent Dissolved	-	-	-	145.2 ug/l	REPORT ug/l	2X Monthly	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Calculated	BPJ
Chlorine, Total Residual	-	-	-	0.7 mg/l	1.0 mg/l	2X Monthly	Grab	BPJ
E. Coli	-	-	-	REPORT col/100mL	REPORT col/100mL	2X Monthly	Grab	BPJ
Solids, Total Dissolved	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
Mercury Total Recoverable	-	-	-	0.012 ug/l	2.4 ug/l	2X Monthly	Grab	303(d)
Iron, Total (As Fe)	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ
BOD, Carbonaceous 05 Day, 20C	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Composite	BPJ
Hydrazine	-	-	-	REPORT mg/l	REPORT mg/l	2X Monthly	Grab	BPJ

002T:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Toxicity, Ceriodaphnia Chronic	-	0 pass(0)/fail(1)	-	-	-	Quarterly	Composite	BPJ
Toxicity, Pimephales Chronic	-	0 pass(0)/fail(1)	-	-	-	Quarterly	Composite	BPJ

02A1, 03A1:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Solids, Total Suspended	-	-	-	30.0 mg/l	45.0 mg/l	2X Monthly	Composite	ELG
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	2X Monthly	Instantaneous	BPJ
BOD, Carbonaceous 05 Day, 20C	-	-	-	25.0 mg/l	40.0 mg/l	2X Monthly	Composite	ELG

02BY, 03BY:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
pH	-	-	6.0 S.U.	-	10.5 S.U.	Daily	Grab	ELG
Copper, Total (As Cu)	-	-	-	1.0 mg/l	1.0 mg/l	Daily	Composite	ELG
Iron, Total (As Fe)	-	-	-	1.0 mg/l	1.0 mg/l	Daily	Composite	ELG
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Instantaneous	BPJ

02C1, 03C1:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Monthly	Calculated	BPJ
Chlorine, Free Available	-	-	-	0.2 mg/l	0.5 mg/l	Monthly	Grab	ELG
Chlorination Duration	-	120.0 min/day	-	-	-	Daily	Measured	ELG

02CY, 03CY:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Chromium, Total (As Cr)	-	-	-	0.2 mg/l	0.2 mg/l	Annually	Composite	ELG
Zinc, Total (As Zn)	-	-	-	1.0 mg/l	1.0 mg/l	Annually	Composite	ELG
Priority Pollutants Total Effluent	-	-	-	-	0 ug/l	Annually	Grab	ELG
Annual Certification Statement	-	-	-	-	0 Yes=0; No=1	Annually	Not Applicable	ELG

02D1, 03D1: No Monitoring Requirements

02E1, 03E1:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Nitrite Plus Nitrate Total 1 Det. (As N)	-	-	-	4.4 mg/l	17.0 mg/l	Monthly	Grab	ELG
Arsenic, Total (As As)	-	-	-	8 ug/l	11 ug/l	Monthly	Grab	ELG
Selenium, Total (As Se)	-	-	-	12 ug/l	23 ug/l	Monthly	Grab	ELG
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Monthly	Instantaneous	BPJ
Mercury, Total (As Hg)	-	-	-	356 ng/l	788 ng/l	Monthly	Grab	ELG

02F1, 03F1: No Monitoring Requirements

02G1, 03G1: No Monitoring Requirements

02H1, 03H1: No Monitoring Requirements

0031:

Parameter	**Monthly Avg Loading**	**Daily Max Loading**	**Daily Min Concentration**	**Monthly Avg Concentration**	**Daily Max Concentration**	**Sample Frequency**	**Sample Type**	**Basis***
pH	-	-	6.0 S.U.	-	9.0 S.U.	Monthly	Grab	WQBEL/ BPJ
Solids, Total Suspended	-	-	-	27.0 mg/l	70.3 mg/l	Monthly	Composite	BPJ
Oil & Grease	-	-	-	-	15.0 mg/l	Monthly	Grab	BPJ
Nitrogen, Ammonia Total (As N)	-	-	-	-	REPORT mg/l	Monthly	Composite	BPJ
Nitrogen, Kjeldahl Total (As N)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	BPJ
Nitrite Plus Nitrate Total 1 Det. (As N)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	BPJ
Phosphorus, Total (As P)	-	REPORT lbs/day	-	-	REPORT mg/l	Monthly	Composite	BPJ
Arsenic, Trivalent Dissolved	-	-	-	-	REPORT ug/l	Monthly	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	REPORT MGD	REPORT MGD	-	-	-	Daily	Recorder	BPJ
Chlorine, Total Residual	-	-	-	-	1.0 mg/l	Monthly	Grab	BPJ
E. Coli	-	-	-	-	REPORT col/100mL	Monthly	Grab	BPJ
BOD, Carbonaceous 05 Day, 20C	-	-	-	-	REPORT mg/l	Monthly	Composite	BPJ
Hydrazine	-	-	-	-	REPORT mg/l	Monthly	Grab	BPJ

003T:

Parameter	**Monthly Avg Loading**	**Daily Max Loading**	**Daily Min Concentration**	**Monthly Avg Concentration**	**Daily Max Concentration**	**Sample Frequency**	**Sample Type**	**Basis***
Toxicity, Ceriodaphnia Acute	-	0 pass(0)/fail(1)	-	-	-	Annually	Grab	BPJ
Toxicity, Pimephales Acute	-	0 pass(0)/fail(1)	-	-	-	Annually	Grab	BPJ

003Q:

Parameter	**Monthly Avg Loading**	**Daily Max Loading**	**Daily Min Concentration**	**Monthly Avg Concentration**	**Daily Max Concentration**	**Sample Frequency**	**Sample Type**	**Basis***
Mercury Total Recoverable	-	-	-	0.012 ug/l	2.4 ug/l	Quarterly	Composite	303(d)

0041:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
pH	-	-	6.0 S.U.	-	9.0 S.U.	Monthly	Grab	WQBEL/ BPJ
Solids, Total Suspended	-	-	-	25.0 mg/l	50.0 mg/l	Monthly	Grab	ELG
Oil & Grease	-	-	-	-	15.0 mg/l	Monthly	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Monthly	Instantaneous	BPJ

004Q:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Mercury Total Recoverable	-	-	-	0.012 ug/l	2.4 ug/l	Quarterly	Composite	303(d)

04A: No Monitoring Requirements.

010S:

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
pH	-	-	REPORT S.U.	-	REPORT S.U.	Semi-Annually	Grab	BPJ
Solids, Total Suspended	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Oil & Grease	-	-	-	-	15.0 mg/l	Semi-Annually	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Semi-Annually	Estimate	BPJ

011S, 012S, 013S, 019S: No Monitoring Requirements

020S, 021S: Stormwater monitoring requirements for the closed ash pond footprint.

Parameter	Monthly Avg Loading	Daily Max Loading	Daily Min Concentration	Monthly Avg Concentration	Daily Max Concentration	Sample Frequency	Sample Type	Basis*
Turbidity	-	-	-	-	REPORT NTU	Semi-Annually	Measured	BPJ
BOD, 5-Day (20 Deg. C)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
pH	-	-	REPORT S.U.	-	REPORT S.U.	Semi-Annually	Grab	BPJ
Solids, Total Suspended	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Oil & Grease	-	-	-	-	15.0 mg/l	Semi-Annually	Grab	BPJ
Nitrogen, Organic Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Nitrogen, Ammonia Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Nitrogen, Kjeldahl Total (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Nitrite Plus Nitrate Total 1 Det. (As N)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Phosphorus, Total (As P)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Arsenic, Total Recoverable	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Cadmium, Total (As Cd)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Chromium, Total (As Cr)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Copper, Total (As Cu)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Lead, Total (As Pb)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Nickel, Total (As Ni)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Zinc, Total (As Zn)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Selenium, Total (As Se)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Flow, In Conduit or Thru Treatment Plant	-	REPORT MGD	-	-	-	Semi-Annually	Estimate	BPJ
Solids, Total Dissolved	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Mercury, Total (As Hg)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ
Iron, Total (As Fe)	-	-	-	-	REPORT mg/l	Semi-Annually	Grab	BPJ

*Basis for Permit Limitation

- BPJ – Best Professional Judgment
- WQBEL – Water Quality Based Effluent Limits
- ELG – Federal Effluent Guideline Limitations
- 303(d) – 303(d) List of Impaired Waters
- 316(a) – Thermal Variance

Discussion

Best Professional Judgment (BPJ)

The parameters of concern for this facility are based on the parameters of concern listed in the permit application, from the current permit, and based upon best professional judgment. These parameters are consistent with similar facilities in the state and have been proven to be reflective of the operations at this facility. The proposed frequencies are based on a review of site specific conditions and an evaluation of similar facilities.

Federal Effluent Guideline Limitations (ELG)

Parameters based upon ELG have had effluent guidelines established under 40 CFR Part 423.12 and 40 CFR Part 423.13. In accordance with 40 CFR Part 423, there shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid. The Department believes that monitoring for PCBs is not necessary to determine compliance with the PCB prohibition since the expected source of PCBs in the discharge would be due to leaks or spills which are addressed by the BMP and SPCC permit conditions.

Outfall DSN001

Monitoring Points: 0011, 01A1, 01AY

Once through cooling water, cooling tower blowdown, and fire protection system waters

Total Residual Chlorine (TRC), Chlorination Duration

The chlorine discharge duration limitations are based on 40 CFR Parts 423.12 and 423.13. The maximum TRC limitation is proposed to be continued from the previous permit. The proposed average limitation is based on EPA's recommended water quality criteria which considers the available dilution in the receiving stream and BPJ. Sampling for TRC is required only during chlorination. In accordance with a letter dated August 11, 1998 from EPA Headquarters and a 1991 memorandum from EPA Region 4's Environmental Services Division (ESD), due to testing and method detection limitations, a Total Residual Chlorine measurement below 0.05 mg/L shall be considered below detection for compliance purposes.

$$\text{Instream Waste Concentration (IWC)} = \frac{Qw}{7Q10 + Qw}$$

$$IWC = 0.316 = \frac{659.9 \text{ MGD}}{1426.76 \text{ MGD} + 659.9 \text{ MGD}}$$

TRC Maximum = 0.019/IWC   0.019/0.316 = 0.06 mg/l;

The maximum limitation from the previous permit is more stringent and has been proposed to be continued.

TRC Average = 0.011/IWC   0.011/0.316 = 0.03 mg/l

Free Available Chlorine

The free available chlorine limitations are proposed to be removed from the permit. Compliance with the more stringent proposed TRC permit limitations is expected to demonstrate compliance with the less stringent free available chlorine effluent guideline values.

Temperature

The temperature limitations are based on a 316(a) thermal variance. The application submitted by the Permittee contained a demonstration for continuation of the variance following EPA's Section 316(a) regulations and guidance. Based on the information required to be submitted to the Department to justify the continuance of the 316(a) thermal variance, the Department has determined that a balanced and indigenous population (BIP) is being maintained in the Mobile River near Plant Barry.

The Department believes that the monitoring previously completed by the Permittee and proposed in this permit at the established sampling locations and the Permittee's 316(a) studies are sufficient to make a determination that a BIP is being maintained; however, the Permittee shall conduct another 316(a) study during the permit cycle. A 316(a) study plan shall be submitted to the Department for review within 365 days of the effective date of this permit and shall be revised as soon as practical based upon subsequent receipt of comments. After the study plan has been approved by the Department, the Permittee shall complete the study and submit the results to the Department within 365 days of the expiration date of this permit.

Whole Effluent Toxicity (Cooling Water Additives)
The discharge of biocides and corrosion inhibitors with non-process wastewaters (e.g. once through cooling water, etc.) can introduce the potential for toxicity in receiving waters. The facility is expected to verify that the use of these chemicals will not present potential toxic effects to representative organisms in the receiving waters and to ensure that the chemicals are used in a manner that is consistent with their labeling and standard industry practices.

Monitoring for Whole Effluent Toxicity is not proposed for Outfall DSN001 based on the use of the chemicals specified in the permit application; however, the Permittee should refer to Part I.D.5 of the permit for further requirements regarding Cooling Water and Boiler Water Additives.

Copper, Zinc
Monitoring for zinc and/or copper is not applicable unless cooling water additives containing zinc and/or copper are used during the monitoring period in either the once through cooling system or the cooling tower system. To certify no process addition, *9 should be reported for zinc and/or copper.

pH
ADEM Administrative Code, Division 6 Regulations, specifically 335-6-10-.09(5) – Specific Water Quality for Fish and Wildlife classified streams states: "Sewage, industrial waste or other wastes shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.0, nor greater than 8.5 standard units."

Internal Outfall DSN01A
Monitoring Points DSN01A1 and DSN01AY:
This internal outfall has been proposed to demonstrate compliance with the EGLs for cooling tower blowdown before comingling with other discharges. The proposed limitations are based on 40 CFR Parts 423.12 and 423.13.

Outfall DSN002
Associated Monitoring Points DSN0021, DSN002T
Internal Outfalls: DSN02A, DSN02B, DSN02C, DSN02D, DSN02E, DSN02F, DSN02G, DSN02H
Discharges from the low volume wastewater (LVWW) system, the ash pond dewatering treatment system, and the pressure relief well treatment system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, ash pond dewatering and decanting wastewaters, pressure relief well wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation

The Permittee shall perform all ash pond dewatering activities in accordance with an Ash Pond Dewatering Plan that has been approved by the Department. The plan shall be modified, if necessary, as soon as possible subsequent to the receipt of comments from the Department. As part of the dewatering plan, APC conducted sampling at various locations and depths within the ash pond. At each sampling location, samples were collected vertically from throughout the water column at one foot intervals from the surface to approximately one foot from the bottom of the ash pond and then composited into a single sample for analysis. The interstitial samples were collected at the water-ash interface at each interstitial sampling location. Prior to analysis, each sample was treated to simulate the proposed mechanical treatment system to be used during dewatering. A combined reasonable potential analysis of wastewaters from the ash pond dewatering treatment system, pressure relief well treatment system, and the LVWW treatment system was performed using available DMR data, data submitted with the permit application, data submitted with the ash pond dewatering plan, and instream background data collected by the Permittee, as requested by the Department. The reasonable potential analyses and sample calculations are attached. Based on the reasonable potential analyses, no parameters have shown a reasonable potential to exceed water quality criteria.

Following the Permittee's submission of notification of completion of dewatering activities, the Permittee may submit a request to the Water Division to discontinue all monitoring requirements applicable to Outfall DSN002 and associated monitoring points. Monitoring may be discontinued after the Permittee receives written confirmation from the Water Division that the aforementioned monitoring requirements are no longer applicable. At that time, the existing Outfall DSN002 discharge structure will be used as a stormwater outfall (DSN021S) for stormwater falling on the majority of the closed ash pond footprint. The stormwater outfall has been designated DSN021S. Monitoring requirements for Outfall DSN021S will not become applicable until after the monitoring associated with Outfall DSN002 is no longer required.

pH

ADEM Administrative Code, Division 6 Regulations, specifically 335-6-10-.09(5) – Specific Water Quality for Fish and Wildlife classified streams states: "Sewage, industrial waste or other wastes shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.0, nor greater than 8.5 standard units." Based on the volume of the receiving stream compared to the volume of the discharge, a pH limitation of 6.0 - 9.0 S.U. is not expected to impact the receiving stream. The proposed pH limitations are also consistent with the requirements of 40 CFR 423.12.

Total Suspended Solids (TSS)

The proposed DSN0021 TSS limitations were calculated using the following guideline and BPJ based factors:

			TSS Allocation in mg/l	
Internal Outfall	Wastestream	Flow in MGD	Average	Maximum
DSN02A	Sanitary	0.009	30	45
DSN02B	Chemical Metal Cleaning Waste	0	30	100
DSN02C	Cooling Tower Blowdown	0	10	20
DSN02D	Coal Pile Runoff	5.07	25	50
DSN02E	FGD	0.17	30	100
DSN02F	Landfill Leachate		Post Ash Pond Closure	
DSN02G	RSCC System Overflow	0.0004	30	100
DSN02H	Low Volume Wastes	3.29	30	100
	Pressure Relief Wells	8.64	10	20
	Ash Pond Dewatering	5.76	30	100
	SUM/CWF	22.94	21.4	58.8

Sample Calculation for Monthly Average TSS:

$$\frac{(0.009*30 + 0*30 + 0*10 + 5.07*25 + 0.17*30 + 0.0004*30 + 3.29*30 + 8.64*10 + 5.76*30)}{22.94} = 21.4$$

The monthly average TSS limitation in the previous permit is more stringent than the calculated value and therefore has been proposed to be continued. The maximum daily limitation is based on the calculated value.

Nutrients (Kjeldahl Nitrogen, Nitrite Plus Nitrate, Phosphorus)

The Department's Water Quality Branch has requested monitoring on a monthly basis during the growing season to provide information regarding the nutrient contribution to the receiving stream.

Oil & Grease

The monthly average and daily maximum limitations for Oil and Grease should prevent the occurrence of a visible sheen in the stream and have been shown to be achievable through the use of proper BMPs. The proposed oil and grease limitations are more stringent than the 40 CFR Parts 423.12 and 423.13 requirements.

Report Only Parameters

These monitoring requirements are proposed to evaluate the effectiveness of the LVWW, ash pond dewatering treatment system, and pressure relief well treatment system.

Arsenic

The previous permit contained a mass arsenic limitation. The limitation has been proposed in terms of concentration and is protective of the instream water quality standard.

Chronic Toxicity Biomonitoring

Testing is proposed diluted to the instream waste concentration (IWC) expressed as a percentage which has been rounded up for toxicity testing purposes. Chronic toxicity testing has been proposed because the IWC is greater than 1%.

$$\text{Instream Waste Concentration (IWC)} = \frac{Qw}{7Q10 + Qw}$$

$$0.0158 = \frac{22.94 \text{ MGD}}{1426.76 \text{ MGD} + 22.94 \text{ MGD}}$$

$$0.0158 \times 100 = 1.58\%$$

Total Residual Chlorine (TRC)

The proposed limitations are based on EPA's recommended water quality criteria which considers the available dilution in the receiving stream and BPJ.

TRC Maximum = 0.019/IWC (Not to exceed 1 mg/l) 0.019/0.0158 = 1.20 mg/l;
A maximum of 1 mg/l has been proposed.

TRC Average = 0.011/IWC 0.011/0.0158 = 0.7 mg/l

DSN002 and DSN003 Internal Outfalls

The internal outfalls and associated monitoring points have been proposed to demonstrate compliance with EGLs and/or state regulations prior to comingling with other wastestreams. All of the DSN002 and DSN003 internal outfalls discharge into the LVWW. The internal outfalls for Outfall DSN002 have been duplicated for Outfall DSN003 to correspond with the proposed future change in discharge location for the LVWW. While the internal monitoring points may not change their physical location, APC shall start reporting discharges under the Outfall DSN003 internal outfalls upon transitioning discharges from the LVWW to Outfall DSN003.

DSN02A, DSN03A

Proposed internal outfall to the LVWW for the main sanitary wastewater treatment plant. Specific limitations for CBOD and TSS have been applied based on secondary treatment standards as required under ADEM Admin. Code r. 335-6-10-.08 in accordance with the 40 CFR 133.102 requirements. The maximum limitations have been proposed as a daily maximum value in lieu of a 7-day average based on the required sampling frequency.

DSN02B, DSN03B

Proposed internal outfall to the LVWW to demonstrate compliance with chemical metal cleaning wastes ELGs. The limitations are based on 40 CFR Parts 423.12 and 423.13.

DSN02C, DSN03C

Proposed internal outfall to the LVWW to demonstrate compliance with the cooling tower blowdown ELGs. The limitations are based on 40 CFR Parts 423.12 and 423.13.

DSN02D, DSN03D

Proposed internal outfall to the LVWW for coal pile runoff. Specific limitations have not been applied at the internal outfall location based on further treatment provided prior to final discharge. End of pipe limitations have been proposed at the final discharge.

DSN02E, DSN03E
Proposed internal outfall to the LVWW for compliance with the FGD wastewater ELGs. The proposed limitations are based on 40 CFR Parts 423.12 and 423.13.

DSN02F, DSN03F
Proposed internal outfall to the LVWW for landfill leachate from the ash pond closure area. Specific limitations have not been applied at the internal outfall location based on further treatment provided prior to final discharge. End of pipe limitations have been proposed at the final discharge.

DSN02G, DSN03G
This is an internal outfall to the LVWW for the remote submerged chain conveyor (RSCC) system overflow. Low volume, short duration discharges may be expected to occur from minor leaks and maintenance events. These discharges are considered low volume wastes according to the 2015 EGL. The 2015 EGL allow for bottom ash transport water to be utilized in the FGD scrubber and then be discharged in accordance with the FGD ELGs. Specific limitations have not been applied at the internal outfall location based on further treatment provided prior to discharge. End of pipe limitations have been proposed at the final discharge.

DSN02H, DSN03H
This internal outfall was not listed in the permit application; however, the Department is administratively proposing it for low volume wastes because of associated ELGs. The ELGs specify limitations for TSS and Oil & Grease. Specific limitations have not been applied at the internal outfall based on further treatment provided prior to final discharge. End of pipe limitations have been proposed at the final discharge.

Outfall DSN003
Associated Monitoring Points DSN0031, DSN003Q, DSN003T
Internal Outfalls: DSN03A, DSN03B, DSN03C, DSN03D, DSN03E, DSN03F, DSN03G, DSN03H
Discharges from the low volume wastewater (LVWW) system including low volume wastewaters, sanitary wastewaters, chemical metal cleaning wastes, cooling tower blowdown, coal pile runoff, FGD wastewaters, ash pond landfill leachate, RSCC system overflow, miscellaneous cooling waters, vehicle rinse waters, fire protection system waters, and stormwater runoff associated with electric power generation

The Department performed a reasonable potential analysis using data submitted with the permit application and instream background data collected by the Permittee, as requested by the Department. The reasonable potential analyses and sample calculations are attached. Based on the reasonable potential analyses, no parameters have shown a reasonable potential to exceed water quality criteria.

pH
ADEM Administrative Code, Division 6 Regulations, specifically 335-6-10-.09(5) – Specific Water Quality for Fish and Wildlife classified streams states: "Sewage, industrial waste or other wastes shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.0, nor greater than 8.5 standard units." Based on the volume of the receiving stream compared to the volume of the discharge, a pH limitation of 6.0 - 9.0 S.U. is not expected to impact the receiving stream. The proposed pH limitations are also consistent with the requirements of 40 CFR 423.12.

Report Only Parameters
These monitoring requirements are proposed to evaluate the effectiveness of the LVWW. Water quality based arsenic limitations have not been proposed for Outfall DSN003 based on the results of the reasonable potential analyses and the more stringent effluent guideline limitations applied at internal Outfall DSN03E.

Nutrients (Kjeldahl Nitrogen, Nitrite Plus Nitrate, Phosphorus)
The Department's Water Quality Branch has requested monitoring on a monthly basis during the growing season to provide information regarding the nutrient contribution to the receiving stream.

Oil & Grease
The daily maximum limitation for Oil and Grease should prevent the occurrence of a visible sheen in the stream and has been shown to be achievable through the use of proper BMPs. The proposed oil and grease limitations are more stringent than the 40 CFR Parts 423.12 and 423.13 requirements.

Total Suspended Solids (TSS)
The proposed TSS limitations were calculated using guideline and BPJ based factors:

			TSS Allocation in mg/l	
Internal Outfall	Wastestream	Flow in MGD	Average	Maximum
DSN03A	Sanitary	0.009	30	45
DSN03B	Chemical Metal Cleaning Waste	0	30	100
DSN03C	Cooling Tower Blowdown	0	10	20
DSN03D	Coal Pile Runoff	5.07	25	50
DSN03E	FGD	0.17	30	100
DSN03F	Landfill Leachate	0.72		
DSN03G	RSCC System Overflow	0.0004	30	100
DSN03H	Low Volume Wastes	2.57	30	100
	SUM/CWF	8.54	27.0	70.3

Acute Toxicity Biomonitoring
Monitoring is proposed using to evaluate the effects of the discharge on the receiving stream. Acute toxicity testing with undiluted effluent has been proposed because the IWC is less than 1%.

$$\text{Instream Waste Concentration (IWC)} = \frac{Qw}{7Q10 + Qw}$$

$$0.0059 = \frac{8.54 \text{ MGD}}{1426.76 \text{ MGD} + 8.54 \text{ MGD}}$$

$$0.0059 \times 100 = 0.59\%$$

Total Residual Chlorine (TRC)
The proposed limitation is based on EPA's recommended water quality criteria which considers the available dilution in the receiving stream and BPJ.

TRC Maximum = 0.019/IWC (Not to exceed 1 mg/l) 0.019/0.0059 = 3.19 mg/l;
A maximum of 1 mg/l has been proposed.

Mercury
The Mobile River is listed on the 303(d) List of Impaired Waters for metals (mercury). The Department has proposed end of pipe water quality based limitations for mercury.

Outfall DSN004 – Lagoon A
Associated Monitoring Points: DSN0041, DSN004Q
Internal Outfalls: DSN04A
Discharges from Lagoon A including coal pile runoff, low volume wastewaters, concrete truck washout wastewaters, carwash wastewaters, fire protection system waters, and stormwater runoff associated with electric power generation.

Lagoon A currently discharges to the LVWW. APC has requested a new outfall, DSN004, for existing discharges from the coal pile runoff pond which is referred to as Lagoon A in the permit application. APC has indicated that Lagoon A has been redesigned to increase treatment capability including chemical addition and solid settling areas. APC has indicated that the carwash wastewaters are generated from washing equipment utilized in the dry fly ash handling area. Potable water is used for the concrete truck washout and carwash operations. No detergents or soaps are used in the carwash or concrete truck washout. Total residual chlorine is not expected to be a parameter of concern based on the retention time of Lagoon A compared to the small volume of potable water used for washing operations.

The Department performed a reasonable potential analysis using data submitted with the permit application and instream background data collected by the Permittee, as requested by the Department. The reasonable potential analyses and sample calculations are attached. Based on the reasonable potential analyses, no parameters have shown a reasonable potential to exceed water quality criteria.

pH
ADEM Administrative Code, Division 6 Regulations, specifically 335-6-10-.09(5) – Specific Water Quality for Fish and Wildlife classified streams states: "Sewage, industrial waste or other wastes shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.0, nor greater than 8.5 standard units." Based on the volume of the receiving stream compared to the volume of the discharge, a pH limitation of 6.0 - 9.0 S.U. is not expected to impact the receiving stream. The proposed pH limitations are also consistent with the requirements of 40 CFR 423.12.

Total Suspended Solids (TSS)
The proposed TSS limitations are based on the 40 CFR 423.12 requirements for coal pile runoff and BPJ.

Oil & Grease
The daily maximum limitation for Oil and Grease should prevent the occurrence of a visible sheen in the stream and has been shown to be achievable through the use of proper BMPs.

Internal Outfall DSN04A
Proposed internal outfall for low volume wastes. The ELGs specify limitations for TSS and Oil & Grease. Specific limitations have not been applied at the internal outfall based on further treatment provided prior to final discharge.

DSN010, DSN013, DSN019
Associated Monitoring Point DSN010S
Stormwater runoff associated with electric power generation and fire protection system waters. Outfall DSN010 has been deemed a representative stormwater outfall. Monitoring is not required at Outfalls DSN013 and DSN019. Best Management Practices (BMPs) are believed to be the most effective way to control the contamination of stormwater from areas of industrial activities. This facility is required to maintain a BMP plan. The requirements of the BMP plan call for minimization of stormwater contact with waste materials, products and by-products, and for prevention of spills or loss of fluids from equipment maintenance activities.

DSN011 and DSN012: Intake screen backwash
Monitoring requirements have not been proposed. There are no pollutants of concern expected to be added to the discharge from backwash operations.

DSN020, DSN021 (Stormwater after Ash Pond Capping Closure)
Associated Monitoring Point DSN020S, DSN021S
After completion of dewatering activities and closure of the ash pond, APC has indicated there will be two stormwater outfalls utilized for management of stormwater runoff from the closed ash pond footprint. These outfalls have been proposed as DSN020 and DSN021, monitoring points DSN020S and DSN021S. Outfall DSN020 will be used to manage a small portion of stormwater falling on the northern edge of the closed ash pond footprint. The existing Outfall DSN002 discharge structure will be transitioned to a stormwater outfall for the majority stormwater runoff from the closed ash pond footprint. The associated monitoring requirements for the transitioned outfall have been proposed as monitoring point DSN021S. The stormwater runoff from the ash pond footprint prior to

completion of dewatering activities is considered waters associated with dewatering activities and is to be monitored and discharged in accordance with the applicable DSN002 monitoring requirements. Discharges under the monitoring requirements of monitoring points DSN020S and DSN021S will not be authorized until the associated ash pond drainage areas have been capped, there is no longer contact with coal combustion residual (CCR) materials in the associated drainage areas, APC has submitted a written request with supporting justification to the Water Division, and APC has received written approval from the Water Division.

Emergency Overflow Outfall
Outfall DSN022 was listed in the permit application as an emergency overflow discharge point from the ash pond. The Permittee indicated that wastewater will not discharge through the emergency point under normal operating conditions. Based on the unexpected use of the outfalls except under upset conditions, Outfall DSN022 has not been included in the proposed draft permit.

303(d) List of Impaired Waters
The Mobile River is listed on the 303(d) List of Impaired Waters for metals (mercury). The Department has proposed end of pipe water quality based limitations for mercury.

Fire Protection System Waters
The Permittee has indicated that firefighting waters have the potential to be discharged through each outfall. The source water is river water which has been filtered and chlorinated. The discharge of firefighting waters is not expected to occur on a frequent basis. Chlorine limitations have not been proposed based on the overland flow of the discharge before reaching the receiving streams and the infrequent nature of discharge. The fire protection system is tested periodically in accordance with Federal and State regulations.

Ash Pond Seep Identification and Corrective Action
The Permittee shall develop and implement an Ash Pond Seep Identification and Corrective Action Plan within 90 days from the effective date of the Permit. When requested by the Director or his designee, the Permittee shall make the plan available for Department review. The plan shall provide for weekly inspections. If a seep is identified during an inspection, the Permittee must provide corrective action as soon as feasible. A log of the inspections shall be maintained at the facility and shall be available for inspection by representatives of the Department. The log shall contain records of all inspections performed for the last three years and each entry shall be signed by the person performing the inspection. The Permittee shall submit an annual report by January 28th of each year detailing any identified seeps and corrective actions taken during the previous calendar year. The first report is due January 28, 2022 for calendar year 2021.

Effluent Guideline Limitations (EGL) Compliance Dates
Through an EGL compliance date justification received on May 7, 2020 the Permittee has requested and provided support for deadlines to attain compliance with the best available technology economically achievable (BAT) effluent limitations for fly ash transport water, bottom ash transport water, and flue gas desulphurization (FGD) wastewater. The Permittee indicated that compliance with the fly ash transport water EGL has been attained. The Permittee provided justification that the most reasonable deadline for compliance with the FGD wastewater and bottom ash transport water EGL is December 31, 2023.

The following schedule for EGL compliance has been proposed:

- There shall be no discharge of pollutants in fly ash transport water generated at the facility on and/or after the effective date of this permit.
- Beginning as soon as possible but no later than December 31, 2023, the Permittee shall demonstrate compliance with the FGD ELGs through the monitoring requirements proposed for internal Outfalls DSN02E1 or DSN03E1 for FGD wastewater generated at the facility on and/or after that date.
- Beginning as soon as possible but no later than December 31, 2023, there shall be no discharge of pollutants in bottom ash transport water generated at the facility on and/or after that date, subject to the following exceptions:

- Low volume, short duration discharges of wastewater from minor leaks (e.g., leaks from valve packing, pipe flanges, or piping) or minor maintenance events (e.g., replacement of valves or pipe sections) are specifically excluded from the definition of "transport water" and may continue to be discharged through Outfalls DSN0021 or DSN0031 subject to the effluent limitations applicable to such discharges through those respective outfalls.

- Bottom ash transport water may be utilized in the FGD scrubber system and discharged through Outfalls DSN0021 or DSN0031 and/or DSN02E1 or DSN03E1 (as applicable) subject to the effluent limitations applicable to such discharges through those respective outfalls.

EPA is proposing a regulation to revise the technology-based effluent limitations guidelines and standards for the steam electric power generating point source category applicable to FGD wastewater and bottom ash transport water. The Department may reopen the permit to incorporate the requirements of a promulgated final rule.

Cooling Water Intake Structure (CWIS) Requirements

Section 316(b) of the Clean Water Act requires that facilities minimize adverse environmental impacts resulting from the operation of cooling water intake structures (CWIS) by using the "Best Technology Available" (BTA). All of those facilities including those not specifically addressed by the rules, must be evaluated for 316(b) compliance. For those facilities not addressed in Phase I, II, or III rules, a BTA determination must be made using "Best Professional Judgment" (BPJ) under the authority of 40 CFR §§ 125 Subpart J and 401.14.

The facility utilizes two CWIS. The Department has made a determination that each CWIS is subject to the 316(b) Phase II requirements. Units 1 and 2 are served by one CWIS, while Units 4 and 5 are served by the other CWIS. Units 6 and 7 obtain cooling tower makeup water from the effluent of the Units 1 and 2 once through cooling water discharge. The CWIS have a combined capacity to withdraw 1,137 MGD which is approximately 7.5% of the annual average flow of the Mobile River. The actual three-year average intake flow is approximately 623 MGD. The Unit 1 and 2 CWIS is divided into six screen bays, each about 11 feet wide equipped with trash racks and traveling water screens. The Unit 4 and 5 CWIS is divided into five screen bays, each about 11 feet wide equipped with trash racks and traveling water screens. The Unit 4 and 5 CWIS traveling water screens are equipped with fish return buckets.

Facilities that are subject to the 316(b) Phase II requirements must submit the information described in 40 CFR 122.21(r)(2) through (r)(8) in order for the Department to make a BTA determination. In addition, facilities that have a design intake flowrate of greater than 125 MGD must also submit specific information detailed in 40 CFR 122.21(r)(9) through (r)(13).

The Permittee has indicated that it could not reasonably develop the required information by the compliance date and consequently has requested an alternate submission schedule in accordance with 40 CFR § 125.95. The Department has established an alternate schedule for submission of the information specified in sections 122.21(r)(2) through 122.21(r)(13) in Part IV of the proposed permit. At this time, the Department has made an interim BTA determination that both cooling water intake structures represent the best technology available to minimize adverse environmental impact in accordance with Section 316(b) of the Federal Clean Water Act (33 U.S.C. section 1326).

The Permittee is required to operate and maintain each CWIS in a manner that minimizes impingement and entrainment levels. Documentation detailing the steps that have and are being taken to minimize the impingement and entrainment levels shall be maintained on-site and made available upon request during inspections. The following conditions are proposed in the draft permit.

1. The cooling water intake structures used by the permittee have been evaluated using available information. At this time, the Department has determined that the cooling water intake structures represent the interim best technology available (40 CFR 125.98(b)(6)) to minimize adverse environmental impact in accordance with Section 316(b) of the Federal Clean Water Act (33 U.S.C. section 1326).

2. The Permittee is required to operate and maintain each CWIS in a manner that minimizes impingement and entrainment levels. Documentation detailing the steps that have and are being taken to minimize the impingement and entrainment levels shall be maintained on site and made available upon request.

3. Nothing in this permit authorizes take for the purposes of a facility's compliance with the "Endangered Species Act."

4. The Permittee shall submit the information for each CWIS as required by 40 CFR 122.21(r) by June 30, 2024.

5. The Permittee must keep records of all submissions that are part of the permit application pertaining to each CWIS until the subsequent permit is issued to the Permittee.

6. The Permittee's permit application must contain readily available information, at the time of permit application development, in identifying all Federally-listed threatened and endangered species and/or designated critical habitat that are or may be present in the action area.

7. The Permittee must conduct weekly visual inspections or employ remote monitoring devices during the period the cooling water intake structures are in operation. This condition is only applicable if control technologies are being employed to comply with final BTA for impingement mortality.

8. The Permittee is required to submit an Annual Certification to the Department no later than January 28^{th} of each year. The Annual Certification shall detail if any changes have been made to impact the operation of each CWIS structure.

Facility Name: **Plant Barry DSN002 Combined Dewatering, Low Volume Wastewater System, and Pressure Relief Wells**

NPDES No.: **AL0002879**

$$Q_d*C_d + Q_{d2}*C_{d2} + Q_s*C_s = Q_r*C_r$$

ID	Pollutant	Carcinogen "yes"	Type	Background from upstream source (C_{d2}) Daily Max	Background from upstream source (C_{d2}) Monthly Ave	Background Instream (C_s) Daily Max	Background Instream (C_s) Monthly Ave	Enter Max Daily Discharge as reported by Applicant (C_d) Max	Enter Avg Daily Discharge as reported by Applicant (C_d) Ave	Partition Coefficient (Stream / Lake)
				µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
1	Antimony		Metals	0	0	[illegible]	[illegible]	3.466	2.632	-
2	**Arsenic*,****	YES	Metals	0	0	0.14	[illegible]	33.465	4.538	0.574
3	Berylium		Metals	0	0	0.24	0.014	0	0	-
4	Cadmium**		Metals	0	0	0	0	0.076	0.076	0.236
5	Chromium / Chromium III**		Metals	0	0	0.52	0.187	1.05	0.83	0.210
6	Chromium / Chromium VI**		Metals	0	0	0	0	0.000	0	
7	Copper**		Metals	0	0	3.94	1.439	5.752	5.569	0.388
8	Lead**		Metals	0	0	0	0	0	0	0.206
9	Mercury**		Metals	0	0	0.01	0.002	0.008	0.003	0.302
10	Nickel**		Metals	0	0	1.48	0.581	8.223	4.26	0.505
11	Selenium		Metals	0	0	0.49	0.133	11.80	11.44	-
12	Silver		Metals	0	0	0	0	0	0	-
13	Thallium		Metals	0	0	0	0	0	0.08	-
14	Zinc**		Metals	0	0	[illegible]	2.044	16.31	9.15	0.330
15	Cyanide		Metals	0	0	0	0	0	0	-
16	Total Phenolic Compounds		Metals	0	0	0	0	0	0	-
17	Hardness (As CaCO3)		Metals	0	0	[illegible]	50.124	0	0	-
18	Acrolein		VOC	0	0	0	0	0	0	-
19	**Acrylonitrile***	YES	VOC	0	0	0	0	0	0	-
20	**Aldrin**	YES	VOC	0	0	0	0	0	0	-
21	**Benzene***	YES	VOC	0	0	0	0	0	0	-
22	**Bromoform***	YES	VOC	0	0	0	0	0	0	-
23	**Carbon Tetrachloride***	YES	VOC	0	0	0	0	0	0	-
24	**Chlordane**	YES	VOC	0	0	0	0	0	0	-
25	Clorobenzene		VOC	0	0	0	0	0	0	-
26	**Chlorodibromo-Methane***	YES	VOC	0	0	0	0	0	0	-
27	Chloroethane		VOC	0	0	0	0	0	0	-
28	2-Chloro-Ethylvinyl Ether		VOC	0	0	0	0	0	0	-
29	**ChloroForm***	YES	VOC	0	0	0	0	0	0	-
30	**4,4'-DDD**	YES	VOC	0	0	0	0	0	0	-
31	**4,4'-DDE**	YES	VOC	0	0	0	0	0	0	-
32	**4,4'-DDT**	YES	VOC	0	0	0	0	0	0	-
33	**Dichlorobromo-Methane***	YES	VOC	0	0	0	0	0	0	-
34	1, 1-Dichloroethane		VOC	0	0	0	0	0	0	-
35	**1, 2-Dichloroethane***	YES	VOC	0	0	0	0	0	0	-
36	Trans-1, 2-Dichloro-Ethylene		VOC	0	0	0	0	0	0	-
37	**1, 1-Dichloroethylene***	YES	VOC	0	0	0	0	0	0	-
38	1, 2-Dichloropropane		VOC	0	0	0	0	0	0	-
39	1, 3-Dichloro-Propylene		VOC	0	0	0	0	0	0	-
40	**Dieldrin**	YES	VOC	0	0	0	0	0	0	-
41	Ethylbenzene		VOC	0	0	0	0	0	0	-
42	Methyl Bromide		VOC	0	0	0	0	0	0	-
43	Methyl Chloride		VOC	0	0	0	0	0	0	-
44	**Methylene Chloride***	YES	VOC	0	0	0	0	0	0	-
45	**1, 1, 2, 2-Tetrachloro-Ethane***	YES	VOC	0	0	0	0	0	0	-
46	**Tetrachloro-Ethylene***	YES	VOC	0	0	0	0	0	0	-
47	Toluene		VOC	0	0	0	0	0	0	-
48	**Toxaphene**	YES	VOC	0	0	0	0	0	0	-
49	**Tributyltine (TBT)**	YES	VOC	0	0	0	0	0	0	-
50	1, 1, 1-Trichloroethane		VOC	0	0	0	0	0	0	-
51	**1, 1, 2-Trichloroethane***	YES	VOC	0	0	0	0	0	0	-
52	**Trichlorethylene***	YES	VOC	0	0	0	0	0	0	-
53	**Vinyl Chloride***	YES	VOC	0	0	0	0	0	0	-
54	P-Chloro-M-Cresol		Acids	0	0	0	0	0	0	-
55	2-Chlorophenol		Acids	0	0	0	0	0	0	-
56	2, 4-Dichlorophenol		Acids	0	0	0	0	0	0	-
57	2, 4-Dimethylphenol		Acids	0	0	0	0	0	0	-
58	4, 6-Dinitro-O-Cresol		Acids	0	0	0	0	0	0	-
59	2, 4-Dinitrophenol		Acids	0	0	0	0	0	0	-
60	**4,6-Dinitro-2-methylophenol**	YES	Acids	0	0	0	0	0	0	-
61	**Dioxin (2,3,7,8-TCDD)**	YES	Acids	0	0	0	0	0	0	-
62	2-Nitrophenol		Acids	0	0	0	0	0	0	-
63	4-Nitrophenol		Acids	0	0	0	0	0	0	-
64	**Pentachlorophenol***	YES	Acids	0	0	0	0	0	0	-
65	Phenol		Acids	0	0	0	0	0	0	-
66	**2, 4, 6-Trichlorophenol***	YES	Acids	0	0	0	0	0	0	-
67	Acenaphthene		Bases	0	0	0	0	0	0	-
68	Acenaphthylene		Bases	0	0	0	0	0	0	-
69	Anthracene		Bases	0	0	0	0	0	0	-
70	Benzidine		Bases	0	0	0	0	0	0	-
71	**Benzo(A)Anthracene***	YES	Bases	0	0	0	0	0	0	-
72	**Benzo(A)Pyrene***	YES	Bases	0	0	0	0	0	0	-
73	3, 4 Benzo-Fluoranthene		Bases	0	0	0	0	0	0	-
74	Benzo(GHI)Perylene		Bases	0	0	0	0	0	0	-
75	Benzo(K)Fluoranthene		Bases	0	0	0	0	0	0	-
76	Bis (2-Chloroethoxy) Methane		Bases	0	0	0	0	0	0	-
77	**Bis (2-Chloroethyl)-Ether***	YES	Bases	0	0	0	0	0	0	-
78	Bis (2-Chloroiso-Propyl) Ether		Bases	0	0	0	0	0	0	-
79	**Bis (2-Ethylhexyl) Phthalate***	YES	Bases	0	0	0	0	0	0	-
80	4-Bromophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
81	Butyl Benzyl Phthalate		Bases	0	0	0	0	0	0	-
82	2-Chloronaphthalene		Bases	0	0	0	0	0	0	-
83	4-Chlorophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
84	**Chrysene***	YES	Bases	0	0	0	0	0	0	-
85	Di-N-Butyl Phthalate		Bases	0	0	0	0	0	0	-
86	Di-N-Octyl Phthalate		Bases	0	0	0	0	0	0	-
87	**Dibenzo(A,H)Anthracene***	YES	Bases	0	0	0	0	0	0	-
88	1, 2-Dichlorobenzene		Bases	0	0	0	0	0	0	-
89	1, 3-Dichlorobenzene		Bases	0	0	0	0	0	0	-
90	1, 4-Dichlorobenzene		Bases	0	0	0	0	0	0	-
91	**3, 3-Dichlorobenzidine***	YES	Bases	0	0	0	0	0	0	-
92	Diethyl Phthalate		Bases	0	0	0	0	0	0	-
93	Dimethyl Phthalate		Bases	0	0	0	0	0	0	-
94	**2, 4-Dinitrotoluene***	YES	Bases	0	0	0	0	0	0	-
95	2, 6-Dinitrotoluene		Bases	0	0	0	0	0	0	-
96	1,2-Diphenylhydrazine		Bases	0	0	0	0	0	0	-
97	**Endosulfan (alpha)**	YES	Bases	0	0	0	0	0	0	-
98	**Endosulfan (beta)**	YES	Bases	0	0	0	0	0	0	-
99	**Endosulfan sulfate**	YES	Bases	0	0	0	0	0	0	-
100	**Endrin**	YES	Bases	0	0	0	0	0	0	-
101	**Endrin Aldeyhide**	YES	Bases	0	0	0	0	0	0	-
102	Fluoranthene		Bases	0	0	0	0	0	0	-
103	Fluorene		Bases	0	0	0	0	0	0	-
104	Heptachlor	YES	Bases	0	0	0	0	0	0	-
105	Heptachlor Epoxide	YES	Bases	0	0	0	0	0	0	-
106	**Hexachlorobenzene***	YES	Bases	0	0	0	0	0	0	-
107	**Hexachlorobutadiene***	YES	Bases	0	0	0	0	0	0	-
108	**Hexachlorocyclohexan (alpa)**	YES	Bases	0	0	0	0	0	0	-
109	**Hexachlorocyclohexan (beta)**	YES	Bases	0	0	0	0	0	0	-
110	**Hexachlorocyclohexan (gamma)**	YES	Bases	0	0	0	0	0	0	-
111	HexachlorocycloPentadiene		Bases	0	0	0	0	0	0	-
112	Hexachloroethane		Bases	0	0	0	0	0	0	-
113	**Indeno(1, 2, 3-CK)Pyrene***	YES	Bases	0	0	0	0	0	0	-
114	Isophorone		Bases	0	0	0	0	0	0	-
115	Naphthalene		Bases	0	0	0	0	0	0	-
116	Nitrobenzene		Bases	0	0	0	0	0	0	-
117	**N-Nitrosodi-N-Propylamine***	YES	Bases	0	0	0	0	0	0	-
118	**N-Nitrosodi-N-Methylamine***	YES	Bases	0	0	0	0	0	0	-
119	**N-Nitrosodi-N-Phenylamine***	YES	Bases	0	0	0	0	0	0	-
120	**PCB-1016**	YES	Bases	0	0	0	0	0	0	-
121	**PCB-1221**	YES	Bases	0	0	0	0	0	0	-
122	**PCB-1232**	YES	Bases	0	0	0	0	0	0	-
123	**PCB-1242**	YES	Bases	0	0	0	0	0	0	-
124	**PCB-1248**	YES	Bases	0	0	0	0	0	0	-
125	**PCB-1254**	YES	Bases	0	0	0	0	0	0	-
126	**PCB-1260**	YES	Bases	0	0	0	0	0	0	-
127	Phenanthrene		Bases	0	0	0	0	0	0	-
128	Pyrene		Bases	0	0	0	0	0	0	-
129	1, 2, 4-Trichlorobenzene		Bases	0	0	0	0	0	0	-

22.94	Enter Q_d = wastewater discharge flow from facility (MGD)
35.4934333	Q_d = wastewater discharge flow (cfs) (this value is calucluted from the MGD)
0	Enter flow from upstream discharge Qd2 = background stream flow in MGD above point of discharge
0	Qd2 = background stream flow from upstream source (cfs)
2207.53	Enter 7Q10, Q_s = background stream flow in cfs above point of discharge
1655.65	Enter or estimated, 1Q10, Q_s = background stream flow in cfs above point of discharge (1Q10 estimated at 75% of 7Q10)
23277	Enter Mean Annual Flow, Q_s = background stream flow in cfs above point of discharge
3927.61	Enter 7Q2, Q_s = background stream flow in cfs above point of discharge (For LWF class streams)
Enter to Left	Enter C_s = background in-stream pollutant concentration in µg/l (assuming this is zero "0" unless there is data)
Q_d +Qd2+Q_s	Q_r = resultant in-stream flow, after discharge
Calculated on other	C_r = resultant in-stream pollutant concentration in µg/l in the stream (after complete mixing occurs)
50.12	Enter, Background Hardness above point of discharge (assumed 50 South of Birmingham and 100 North of Birmingham)
7.00 s.u.	Enter, Background pH above point of discharge
yes	Enter, Is discharge to a stream? "YES" Other option would be to a Lake. (This changes the partition coefficients for the metals)

** Using Partition Coefficients

July 23, 2020

Facility Name: Plant Barry DSN002 Combined Dewatering, Low Volume Wastewater System, and Pressure Relief Wells

NPDES No.: AL0002879

Freshwater F&W classification.					Max Daily Discharge as reported by Applicant (C_{dmax})	Freshwater Acute (µg/l) Q_s =1Q10				Background from upstream source (Cd2) Monthly Ave	Avg Daily Discharge as reported by Applicant (C_{davg})	Freshwater Chronic (µg/l) Q_s = 7Q10				Human Health Consumption Fish only (µg/l) Carcinogen Q_s = Annual Average Non-Carcinogen Q_s = 7Q10			
ID	Pollutant	RP?	Carcinogen yes	Background from upstream source (Cd2) Daily Max		Water Quality Criteria (C_e)	Draft Permit Limit (C_{dmax})	20% of Draft Permit Limit	RP?			Water Quality Criteria (C_e)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?	Water Quality Criteria (C_e)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?
1	Antimony			0	3.465942459	-	-	-	-	0	2.632023017	-	-	-	-	[illegible]	2.36E+04	4.72E+03	No
2	Arsenic		YES	0	33.46469573	[illegible]	28216.228	5643.246	No	0	4.537604185	[illegible]	16509.386	3301.877	No	0.303	145.219	29.044	No
3	Berylium			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
4	Cadmium			0	0.075571927	[illegible]	207.624	41.525	No	0	0.075571927	[illegible]	40.743	8.149	No	-	-	-	-
5	Chromium/ Chromium III			0	1.048137751	[illegible]	73400.386	14680.078	No	0	0.833539585	[illegible]	12655.623	2531.125	No	-	-	-	-
6	Chromium/ Chromium VI			0	0	[illegible]	762.347	152.469	No	0	0	[illegible]	695.150	139.030	No	-	-	-	-
7	Copper			0	5.752292938	[illegible]	677.108	135.422	No	0	5.568997384	[illegible]	718.940	143.788	No	-	-	-	-
8	Lead			0	0	[illegible]	6989.380	1397.876	No	0	0	[illegible]	351.249	72.250	No	-	-	-	-
9	Mercury			0	0.007857018	[illegible]	113.886	22.777	No	0	0.002986922	[illegible]	0.612	0.122	No	4.24E-02	2.53E+00	5.07E-01	No
10	Nickel			0	8.222955536	[illegible]	24559.629	4911.926	No	0	4.259083731	[illegible]	3592.060	718.412	No	9.93E+02	6.27E+04	1.25E+04	No
11	Selenium			0	11.80226678	[illegible]	930.076	186.015	No	0	11.4365118	[illegible]	307.709	61.542	No	[illegible]	1.54E+05	3.07E+04	No
12	Silver			0	0	[illegible]	46.722	9.344	No	0	0	-	-	-	-	-	-	-	-
13	Thallium			0	0.077433304	-	-	-	-	0	0.077433304	-	-	-	-	[illegible]	1.73E+01	3.46E+00	No
14	Zinc			0	16.30653531	[illegible]	9188.060	1837.616	No	0	9.152142075	[illegible]	12474.021	2494.804	No	1.49E+04	9.41E+05	1.88E+05	No
15	Cyanide			0	0	[illegible]	1048.226	209.645	No	0	0	[illegible]	328.616	65.723	No	[illegible]	5.90E+05	1.18E+05	No
16	Total Phenolic Compounds			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
17	Hardness (As CaCO3)			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
18	Acrolein			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.43E+02	6.86E+01	No
19	Acrylonitrile		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.46E+01	1.89E+01	No
20	Aldrin		YES	0	0	[illegible]	142.940	28.588	No	0	0	-	-	-	-	[illegible]	1.93E-02	3.86E-03	No
21	Benzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.02E+04	2.03E+03	No
22	Bromoform		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.17E+04	1.03E+04	No
23	Carbon Tetrachloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.29E+02	1.26E+02	No
24	Chlordane		YES	0	0	[illegible]	114.352	22.870	No	0	0	[illegible]	0.272	0.054	No	[illegible]	3.11E-01	6.21E-02	No
25	Clorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.73E+04	1.15E+04	No
26	Chlorodibromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.87E+03	9.73E+02	No
27	Chloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
28	2-Chloro-Ethylvinyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
29	ChloroForm		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.70E+04	1.34E+04	No
30	4,4' - DDD		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.19E-01	2.38E-02	No
31	4,4' - DDE		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.41E-02	1.68E-02	No
32	4,4' - DDT		YES	0	0	1.100	52.411	10.482	No	0	0	0.001	0.063	0.013	No	[illegible]	8.41E-02	1.68E-02	No
33	Dichlorobromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.59E+03	1.32E+03	No
34	1, 1-Dichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
35	1, 2-Dichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.40E+04	2.81E+03	No
36	Trans-1, 2-Dichloro-Ethylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.73E+05	7.47E+04	No
37	1, 1-Dichloroethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.74E+05	5.47E+05	No
38	1, 2-Dichloropropane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.37E+02	1.07E+02	No
39	1, 3-Dichloro-Propylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.76E+02	1.55E+02	No
40	Dieldrin		YES	0	0	[illegible]	11.435	2.287	No	0	0	[illegible]	3.539	0.708	No	[illegible]	2.05E-02	4.10E-03	No
41	Ethylbenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.86E+04	1.57E+04	No
42	Methyl Bromide			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.51E+04	1.10E+04	No
43	Methyl Chloride			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
44	Methylene Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.27E+05	4.54E+04	No
45	1, 1, 2, 2-Tetrachloro-Ethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.53E+03	3.07E+02	No
46	Tetrachloro-Ethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.26E+03	2.52E+02	No
47	Toluene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.51E+05	1.10E+05	No
48	Toxaphene		YES	0	0	[illegible]	34.782	6.956	No	0	0	[illegible]	0.013	0.003	No	[illegible]	1.06E-01	2.13E-02	No
49	Tributyltin (TBT)		YES	0	0	[illegible]	21.917	4.383	No	0	0	[illegible]	4.550	0.910	No	-	-	-	-
50	1, 1, 1-Trichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
51	1, 1, 2-Trichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.97E+03	1.19E+03	No
52	Trichlorethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.15E+04	2.29E+03	No
53	Vinyl Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.36E+02	1.87E+02	No
54	P-Chloro-M-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
55	2-Chlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.50E+03	1.10E+03	No
56	2, 4-Dichlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.09E+04	2.17E+03	No
57	2, 4-Dimethylphenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.14E+04	6.29E+03	No
58	4, 6-Dinitro-O-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
59	2, 4-Dinitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.97E+05	3.93E+04	No
60	4,6-Dinitro-2-methylphenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.09E+05	2.17E+04	No
61	Dioxin (2,3,7,8-TCDD)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.75E-05	3.50E-06	No
62	2-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
63	4-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
64	Pentachlorophenol		YES	0	0	[illegible]	415.637	83.127	No	0	0	[illegible]	422.941	84.588	No	[illegible]	1.18E+03	2.32E+02	No
65	Phenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+07	6.32E+06	No
66	2, 4, 6-Trichlorophenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.29E+02	1.86E+02	No
67	Acenaphthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.66E+04	7.31E+03	No
68	Acenaphthylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
69	Anthracene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.47E+06	2.95E+05	No
70	Benzidine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.33E-03	1.47E-03	No
71	Benzo(A)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.00E+00	1.40E+00	No
72	Benzo(A)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.00E+00	1.40E+00	No
73	Benzo(b)fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.73E-01	1.35E-01	No
74	Benzo(GHI)Perylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
75	Benzo(K)Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.73E-01	1.38E-01	No
76	Bis (2-Chloroethoxy) Methane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
77	Bis (2-Chloroethyl)-Ether		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.02E+02	4.04E+01	No
78	Bis (2-Chloroiso-Propyl) Ether			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.39E+06	4.78E+05	No
79	Bis (2-Ethylhexyl) Phthalate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.42E+02	1.68E+02	No
80	4-Bromophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
81	Butyl Benzyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.12E+04	1.42E+04	No
82	2-Chloronaphthalene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.84E+04	1.17E+04	No
83	4-Chlorophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
84	Chrysene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.00E+00	1.40E+00	No
85	Di-N-Butyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.66E+05	3.31E+04	No
86	Di-N-Octyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
87	Dibenzo(A,H)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.00E+00	1.40E+00	No
88	1, 2-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.77E+04	9.55E+03	No
89	1, 3-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.55E+04	7.11E+03	No
90	1, 4-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.11E+03	1.42E+03	No
91	3, 3-Dichlorobenzidine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.09E+01	2.18E+00	No
92	Diethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.62E+06	3.23E+05	No
93	Dimethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.10E+07	8.19E+06	No
94	2, 4-Dinitrotoluene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.30E+03	2.60E+02	No
95	2, 6-Dinitrotoluene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
96	1,2-Diphenylhydrazine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.40E+00	1.48E+00	No
97	Endosulfan (alpha)		YES	0	0	[illegible]	10.482	2.096	No	0	0	[illegible]	3.539	0.708	No	[illegible]	3.41E+04	6.81E+03	No
98	Endosulfan (beta)		YES	0	0	[illegible]	10.482	2.096	No	0	0	[illegible]	3.539	0.708	No	[illegible]	3.41E+04	6.81E+03	No
99	Endosulfan sulfate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.41E+04	6.81E+03	No
100	Endrin		YES	0	0	[illegible]	4.098	0.820	No	0	0	[illegible]	2.275	0.455	No	[illegible]	2.32E+01	4.63E+00	No
101	Endrin Aldeyhde		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.16E+02	2.32E+01	No
102	Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.13E+03	1.03E+03	No
103	Fluorene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.97E+05	3.93E+04	No
104	Heptochlor		YES	0	0	[illegible]	24.776	4.955	No	0	0	[illegible]	0.240	0.048	No	[illegible]	3.04E-02	6.08E-03	No
105	Heptachlor Epoxide		YES	0	0	[illegible]	24.776	4.955	No	0	0	[illegible]	0.240	0.048	No	[illegible]	1.50E-02	3.01E-03	No
106	Hexachlorobenzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.10E-01	2.20E-02	No
107	Hexachlorobutadiene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.07E+03	1.41E+03	No
108	Hexachlorocyclohexan (alpha)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.87E+00	3.74E-01	No
109	Hexachlorocyclohexan (beta)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.56E+00	1.31E+00	No
110	Hexachlorocyclohexan (gamma)		YES	0	0	[illegible]	45.264	9.053	No	0	0	-	-	-	-	[illegible]	7.07E+02	1.41E+02	No
111	HexachlorocycloPentadiene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.08E+04	8.15E+03	No
112	Hexachloroethane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.21E+02	2.42E+01	No
113	Indeno(1, 2, 3-CK)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.00E+00	1.40E+00	No
114	Isophorone			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.54E+04	7.08E+03	No
115	Naphthalene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
116	Nitrobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.55E+04	5.10E+03	No
117	N-Nitrosodi-N-Propylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.94E+02	3.87E+01	No
118	N-Nitrosodimethylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.16E+03	2.31E+02	No
119	N-Nitrosodiphenylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.30E+03	4.60E+02	No
120	PCB-1016		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
121	PCB-1221		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
122	PCB-1232		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
123	PCB-1242		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
124	PCB-1248		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
125	PCB-1254		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
126	PCB-1260		YES	0	0	-	-	-	-	0	0	[illegible]	0.885	0.177	No	[illegible]	2.46E-02	4.91E-03	No
127	Phenanthrene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
128	Pyrene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.47E+05	2.95E+04	No
129	1, 2, 4-Trichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.59E+03	5.17E+02	No

Facility Name: Plant Barry DSN002 Combined Dewatering and Pressure Relief Wells

NPDES No.: AL0002879

$$Q_d*C_d + Q_{d2}*C_{d2} + Q_s*C_s = Q_r*C_r$$

ID	Pollutant	Carcinogen "yes"	Type	Background from upstream source (C_{d2}) Daily Max	Background from upstream source (C_{d2}) Monthly Ave	Background Instream (C_s) Daily Max	Background Instream (C_s) Monthly Ave	Enter Max Daily Discharge as reported by Applicant (C_d) Max	Enter Avg Daily Discharge as reported by Applicant (C_d) Ave	Partition Coefficient (Stream / Lake)
				µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
1	Antimony		Metals	0	0	[illegible]	[illegible]	2.758	1.429	-
2	**Arsenic*,****	YES	Metals	0	0	0.14	0.082	5.6	2.366	0.574
3	Berylium		Metals	0	0	0.24	0.014117647	0	0	-
4	Cadmium**		Metals	0	0	0	0	0	0.000	0.236
5	Chromium / Chromium III**		Metals	0	0	[illegible]	[illegible]	0.69	0.35	0.210
6	Chromium / Chromium VI**		Metals	0	0	0	0	0	0	
7	Copper**		Metals	0	0	[illegible]	1.439	1.454	1.162	0.388
8	Lead**		Metals	0	0	0	0	0	0	0.206
9	Mercury**		Metals	0	0	0.01	[illegible]	0.0054	0.0012	0.302
10	Nickel**		Metals	0	0	1.48	[illegible]	11.87	5.56	0.505
11	Selenium		Metals	0	0	0.49	0.133	5.28	4.70	-
12	Silver		Metals	0	0	0	0	0	0	-
13	Thallium		Metals	0	0	0	0	0	0.00	-
14	Zinc**		Metals	0	0	5.05	2.044	24.99	13.59	0.330
15	Cyanide		Metals	0	0	0	0	0	0	-
16	Total Phenolic Compounds		Metals	0	0	0	0	0	0	-
17	Hardness (As CaCO3)		Metals	0	0	69.2	30.124	0	0	-
18	Acrolein		VOC	0	0	0	0	0	0	-
19	**Acrylonitrile***	YES	VOC	0	0	0	0	0	0	-
20	**Aldrin**	YES	VOC	0	0	0	0	0	0	-
21	**Benzene***	YES	VOC	0	0	0	0	0	0	-
22	**Bromoform***	YES	VOC	0	0	0	0	0	0	-
23	**Carbon Tetrachloride***	YES	VOC	0	0	0	0	0	0	-
24	**Chlordane**	YES	VOC	0	0	0	0	0	0	-
25	Clorobenzene		VOC	0	0	0	0	0	0	-
26	**Chlorodibromo-Methane***	YES	VOC	0	0	0	0	0	0	-
27	Chloroethane		VOC	0	0	0	0	0	0	-
28	2-Chloro-Ethylvinyl Ether		VOC	0	0	0	0	0	0	-
29	**ChloroForm***	YES	VOC	0	0	0	0	0	0	-
30	**4,4'-DDD**	YES	VOC	0	0	0	0	0	0	-
31	**4,4'-DDE**	YES	VOC	0	0	0	0	0	0	-
32	**4,4'-DDT**	YES	VOC	0	0	0	0	0	0	-
33	**Dichlorobromo-Methane***	YES	VOC	0	0	0	0	0	0	-
34	1, 1-Dichloroethane		VOC	0	0	0	0	0	0	-
35	**1, 2-Dichloroethane***	YES	VOC	0	0	0	0	0	0	-
36	Trans-1, 2-Dichloro-Ethylene		VOC	0	0	0	0	0	0	-
37	**1, 1-Dichloroethylene***	YES	VOC	0	0	0	0	0	0	-
38	1, 2-Dichloropropane		VOC	0	0	0	0	0	0	-
39	1, 3-Dichloro-Propylene		VOC	0	0	0	0	0	0	-
40	**Dieldrin**	YES	VOC	0	0	0	0	0	0	-
41	Ethylbenzene		VOC	0	0	0	0	0	0	-
42	Methyl Bromide		VOC	0	0	0	0	0	0	-
43	Methyl Chloride		VOC	0	0	0	0	0	0	-
44	**Methylene Chloride***	YES	VOC	0	0	0	0	0	0	-
45	**1, 1, 2, 2-Tetrachloro-Ethane***	YES	VOC	0	0	0	0	0	0	-
46	**Tetrachloro-Ethylene***	YES	VOC	0	0	0	0	0	0	-
47	Toluene		VOC	0	0	0	0	0	0	-
48	**Toxaphene**	YES	VOC	0	0	0	0	0	0	-
49	**Tributyltine (TBT)**	YES	VOC	0	0	0	0	0	0	-
50	1, 1, 1-Trichloroethane		VOC	0	0	0	0	0	0	-
51	**1, 1, 2-Trichloroethane***	YES	VOC	0	0	0	0	0	0	-
52	**Trichlorethylene***	YES	VOC	0	0	0	0	0	0	-
53	**Vinyl Chloride***	YES	VOC	0	0	0	0	0	0	-
54	P-Chloro-M-Cresol		Acids	0	0	0	0	0	0	-
55	2-Chlorophenol		Acids	0	0	0	0	0	0	-
56	2, 4-Dichlorophenol		Acids	0	0	0	0	0	0	-
57	2, 4-Dimethylphenol		Acids	0	0	0	0	0	0	-
58	4, 6-Dinitro-O-Cresol		Acids	0	0	0	0	0	0	-
59	2, 4-Dinitrophenol		Acids	0	0	0	0	0	0	-
60	**4,6-Dintro-2-methylphenol**	YES	Acids	0	0	0	0	0	0	-
61	**Dioxin (2,3,7,8-TCDD)**	YES	Acids	0	0	0	0	0	0	-
62	2-Nitrophenol		Acids	0	0	0	0	0	0	-
63	4-Nitrophenol		Acids	0	0	0	0	0	0	-
64	**Pentachlorophenol***	YES	Acids	0	0	0	0	0	0	-
65	Phenol		Acids	0	0	0	0	0	0	-
66	**2, 4, 6-Trichlorophenol***	YES	Acids	0	0	0	0	0	0	-
67	Acenaphthene		Bases	0	0	0	0	0	0	-
68	Acenaphthylene		Bases	0	0	0	0	0	0	-
69	Anthracene		Bases	0	0	0	0	0	0	-
70	Benzidine		Bases	0	0	0	0	0	0	-
71	**Benzo(A)Anthracene***	YES	Bases	0	0	0	0	0	0	-
72	**Benzo(A)Pyrene***	YES	Bases	0	0	0	0	0	0	-
73	3, 4 Benzo-Fluoranthene		Bases	0	0	0	0	0	0	-
74	Benzo(GHI)Perylene		Bases	0	0	0	0	0	0	-
75	Benzo(K)Fluoranthene		Bases	0	0	0	0	0	0	-
76	Bis (2-Chloroethoxy) Methane		Bases	0	0	0	0	0	0	-
77	**Bis (2-Chloroethyl)-Ether***	YES	Bases	0	0	0	0	0	0	-
78	Bis (2-Chloroiso-Propyl) Ether		Bases	0	0	0	0	0	0	-
79	**Bis (2-Ethylhexyl) Phthalate***	YES	Bases	0	0	0	0	0	0	-
80	4-Bromophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
81	Butyl Benzyl Phthalate		Bases	0	0	0	0	0	0	-
82	2-Chloronaphthalene		Bases	0	0	0	0	0	0	-
83	4-Chlorophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
84	**Chrysene***	YES	Bases	0	0	0	0	0	0	-
85	Di-N-Butyl Phthalate		Bases	0	0	0	0	0	0	-
86	Di-N-Octyl Phthalate		Bases	0	0	0	0	0	0	-
87	**Dibenzo(A,H)Anthracene***	YES	Bases	0	0	0	0	0	0	-
88	1, 2-Dichlorobenzene		Bases	0	0	0	0	0	0	-
89	1, 3-Dichlorobenzene		Bases	0	0	0	0	0	0	-
90	1, 4-Dichlorobenzene		Bases	0	0	0	0	0	0	-
91	**3, 3-Dichlorobenzidine***	YES	Bases	0	0	0	0	0	0	-
92	Diethyl Phthalate		Bases	0	0	0	0	0	0	-
93	Dimethyl Phthalate		Bases	0	0	0	0	0	0	-
94	**2, 4-Dinitrotoluene***	YES	Bases	0	0	0	0	0	0	-
95	2, 6-Dinitrotoluene		Bases	0	0	0	0	0	0	-
96	1,2-Diphenylhydrazine		Bases	0	0	0	0	0	0	-
97	**Endosulfan (alpha)**	YES	Bases	0	0	0	0	0	0	-
98	**Endosulfan (beta)**	YES	Bases	0	0	0	0	0	0	-
99	**Endosulfan sulfate**	YES	Bases	0	0	0	0	0	0	-
100	**Endrin**	YES	Bases	0	0	0	0	0	0	-
101	**Endrin Aldehyde**	YES	Bases	0	0	0	0	0	0	-
102	Fluoranthene		Bases	0	0	0	0	0	0	-
103	Fluorene		Bases	0	0	0	0	0	0	-
104	Heptachlor	YES	Bases	0	0	0	0	0	0	-
105	Heptachlor Epoxide	YES	Bases	0	0	0	0	0	0	-
106	**Hexachlorobenzene***	YES	Bases	0	0	0	0	0	0	-
107	**Hexachlorobutadiene***	YES	Bases	0	0	0	0	0	0	-
108	**Hexachlorocyclohexan (alpa)**	YES	Bases	0	0	0	0	0	0	-
109	**Hexachlorocyclohexan (beta)**	YES	Bases	0	0	0	0	0	0	-
110	**Hexachlorocyclohexan (gamma)**	YES	Bases	0	0	0	0	0	0	-
111	HexachlorocycloPentadiene		Bases	0	0	0	0	0	0	-
112	Hexachloroethane		Bases	0	0	0	0	0	0	-
113	**Indeno(1, 2, 3-CK)Pyrene***	YES	Bases	0	0	0	0	0	0	-
114	Isophorone		Bases	0	0	0	0	0	0	-
115	Naphthalene		Bases	0	0	0	0	0	0	-
116	Nitrobenzene		Bases	0	0	0	0	0	0	-
117	**N-Nitrosodi-N-Propylamine***	YES	Bases	0	0	0	0	0	0	-
118	**N-Nitrosodi-N-Methylamine***	YES	Bases	0	0	0	0	0	0	-
119	**N-Nitrosodi-N-Phenylamine***	YES	Bases	0	0	0	0	0	0	-
120	**PCB-1016**	YES	Bases	0	0	0	0	0	0	-
121	**PCB-1221**	YES	Bases	0	0	0	0	0	0	-
122	**PCB-1232**	YES	Bases	0	0	0	0	0	0	-
123	**PCB-1242**	YES	Bases	0	0	0	0	0	0	-
124	**PCB-1248**	YES	Bases	0	0	0	0	0	0	-
125	**PCB-1254**	YES	Bases	0	0	0	0	0	0	-
126	**PCB-1260**	YES	Bases	0	0	0	0	0	0	-
127	Phenanthrene		Bases	0	0	0	0	0	0	-
128	Pyrene		Bases	0	0	0	0	0	0	-
129	1, 2, 4-Trichlorobenzene		Bases	0	0	0	0	0	0	-

14.4	Enter Q_d = wastewater discharge flow from facility (MGD)
22.2800976	Q_d = wastewater discharge flow (cfs) (this value is caluclated from the MGD)
0	Enter flow from upstream discharge Qd2 = background stream flow in MGD above point of discharge
0	Qd2 = background stream flow from upstream source (cfs)
2207.53	Enter 7Q10, Q_s = background stream flow in cfs above point of discharge
1655.65	Enter or estimated, 1Q10, Q_s = background stream flow in cfs above point of discharge (1Q10 estimated at 75% of 7Q10)
23277	Enter Mean Annual Flow, Q_s = background stream flow in cfs above point of discharge
3927.61	Enter 7Q2, Q_s = background stream flow in cfs above point of discharge (For LWF class streams)
Enter to Left	Enter C_s = background in-stream pollutant concentration in µg/l (assuming this is zero "0" unless there is data)
Q_d +Qd2+Q_s	Q_r = resultant in-stream flow, after discharge
Calculated on other	C_r = resultant in-stream pollutant concentration in µg/l in the stream (after complete mixing occurs)
50.12	Enter, Background Hardness above point of discharge (assumed 50 South of Birmingham and 100 North of Birmingham)
7.00 s.u.	Enter, Background pH above point of discharge
yes	Enter, Is discharge to a stream? "YES" Other option would be to a Lake. (This changes the partition coefficients for the metals)

** Using Partition Coefficients

July 23, 2020

Facility Name: Plant Barry DSN002 Combined Dewatering and Pressure Relief Wells

NPDES No.: AL0002879

Freshwater F&W classification.					Max Daily Discharge as reported by Applicant (C_{dmax})	Freshwater Acute (µg/l) Q_s =1Q10				Background from upstream source (Cd2) Monthly Ave	Avg Daily Discharge as reported by Applicant (C_{davg})	Freshwater Chronic (µg/l) Q_s = 7Q10				Human Health Consumption Fish only (µg/l) Carcinogen Q_s = Annual Average Non-Carcinogen Q_s = 7Q10			
ID	Pollutant	RP?	Carcinogen yes	Background from upstream source (Cd2) Daily Max		Water Quality Criteria (C_c)	Draft Permit Limit (C_{dmax})	20% of Draft Permit Limit	RP?			Water Quality Criteria (C_c)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?	Water Quality Criteria (C_c)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?
1	Antimony			0	2.7578	-	-	-	-	0	1.42932	-	-	-	-	[illegible]	3.74E+04	7.47E+03	No
2	Arsenic		YES	0	5.5998	[illegible]	44598.731	8919.746	No	0	2.3856	[illegible]	26145.390	5229.078	No	0.303	231.162	46.232	No
3	Berylium			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
4	Cadmium			0	0	[illegible]	328.173	65.635	No	0	0	[illegible]	64.524	12.905	No	-	-	-	-
5	Chromium/ Chromium III			0	0.6912	[illegible]	116016.982	23203.396	No	0	0.3493332	[illegible]	20042.230	4008.446	No	-	-	-	-
6	Chromium/ Chromium VI			0	0	[illegible]	1204.971	240.994	No	0	0	[illegible]	1100.889	220.178	No	-	-	-	-
7	Copper			0	1.454	[illegible]	1067.955	213.591	No	0	1.162	[illegible]	1137.725	227.545	No	-	-	-	-
8	Lead			0	0	[illegible]	11047.475	2209.495	No	0	0	[illegible]	572.099	114.420	No	-	-	-	-
9	Mercury			0	0.0054	[illegible]	180.003	36.001	No	0	0.0012	[illegible]	0.968	0.194	No	4.24E-02	4.01E+00	8.03E-01	No
10	Nickel			0	11.872	[illegible]	38818.301	7763.660	No	0	5.557332	[illegible]	5688.303	1137.661	No	9.93E+02	9.93E+04	1.99E+04	No
11	Selenium			0	5.28	[illegible]	1469.802	293.960	No	0	4.697332	[illegible]	487.232	97.446	No	[illegible]	2.43E+05	4.86E+04	No
12	Silver			0	0	[illegible]	73.849	14.770	No	0	0	-	-	-	-	-	-	-	-
13	Thallium			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.74E+01	5.48E+00	No
14	Zinc			0	24.99	[illegible]	14519.827	2903.965	No	0	13.589468	[illegible]	19753.553	3950.711	No	1.49E+04	1.49E+06	2.98E+05	No
15	Cyanide			0	0	[illegible]	1656.836	331.367	No	0	0	[illegible]	520.420	104.084	No	[illegible]	9.34E+05	1.87E+05	No
16	Total Phenolic Compounds			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
17	Hardness (As CaCO3)			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
18	Acrolein			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.43E+02	1.09E+02	No
19	Acrylonitrile		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.51E+02	3.01E+01	No
20	Aldrin		YES	0	0	[illegible]	225.932	45.186	No	0	0	-	-	-	-	[illegible]	3.07E-02	6.15E-03	No
21	Benzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.62E+04	3.24E+03	No
22	Bromoform		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.24E+04	1.65E+04	No
23	Carbon Tetrachloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.00E+03	2.00E+02	No
24	Chlordane		YES	0	0	[illegible]	180.748	36.149	No	0	0	[illegible]	0.430	0.086	No	[illegible]	4.94E-01	9.89E-02	No
25	Clorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.07E+04	1.81E+04	No
26	Chlorodibromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.75E+03	1.55E+03	No
27	Chloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
28	2-Chloro-Ethylvinyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
29	ChloroForm		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.07E+05	2.13E+04	No
30	4,4' - DDD		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.90E-01	3.79E-02	No
31	4,4' - DDE		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.34E-01	2.68E-02	No
32	4,4' - DDT		YES	0	0	1.100	62.842	16.568	No	0	0	0.001	0.100	0.020	No	[illegible]	1.34E-01	2.68E-02	No
33	Dichlorobromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.05E+04	2.10E+03	No
34	1, 1-Dichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
35	1, 2-Dichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.23E+04	4.47E+03	No
36	Trans-1, 2-Dichloro-Ethylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.91E+05	1.18E+05	No
37	1, 1-Dichloroethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.36E+05	8.71E+05	No
38	1, 2-Dichloropropane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.50E+02	1.70E+02	No
39	1, 3-Dichloro-Propylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.23E+03	2.46E+02	No
40	Dieldrin		YES	0	0	[illegible]	18.075	3.615	No	0	0	[illegible]	5.605	1.121	No	[illegible]	3.27E-02	6.53E-03	No
41	Ethylbenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.25E+05	2.49E+04	No
42	Methyl Bromide			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.72E+04	1.74E+04	No
43	Methyl Chloride			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
44	Methylene Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.61E+05	7.23E+04	No
45	1, 1, 2, 2-Tetrachloro-Ethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.44E+03	4.88E+02	No
46	Tetrachloro-Ethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.00E+03	4.01E+02	No
47	Toluene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.73E+05	1.75E+05	No
48	Toxaphene		YES	0	0	[illegible]	54.977	10.995	No	0	0	[illegible]	0.020	0.004	No	[illegible]	1.69E-01	3.39E-02	No
49	Tributyltin (TBT)		YES	0	0	[illegible]	34.643	6.929	No	0	0	[illegible]	7.206	1.441	No	-	-	-	-
50	1, 1, 1-Trichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
51	1, 1, 2-Trichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.51E+03	1.90E+03	No
52	Trichlorethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.83E+04	3.65E+03	No
53	Vinyl Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.49E+03	2.98E+02	No
54	P-Chloro-M-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
55	2-Chlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.71E+03	1.74E+03	No
56	2, 4-Dichlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.72E+04	3.44E+03	No
57	2, 4-Dimethylphenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.98E+04	9.96E+03	No
58	4, 6-Dinitro-O-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
59	2, 4-Dinitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.11E+05	6.23E+04	No
60	4,6-Dinitro-2-methylphenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.73E+05	3.46E+04	No
61	Dioxin (2,3,7,8-TCDD)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.79E-05	5.58E-06	No
62	2-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
63	4-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
64	Pentachlorophenol		YES	0	0	[illegible]	656.960	131.392	No	0	0	[illegible]	669.799	133.960	No	[illegible]	1.85E+03	3.70E+02	No
65	Phenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.00E+07	1.00E+07	No
66	2, 4, 6-Trichlorophenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.48E+03	2.96E+02	No
67	Acenaphthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.79E+04	1.16E+04	No
68	Acenaphthylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
69	Anthracene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.34E+06	4.67E+05	No
70	Benzidine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.16E-02	2.32E-03	No
71	Benzo(A)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.11E+01	2.23E+00	No
72	Benzo(A)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.11E+01	2.23E+00	No
73	Benzo(b)fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.07E+00	2.13E-01	No
74	Benzo(GHI)Perylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
75	Benzo(K)Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.07E+00	2.13E-01	No
76	Bis (2-Chloroethoxy) Methane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
77	Bis (2-Chloroethyl)-Ether		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.21E+02	6.43E+01	No
78	Bis (2-Chloroiso-Propyl) Ether			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.78E+06	7.56E+05	No
79	Bis (2-Ethylhexyl) Phthalate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.34E+03	2.68E+02	No
80	4-Bromophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
81	Butyl Benzyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.13E+05	2.26E+04	No
82	2-Chloronaphthalene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.25E+04	1.85E+04	No
83	4-Chlorophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
84	Chrysene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.11E+01	2.23E+00	No
85	Di-N-Butyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.62E+05	5.25E+04	No
86	Di-N-Octyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
87	Dibenzo(A,H)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.11E+01	2.23E+00	No
88	1, 2-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.56E+04	1.51E+04	No
89	1, 3-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.63E+04	1.13E+04	No
90	1, 4-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.13E+04	2.25E+03	No
91	3, 3-Dichlorobenzidine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.74E+01	3.48E+00	No
92	Diethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.56E+06	5.12E+05	No
93	Dimethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.48E+07	1.30E+07	No
94	2, 4-Dinitrotoluene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.07E+03	4.14E+02	No
95	2, 6-Dinitrotoluene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
96	1,2-Diphenylhydrazine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.17E+01	2.34E+00	No
97	Endosulfan (alpha)		YES	0	0	[illegible]	16.568	3.314	No	0	0	[illegible]	5.605	1.121	No	[illegible]	5.42E+04	1.08E+04	No
98	Endosulfan (beta)		YES	0	0	[illegible]	16.568	3.314	No	0	0	[illegible]	5.605	1.121	No	[illegible]	5.42E+04	1.08E+04	No
99	Endosulfan sulfate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.42E+04	1.08E+04	No
100	Endrin		YES	0	0	[illegible]	6.477	1.295	No	0	0	[illegible]	3.603	0.721	No	[illegible]	3.69E+01	7.38E+00	No
101	Endrin Aldeyhde		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.84E+02	3.69E+01	No
102	Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.12E+03	1.62E+03	No
103	Fluorene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.11E+05	6.23E+04	No
104	Heptachlor		YES	0	0	[illegible]	39.162	7.832	No	0	0	[illegible]	0.380	0.076	No	[illegible]	4.84E-02	9.68E-03	No
105	Heptachlor Epoxide		YES	0	0	[illegible]	39.162	7.832	No	0	0	[illegible]	0.380	0.076	No	[illegible]	2.39E-02	4.79E-03	No
106	Hexachlorobenzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.75E-01	3.51E-02	No
107	Hexachlorobutadiene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.13E+04	2.25E+03	No
108	Hexachlorocyclohexan (alpha)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.98E+00	5.88E-01	No
109	Hexachlorocyclohexan (beta)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.04E+01	2.09E+00	No
110	Hexachlorocyclohexan (gamma)		YES	0	0	[illegible]	71.545	14.309	No	0	0	-	-	-	-	[illegible]	1.13E+03	2.25E+02	No
111	HexachlorocycloPentadiene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.46E+04	1.29E+04	No
112	Hexachloroethane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.92E+02	3.84E+01	No
113	Indeno(1, 2, 3-CK)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.11E+01	2.23E+00	No
114	Isophorone			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.61E+04	1.12E+04	No
115	Naphthalene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
116	Nitrobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.04E+04	8.08E+03	No
117	N-Nitrosodi-N-Propylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.08E+02	6.17E+01	No
118	N-Nitrosodimethylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.84E+03	3.68E+02	No
119	N-Nitrosodiphenylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.66E+03	7.32E+02	No
120	PCB-1016		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
121	PCB-1221		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
122	PCB-1232		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
123	PCB-1242		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
124	PCB-1248		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
125	PCB-1254		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
126	PCB-1260		YES	0	0	-	-	-	-	0	0	[illegible]	1.401	0.280	No	[illegible]	3.91E-02	7.82E-03	No
127	Phenanthrene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
128	Pyrene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.34E+05	4.67E+04	No
129	1, 2, 4-Trichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.10E+03	8.19E+02	No

Facility Name: **Plant Barry DSN003 Low Volume Wastewater System**

NPDES No.: **AL0002879**

$$Q_d*C_d + Q_{d2}*C_{d2} + Q_s*C_s = Q_r*C_r$$

ID	Pollutant	Carcinogen "yes"	Type	Background from upstream source (C_{d2}) Daily Max	Background from upstream source (C_{d2}) Monthly Ave	Background Instream (C_s) Daily Max	Background Instream (C_s) Monthly Ave	Enter Max Daily Discharge as reported by Applicant (C_d) Max	Enter Avg Daily Discharge as reported by Applicant (C_d) Ave	Partition Coefficient (Stream / Lake)
				µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
1	Antimony		Metals	0	0	[illegible]	[illegible]	4.66	4.66	-
2	**Arsenic*,****	YES	Metals	0	0	[illegible]	[illegible]	80.45	8.2	0.574
3	Beryllium		Metals	0	0	0.24	[illegible]	0	0	-
4	Cadmium**		Metals	0	0	0	0	0.203	0.203	0.236
5	Chromium / Chromium III**		Metals	0	0	0.52	[illegible]	1.65	1.65	0.210
6	Chromium / Chromium VI**		Metals	0	0	0	0	0	0	
7	Copper**		Metals	0	0	3.96	1.439	13	13	0.388
8	Lead**		Metals	0	0	0	0	0	0	0.208
9	Mercury**		Metals	0	0	0.01	[illegible]	0.012	0.006	0.302
10	Nickel**		Metals	0	0	1.40	[illegible]	2.07	2.07	0.505
11	Selenium		Metals	0	0	0.49	0.133	22.8	22.8	-
12	Silver		Metals	0	0	0	0	0	0	-
13	Thallium		Metals	0	0	0	0	0.208	0.208	-
14	Zinc**		Metals	0	0	5.05	[illegible]	1.67	1.67	0.330
15	Cyanide		Metals	0	0	0	0	0	0	-
16	Total Phenolic Compounds		Metals	0	0	0	0	0	0	-
17	Hardness (As CaCO3)		Metals	0	0	68.2	50.124	0	0	-
18	Acrolein		VOC	0	0	0	0	0	0	-
19	**Acrylonitrile***	YES	VOC	0	0	0	0	0	0	-
20	**Aldrin**	YES	VOC	0	0	0	0	0	0	-
21	**Benzene***	YES	VOC	0	0	0	0	0	0	-
22	**Bromoform***	YES	VOC	0	0	0	0	0	0	-
23	**Carbon Tetrachloride***	YES	VOC	0	0	0	0	0	0	-
24	**Chlordane**	YES	VOC	0	0	0	0	0	0	-
25	Clorobenzene		VOC	0	0	0	0	0	0	-
26	**Chlorodibromo-Methane***	YES	VOC	0	0	0	0	0	0	-
27	Chloroethane		VOC	0	0	0	0	0	0	-
28	2-Chloro-Ethylvinyl Ether		VOC	0	0	0	0	0	0	-
29	**ChloroForm***	YES	VOC	0	0	0	0	0	0	-
30	**4,4'-DDD**	YES	VOC	0	0	0	0	0	0	-
31	**4,4'-DDE**	YES	VOC	0	0	0	0	0	0	-
32	**4.4'-DDT**	YES	VOC	0	0	0	0	0	0	-
33	**Dichlorobromo-Methane***	YES	VOC	0	0	0	0	0	0	-
34	1, 1-Dichloroethane		VOC	0	0	0	0	0	0	-
35	**1, 2-Dichloroethane***	YES	VOC	0	0	0	0	0	0	-
36	Trans-1, 2-Dichloro-Ethylene		VOC	0	0	0	0	0	0	-
37	**1, 1-Dichloroethylene***	YES	VOC	0	0	0	0	0	0	-
38	1, 2-Dichloropropane		VOC	0	0	0	0	0	0	-
39	1, 3-Dichloro-Propylene		VOC	0	0	0	0	0	0	-
40	**Dieldrin**	YES	VOC	0	0	0	0	0	0	-
41	Ethylbenzene		VOC	0	0	0	0	0	0	-
42	Methyl Bromide		VOC	0	0	0	0	0	0	-
43	Methyl Chloride		VOC	0	0	0	0	0	0	-
44	**Methylene Chloride***	YES	VOC	0	0	0	0	0	0	-
45	**1, 1, 2, 2-Tetrachloro-Ethane***	YES	VOC	0	0	0	0	0	0	-
46	**Tetrachloro-Ethylene***	YES	VOC	0	0	0	0	0	0	-
47	Toluene		VOC	0	0	0	0	0	0	-
48	**Toxaphene**	YES	VOC	0	0	0	0	0	0	-
49	**Tributyltine (TBT)**	YES	VOC	0	0	0	0	0	0	-
50	1, 1, 1-Trichloroethane		VOC	0	0	0	0	0	0	-
51	**1, 1, 2-Trichloroethane***	YES	VOC	0	0	0	0	0	0	-
52	**Trichlorethylene***	YES	VOC	0	0	0	0	0	0	-
53	**Vinyl Chloride***	YES	VOC	0	0	0	0	0	0	-
54	P-Chloro-M-Cresol		Acids	0	0	0	0	0	0	-
55	2-Chlorophenol		Acids	0	0	0	0	0	0	-
56	2, 4-Dichlorophenol		Acids	0	0	0	0	0	0	-
57	2, 4-Dimethylphenol		Acids	0	0	0	0	0	0	-
58	4, 6-Dinitro-O-Cresol		Acids	0	0	0	0	0	0	-
59	2, 4-Dinitrophenol		Acids	0	0	0	0	0	0	-
60	**4,6-Dintro-2-methylophenol**	YES	Acids	0	0	0	0	0	0	-
61	**Dioxin (2,3,7,8-TCDD)**	YES	Acids	0	0	0	0	0	0	-
62	2-Nitrophenol		Acids	0	0	0	0	0	0	-
63	4-Nitrophenol		Acids	0	0	0	0	0	0	-
64	**Pentachlorophenol***	YES	Acids	0	0	0	0	0	0	-
65	Phenol		Acids	0	0	0	0	0	0	-
66	**2, 4, 6-Trichlorophenol***	YES	Acids	0	0	0	0	0	0	-
67	Acenaphthene		Bases	0	0	0	0	0	0	-
68	Acenaphthylene		Bases	0	0	0	0	0	0	-
69	Anthracene		Bases	0	0	0	0	0	0	-
70	Benzidine		Bases	0	0	0	0	0	0	-
71	**Benzo(A)Anthracene***	YES	Bases	0	0	0	0	0	0	-
72	**Benzo(A)Pyrene***	YES	Bases	0	0	0	0	0	0	-
73	3, 4 Benzo-Fluoranthene		Bases	0	0	0	0	0	0	-
74	Benzo(GHI)Perylene		Bases	0	0	0	0	0	0	-
75	Benzo(K)Fluoranthene		Bases	0	0	0	0	0	0	-
76	Bis (2-Chloroethoxy) Methane		Bases	0	0	0	0	0	0	-
77	**Bis (2-Chloroethyl)-Ether***	YES	Bases	0	0	0	0	0	0	-
78	Bis (2-Chloroiso-Propyl) Ether		Bases	0	0	0	0	0	0	-
79	**Bis (2-Ethylhexyl) Phthalate***	YES	Bases	0	0	0	0	0	0	-
80	4-Bromophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
81	Butyl Benzyl Phthalate		Bases	0	0	0	0	0	0	-
82	2-Chloronaphthalene		Bases	0	0	0	0	0	0	-
83	4-Chlorophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
84	**Chrysene***	YES	Bases	0	0	0	0	0	0	-
85	Di-N-Butyl Phthalate		Bases	0	0	0	0	0	0	-
86	Di-N-Octyl Phthalate		Bases	0	0	0	0	0	0	-
87	**Dibenzo(A,H)Anthracene***	YES	Bases	0	0	0	0	0	0	-
88	1, 2-Dichlorobenzene		Bases	0	0	0	0	0	0	-
89	1, 3-Dichlorobenzene		Bases	0	0	0	0	0	0	-
90	1, 4-Dichlorobenzene		Bases	0	0	0	0	0	0	-
91	**3, 3-Dichlorobenzidine***	YES	Bases	0	0	0	0	0	0	-
92	Diethyl Phthalate		Bases	0	0	0	0	0	0	-
93	Dimethyl Phthalate		Bases	0	0	0	0	0	0	-
94	**2, 4-Dinitrotoluene***	YES	Bases	0	0	0	0	0	0	-
95	2, 6-Dinitrotoluene		Bases	0	0	0	0	0	0	-
96	1,2-Diphenylhydrazine		Bases	0	0	0	0	0	0	-
97	**Endosulfan (alpha)**	YES	Bases	0	0	0	0	0	0	-
98	**Endosulfan (beta)**	YES	Bases	0	0	0	0	0	0	-
99	**Endosulfan sulfate**	YES	Bases	0	0	0	0	0	0	-
100	**Endrin**	YES	Bases	0	0	0	0	0	0	-
101	**Endrin Aldeyhide**	YES	Bases	0	0	0	0	0	0	-
102	Fluoranthene		Bases	0	0	0	0	0	0	-
103	Fluorene		Bases	0	0	0	0	0	0	-
104	Heptochlor	YES	Bases	0	0	0	0	0	0	-
105	Heptachlor Epoxide	YES	Bases	0	0	0	0	0	0	-
106	**Hexachlorobenzene***	YES	Bases	0	0	0	0	0	0	-
107	**Hexachlorobutadiene***	YES	Bases	0	0	0	0	0	0	-
108	**Hexachlorocyclohexan (alpa)**	YES	Bases	0	0	0	0	0	0	-
109	**Hexachlorocyclohexan (beta)**	YES	Bases	0	0	0	0	0	0	-
110	**Hexachlorocyclohexan (gamma)**	YES	Bases	0	0	0	0	0	0	-
111	HexachlorocycloPentadiene		Bases	0	0	0	0	0	0	-
112	Hexachloroethane		Bases	0	0	0	0	0	0	-
113	**Indeno(1, 2, 3-CK)Pyrene***	YES	Bases	0	0	0	0	0	0	-
114	Isophorone		Bases	0	0	0	0	0	0	-
115	Naphthalene		Bases	0	0	0	0	0	0	-
116	Nitrobenzene		Bases	0	0	0	0	0	0	-
117	**N-Nitrosodi-N-Propylamine***	YES	Bases	0	0	0	0	0	0	-
118	**N-Nitrosodi-N-Methylamine***	YES	Bases	0	0	0	0	0	0	-
119	**N-Nitrosodi-N-Phenylamine***	YES	Bases	0	0	0	0	0	0	-
120	**PCB-1016**	YES	Bases	0	0	0	0	0	0	-
121	**PCB-1221**	YES	Bases	0	0	0	0	0	0	-
122	**PCB-1232**	YES	Bases	0	0	0	0	0	0	-
123	**PCB-1242**	YES	Bases	0	0	0	0	0	0	-
124	**PCB-1248**	YES	Bases	0	0	0	0	0	0	-
125	**PCB-1254**	YES	Bases	0	0	0	0	0	0	-
126	**PCB-1260**	YES	Bases	0	0	0	0	0	0	-
127	Phenanthrene		Bases	0	0	0	0	0	0	-
128	Pyrene		Bases	0	0	0	0	0	0	-
129	1, 2, 4-Trichlorobenzene		Bases	0	0	0	0	0	0	-

8.54	Enter Q_d = wastewater discharge flow from facility (MGD)
13.2133357	Q_d = wastewater discharge flow (cfs) (this value is caluclated from the MGD)
0	Enter flow from upstream discharge Qd2 = background stream flow in MGD above point of discharge
0	Qd2 = background stream flow from upstream source (cfs)
2207.53	Enter 7Q10, Q_s = background stream flow in cfs above point of discharge
1655.65	Enter or estimated, 1Q10, Q_s = background stream flow in cfs above point of discharge (1Q10 estimated at 75% of 7Q10)
23277	Enter Mean Annual Flow, Q_s = background stream flow in cfs above point of discharge
3927.61	Enter 7Q2, Q_s = background stream flow in cfs above point of discharge (For LWF class streams)
Enter to Left	Enter C_s = background in-stream pollutant concentration in µg/l (assuming this is zero "0" unless there is data)
Q_d +Qd2+Q_s	Q_r = resultant in-stream flow, after discharge
Calculated on other	C_r = resultant in-stream pollutant concentration in µg/l in the stream (after complete mixing occurs)
50.12	Enter, Background Hardness above point of discharge (assumed 50 South of Birmingham and 100 North of Birmingham)
7.00 s.u.	Enter, Background pH above point of discharge
yes	Enter, Is discharge to a stream? "YES" Other option would be to a Lake. (This changes the partition coefficients for the metals)

** Using Partition Coefficients

May 20, 2020

Facility Name: Plant Barry DSN003 Low Volume Wastewater System

NPDES No.: AL0002879

Freshwater F&W classification.					Max Daily Discharge as reported by Applicant (C_{dmax})	Freshwater Acute (ug/l) Q_s =1Q10				Background from upstream source (Cd2) Monthly Ave	Avg Daily Discharge as reported by Applicant (C_{davg})	Freshwater Chronic (ug/l) Q_s = 7Q10				Human Health Consumption Fish only (ug/l) Carcinogen Q_s = Annual Average Non-Carcinogen Q_s = 7Q10			
ID	Pollutant	RP?	Carcinogen yes	Background from upstream source (Cd2) Daily Max		Water Quality Criteria (C_a)	Draft Permit Limit (C_{dmax})	20% of Draft Permit Limit	RP?			Water Quality Criteria (C_c)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?	Water Quality Criteria (C_c)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?
1	Antimony			0	4.66	-	-	-	-	0	4.66	-	-	-	-	[illegible]	6.27E+04	1.25E+04	No
2	Arsenic		YES	0	80.45	[illegible]	74795.158	14959.032	No	0	8.2	[illegible]	43908.587	8781.317	No	0.303	389.6	77.915	No
3	Beryllium			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
4	Cadmium			0	0.203	[illegible]	550.369	110.074	No	0	0.203	[illegible]	108.356	21.671	No	-	-	-	-
5	Chromium/ Chromium III			0	1.65	[illegible]	194568.401	38913.680	No	0	1.65	[illegible]	33657.311	6731.462	No	-	-	-	-
6	Chromium/ Chromium VI			0	0	[illegible]	2020.823	404.165	No	0	0	[illegible]	1848.752	369.750	No	-	-	-	-
7	Copper			0	13	[illegible]	1788.369	357.674	No	0	13	[illegible]	1909.635	381.927	No	-	-	-	-
8	Lead			0	0	[illegible]	18527.403	3705.481	No	0	0	[illegible]	960.742	192.148	No	-	-	-	-
9	Mercury			0	0.0119	[illegible]	301.870	60.374	No	0	0.00614	[illegible]	1.624	0.325	No	4.24E-02	6.74E+00	1.35E+00	No
10	Nickel			0	2.07	[illegible]	65100.057	13020.011	No	0	2.07	[illegible]	9552.122	1910.424	No	9.93E+02	1.67E+05	3.34E+04	No
11	Selenium			0	22.8	[illegible]	2464.631	492.926	No	0	22.8	[illegible]	818.131	163.626	No	[illegible]	4.08E+05	8.17E+04	No
12	Silver			0	0	[illegible]	123.651	24.770	No	0	0	-	-	-	-	-	-	-	-
13	Thallium			0	0.208	-	-	-	-	0	0.208	-	-	-	-	[illegible]	4.60E+01	9.20E+00	No
14	Zinc			0	1.67	[illegible]	24347.365	4869.473	No	0	1.67	[illegible]	33171.275	6634.255	No	1.49E+04	2.50E+06	5.01E+05	No
15	Cyanide			0	0	[illegible]	2778.632	555.726	No	0	0	[illegible]	873.955	174.791	No	[illegible]	1.57E+06	3.14E+05	No
16	Total Phenolic Compounds			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
17	Hardness (As CaCO3)			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
18	Acrolein			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.12E+02	1.82E+02	No
19	Acrylonitrile		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.54E+02	5.08E+01	No
20	Aldrin		YES	0	0	[illegible]	378.904	75.781	No	0	0	-	-	-	-	[illegible]	5.18E-02	1.04E-02	No
21	Benzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.73E+04	5.45E+03	No
22	Bromoform		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.39E+05	2.78E+04	No
23	Carbon Tetrachloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.69E+03	3.37E+02	No
24	Chlordane		YES	0	0	[illegible]	303.123	60.625	No	0	0	[illegible]	0.723	0.145	No	[illegible]	8.33E-01	1.67E-01	No
25	Clorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.52E+05	3.05E+04	No
26	Chlorodibromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.31E+04	2.61E+03	No
27	Chloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
28	2-Chloro-Ethylvinyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
29	ChloroForm		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.80E+05	3.60E+04	No
30	4,4' - DDD		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.20E-01	6.39E-02	No
31	4,4' - DDE		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.26E-01	4.51E-02	No
32	4,4' - DDT		YES	0	0	1.100	136.932	27.786	No	0	0	0.001	0.168	0.034	No	[illegible]	2.26E-01	4.51E-02	No
33	Dichlorobromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.77E+04	3.54E+03	No
34	1, 1-Dichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
35	1, 2-Dichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.77E+04	7.53E+03	No
36	Trans-1, 2-Dichloro-Ethylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.93E+05	1.99E+05	No
37	1, 1-Dichloroethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.34E+06	1.47E+06	No
38	1, 2-Dichloropropane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.43E+03	2.86E+02	No
39	1, 3-Dichloro-Propylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.06E+03	4.13E+02	No
40	Dieldrin		YES	0	0	[illegible]	30.312	6.062	No	0	0	[illegible]	9.412	1.882	No	[illegible]	5.50E-02	1.10E-02	No
41	Ethylbenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.09E+05	4.18E+04	No
42	Methyl Bromide			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.46E+05	2.93E+04	No
43	Methyl Chloride			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
44	Methylene Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.09E+05	1.22E+05	No
45	1, 1, 2, 2-Tetrachloro-Ethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.11E+03	8.23E+02	No
46	Tetrachloro-Ethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.38E+03	6.76E+02	No
47	Toluene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.47E+06	2.93E+05	No
48	Toxaphene		YES	0	0	[illegible]	92.200	18.440	No	0	0	[illegible]	0.034	0.007	No	[illegible]	2.85E-01	5.71E-02	No
49	Tributyltin (TBT)		YES	0	0	[illegible]	58.099	11.620	No	0	0	[illegible]	12.101	2.420	No	-	-	-	-
50	1, 1, 1-Trichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
51	1, 1, 2-Trichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.60E+04	3.21E+03	No
52	Trichlorethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.08E+04	6.16E+03	No
53	Vinyl Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.51E+03	5.02E+02	No
54	P-Chloro-M-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
55	2-Chlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.46E+04	2.93E+03	No
56	2, 4-Dichlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.89E+04	5.78E+03	No
57	2, 4-Dimethylphenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.36E+04	1.67E+04	No
58	4, 6-Dinitro-O-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
59	2, 4-Dinitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.23E+05	1.05E+05	No
60	4,6-Dinitro-2-methylphenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.92E+05	5.83E+04	No
61	Dioxin (2,3,7,8-TCDD)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.70E-08	9.40E-09	No
62	2-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
63	4-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
64	Pentachlorophenol		YES	0	0	[illegible]	1101.768	220.354	No	0	0	[illegible]	1124.811	224.962	No	[illegible]	3.12E+03	6.23E+02	No
65	Phenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.40E+07	1.68E+07	No
66	2, 4, 6-Trichlorophenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.49E+03	4.99E+02	No
67	Acenaphthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.72E+04	1.94E+04	No
68	Acenaphthylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
69	Anthracene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.92E+06	7.84E+05	No
70	Benzidine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.95E-02	3.90E-03	No
71	Benzo(A)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.88E+01	3.76E+00	No
72	Benzo(A)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.88E+01	3.76E+00	No
73	Benzo(b)fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.79E+00	3.58E-01	No
74	Benzo(GHI)Perylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
75	Benzo(K)Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.79E+00	3.58E-01	No
76	Bis (2-Chloroethoxy) Methane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
77	Bis (2-Chloroethyl)-Ether		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.42E+02	1.08E+02	No
78	Bis (2-Chloroiso-Propyl) Ether			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.35E+06	1.27E+06	No
79	Bis (2-Ethylhexyl) Phthalate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.26E+03	4.52E+02	No
80	4-Bromophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
81	Butyl Benzyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.89E+05	3.79E+04	No
82	2-Chloronaphthalene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.55E+05	3.11E+04	No
83	4-Chlorophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
84	Chrysene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.88E+01	3.76E+00	No
85	Di-N-Butyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.41E+05	8.81E+04	No
86	Di-N-Octyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
87	Dibenzo(A,H)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.88E+01	3.76E+00	No
88	1, 2-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.27E+05	2.54E+04	No
89	1, 3-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.45E+04	1.89E+04	No
90	1, 4-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.89E+04	3.78E+03	No
91	3, 3-Dichlorobenzidine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.93E+01	5.86E+00	No
92	Diethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.30E+06	8.60E+05	No
93	Dimethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.09E+08	2.18E+07	No
94	2, 4-Dinitrotoluene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.49E+03	6.98E+02	No
95	2, 6-Dinitrotoluene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
96	1,2-Diphenylhydrazine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.97E+01	3.94E+00	No
97	Endosulfan (alpha)		YES	0	0	[illegible]	27.786	5.557	No	0	0	[illegible]	9.412	1.882	No	[illegible]	9.14E+04	1.83E+04	No
98	Endosulfan (beta)		YES	0	0	[illegible]	27.786	5.557	No	0	0	[illegible]	9.412	1.882	No	[illegible]	9.14E+04	1.83E+04	No
99	Endosulfan sulfate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.14E+04	1.83E+04	No
100	Endrin		YES	0	0	[illegible]	10.862	2.172	No	0	0	[illegible]	6.050	1.210	No	[illegible]	6.22E+01	1.24E+01	No
101	Endrin Aldeyhde		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.11E+02	6.22E+01	No
102	Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.36E+04	2.73E+03	No
103	Fluorene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.23E+05	1.05E+05	No
104	Heptachlor		YES	0	0	[illegible]	65.677	13.135	No	0	0	[illegible]	0.639	0.128	No	[illegible]	8.18E-02	1.63E-02	No
105	Heptachlor Epoxide		YES	0	0	[illegible]	65.677	13.135	No	0	0	[illegible]	0.639	0.128	No	[illegible]	4.04E-02	8.07E-03	No
106	Hexachlorobenzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.96E-01	5.92E-02	No
107	Hexachlorobutadiene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.90E+04	3.79E+03	No
108	Hexachlorocyclohexan (alpha)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.02E+00	1.00E+00	No
109	Hexachlorocyclohexan (beta)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.76E+01	3.52E+00	No
110	Hexachlorocyclohexan (gamma)		YES	0	0	[illegible]	119.966	23.997	No	0	0	-	-	-	-	[illegible]	1.80E+03	3.60E+02	No
111	HexachlorocycloPentadiene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.08E+05	2.17E+04	No
112	Hexachloroethane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.22E+02	6.45E+01	No
113	Indeno(1, 2, 3-CK)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.88E+01	3.76E+00	No
114	Isophorone			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.42E+04	1.88E+04	No
115	Naphthalene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
116	Nitrobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.78E+04	1.36E+04	No
117	N-Nitrosodi-N-Propylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.20E+02	1.04E+02	No
118	N-Nitrosodimethylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.10E+03	6.20E+02	No
119	N-Nitrosodiphenylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.17E+03	1.23E+03	No
120	PCB-1016		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
121	PCB-1221		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
122	PCB-1232		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
123	PCB-1242		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
124	PCB-1248		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
125	PCB-1254		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
126	PCB-1260		YES	0	0	-	-	-	-	0	0	[illegible]	2.353	0.471	No	[illegible]	6.59E-02	1.32E-02	No
127	Phenanthrene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
128	Pyrene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.92E+05	7.84E+04	No
129	1, 2, 4-Trichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.88E+03	1.38E+03	No

Facility Name: **Plant Barry DSN004 Low Volume Wastewater System**

NPDES No.: **AL0002879**

$$Q_d*C_d + Q_{d2}*C_{d2} + Q_s*C_s = Q_r*C_r$$

ID	Pollutant	Carcinogen "yes"	Type	Background from upstream source (C_{d2}) Daily Max µg/l	Background from upstream source (C_{d2}) Monthly Ave µg/l	Background Instream (C_s) Daily Max µg/l	Background Instream (C_s) Monthly Ave µg/l	Enter Max Daily Discharge as reported by Applicant (C_d) Max µg/l	Enter Avg Daily Discharge as reported by Applicant (C_d) Ave µg/l	Partition Coefficient (Stream / Lake)
1	Antimony		Metals	0	0	[illegible]	[illegible]	0	0	-
2	**Arsenic*,** **	YES	Metals	0	0	[illegible]	[illegible]	0	0	0.574
3	Beryllium		Metals	0	0	[illegible]	[illegible]	0	0	-
4	Cadmium**		Metals	0	0	[illegible]	0	0	0	0.236
5	Chromium / Chromium III**		Metals	0	0	0.52	[illegible]	1	1	0.210
6	Chromium / Chromium VI**		Metals	0	0	[illegible]	0	0	0	
7	Copper**		Metals	0	0	3.94	1.439	18	18	0.388
8	Lead**		Metals	0	0	0	0	0	0	0.208
9	Mercury**		Metals	0	0	0.01	[illegible]	0.00147	0.00147	0.302
10	Nickel**		Metals	0	0	1.48	[illegible]	37	37	0.505
11	Selenium		Metals	0	0	0.49	0.133	0.31	0.31	-
12	Silver		Metals	0	0	0	0	0	0	-
13	Thallium		Metals	0	0	0	0	0	0	-
14	Zinc**		Metals	0	0	5.05	2.044	27	27	0.330
15	Cyanide		Metals	0	0	[illegible]	0	10	10	-
16	Total Phenolic Compounds		Metals	0	0	[illegible]	0	0	0	-
17	Hardness (As CaCO3)		Metals	0	0	69.2	50.124	0	0	-
18	Acrolein		VOC	0	0	[illegible]	[illegible]	0	0	-
19	**Acrylonitrile***	YES	VOC	0	0	0	0	0	0	-
20	**Aldrin**	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
21	**Benzene***	YES	VOC	0	0	0	0	0	0	-
22	**Bromoform***	YES	VOC	0	0	0	0	0	0	-
23	**Carbon Tetrachloride***	YES	VOC	0	0	0	0	0	0	-
24	**Chlordane**	YES	VOC	0	0	0	0	0	0	-
25	Clorobenzene		VOC	0	0	0	0	0	0	-
26	**Chlorodibromo-Methane***	YES	VOC	0	0	0	0	0	0	-
27	Chloroethane		VOC	0	0	0	0	0	0	-
28	2-Chloro-Ethylvinyl Ether		VOC	0	0	0	0	0	0	-
29	**ChloroForm***	YES	VOC	0	0	0	0	0	0	-
30	**4,4'-DDD**	YES	VOC	0	0	0	0	0	0	-
31	**4,4'-DDE**	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
32	**4,4'-DDT**	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
33	**Dichlorobromo-Methane***	YES	VOC	0	0	[illegible]	0	0	0	-
34	1, 1-Dichloroethane		VOC	0	0	[illegible]	[illegible]	0	0	-
35	**1, 2-Dichloroethane***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
36	Trans-1, 2-Dichloro-Ethylene		VOC	0	0	[illegible]	[illegible]	0	0	-
37	**1, 1-Dichloroethylene***	YES	VOC	0	0	0	0	0	0	-
38	1, 2-Dichloropropane		VOC	0	0	0	[illegible]	0	0	-
39	1, 3-Dichloro-Propylene		VOC	0	0	[illegible]	[illegible]	0	0	-
40	**Dieldrin**	YES	VOC	0	0	0	[illegible]	0	0	-
41	Ethylbenzene		VOC	0	0	[illegible]	[illegible]	0	0	-
42	Methyl Bromide		VOC	0	0	[illegible]	0	.0	0	-
43	Methyl Chloride		VOC	0	0	0	0	0	0	-
44	**Methylene Chloride***	YES	VOC	0	0	0	[illegible]	0	0	-
45	**1, 1, 2, 2-Tetrachloro-Ethane***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
46	**Tetrachloro-Ethylene***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
47	Toluene		VOC	0	0	[illegible]	[illegible]	0	0	-
48	**Toxaphene**	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
49	**Tributyltine (TBT)**	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
50	1, 1, 1-Trichloroethane		VOC	0	0	[illegible]	[illegible]	0	0	-
51	**1, 1, 2-Trichloroethane***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
52	**Trichlorethylene***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
53	**Vinyl Chloride***	YES	VOC	0	0	[illegible]	[illegible]	0	0	-
54	P-Chloro-M-Cresol		Acids	0	0	[illegible]	[illegible]	0	0	-
55	2-Chlorophenol		Acids	0	0	[illegible]	[illegible]	0	0	-
56	2, 4-Dichlorophenol		Acids	0	0	[illegible]	[illegible]	0	0	-
57	2, 4-Dimethylphenol		Acids	0	0	[illegible]	[illegible]	0	0	-
58	4, 6-Dinitro-O-Cresol		Acids	0	0	0	[illegible]	0	0	-
59	2, 4-Dinitrophenol		Acids	0	0	0	0	0	0	-
60	**4,6-Dintro-2-methylophenol**	YES	Acids	0	0	[illegible]	[illegible]	0	0	-
61	**Dioxin (2,3,7,8-TCDD)**	YES	Acids	0	0	[illegible]	[illegible]	0	0	-
62	2-Nitrophenol		Acids	0	0	0	[illegible]	0	0	-
63	4-Nitrophenol		Acids	0	0	[illegible]	0	0	0	-
64	**Pentachlorophenol***	YES	Acids	0	0	[illegible]	0	0	0	-
65	Phenol		Acids	0	0	0	0	0	0	-
66	**2, 4, 6-Trichlorophenol***	YES	Acids	0	0	0	0	0	0	-
67	Acenaphthene		Bases	0	0	[illegible]	[illegible]	0	0	-
68	Acenaphthylene		Bases	0	0	0	[illegible]	0	0	-
69	Anthracene		Bases	0	0	[illegible]	[illegible]	0	0	-
70	Benzidine		Bases	0	0	[illegible]	[illegible]	0	0	-
71	**Benzo(A)Anthracene***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
72	**Benzo(A)Pyrene***	YES	Bases	0	0	0	[illegible]	0	0	-
73	3, 4 Benzo-Fluoranthene		Bases	0	0	0	[illegible]	0	0	-
74	Benzo(GHI)Perylene		Bases	0	0	0	0	0	0	-
75	Benzo(K)Fluoranthene		Bases	0	0	[illegible]	[illegible]	0	0	-
76	Bis (2-Chloroethoxy) Methane		Bases	0	0	[illegible]	[illegible]	0	0	-
77	**Bis (2-Chloroethyl)-Ether***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
78	Bis (2-Chloroiso-Propyl) Ether		Bases	0	0	0	[illegible]	0	0	-
79	**Bis (2-Ethylhexyl) Phthalate***	YES	Bases	0	0	0	[illegible]	0	0	-
80	4-Bromophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
81	Butyl Benzyl Phthalate		Bases	0	0	[illegible]	[illegible]	0	0	-
82	2-Chloronaphthalene		Bases	0	0	[illegible]	[illegible]	0	0	-
83	4-Chlorophenyl Phenyl Ether		Bases	0	0	0	0	0	0	-
84	**Chrysene***	YES	Bases	0	0	[illegible]	0	0	0	-
85	Di-N-Butyl Phthalate		Bases	0	0	[illegible]	[illegible]	0	0	-
86	Di-N-Octyl Phthalate		Bases	0	0	[illegible]	[illegible]	0	0	-
87	**Dibenzo(A,H)Anthracene***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
88	1, 2-Dichlorobenzene		Bases	0	0	[illegible]	[illegible]	0	0	-
89	1, 3-Dichlorobenzene		Bases	0	0	[illegible]	[illegible]	0	0	-
90	1, 4-Dichlorobenzene		Bases	0	0	[illegible]	[illegible]	0	0	-
91	**3, 3-Dichlorobenzidine***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
92	Diethyl Phthalate		Bases	0	0	[illegible]	[illegible]	0	0	-
93	Dimethyl Phthalate		Bases	0	0	[illegible]	[illegible]	0	0	-
94	**2, 4-Dinitrotoluene***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
95	2, 6-Dinitrotoluene		Bases	0	0	[illegible]	[illegible]	0	0	-
96	1,2-Diphenylhydrazine		Bases	0	0	[illegible]	[illegible]	0	0	-
97	**Endosulfan (alpha)**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
98	**Endosulfan (beta)**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
99	**Endosulfan sulfate**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
100	**Endrin**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
101	**Endrin Aldeyhide**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
102	Fluoranthene		Bases	0	0	[illegible]	[illegible]	0	0	-
103	Fluorene		Bases	0	0	[illegible]	[illegible]	0	0	-
104	Heptochlor	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
105	Heptachlor Epoxide	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
106	**Hexachlorobenzene***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
107	**Hexachlorobutadiene***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
108	**Hexachlorocyclohexan (alpa)**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
109	**Hexachlorocyclohexan (beta)**	YES	Bases	0	0	0	[illegible]	0	0	-
110	**Hexachlorocyclohexan (gamma)**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
111	HexachlorocycloPentadiene		Bases	0	0	[illegible]	0	0	0	-
112	Hexachloroethane		Bases	0	0	[illegible]	0	0	0	-
113	**Indeno(1, 2, 3-CK)Pyrene***	YES	Bases	0	0	[illegible]	0	0	0	-
114	Isophorone		Bases	0	0	[illegible]	0	0	0	-
115	Naphthalene		Bases	0	0	[illegible]	0	0	0	-
116	Nitrobenzene		Bases	0	0	[illegible]	0	0	0	-
117	**N-Nitrosodi-N-Propylamine***	YES	Bases	0	0	[illegible]	0	0	0	-
118	**N-Nitrosodi-N-Methylamine***	YES	Bases	0	0	0	[illegible]	0	0	-
119	**N-Nitrosodi-N-Phenylamine***	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
120	**PCB-1016**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
121	**PCB-1221**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
122	**PCB-1232**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
123	**PCB-1242**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
124	**PCB-1248**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
125	**PCB-1254**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
126	**PCB-1260**	YES	Bases	0	0	[illegible]	[illegible]	0	0	-
127	Phenanthrene		Bases	0	0	[illegible]	[illegible]	0	0	-
128	Pyrene		Bases	0	0	[illegible]	[illegible]	0	0	-
129	1, 2, 4-Trichlorobenzene		Bases	0	0	[illegible]	[illegible]	0	0	-

5.07	Enter Q_d = wastewater discharge flow from facility (MGD)
7.84445103	Q_d = wastewater discharge flow (cfs) (this value is caluclated from the MGD)
0	Enter flow from upstream discharge Qd2 = background stream flow in MGD above point of discharge
0	Qd2 = background stream flow from upstream source (cfs)
2207.53	Enter 7Q10, Q_s = background stream flow in cfs above point of discharge
1655.65	Enter or estimated, 1Q10, Q_s = background stream flow in cfs above point of discharge (1Q10 estimated at 75% of 7Q10)
23277	Enter Mean Annual Flow, Q_s = background stream flow in cfs above point of discharge
3927.61	Enter 7Q2, Q_s = background stream flow in cfs above point of discharge (For LWF class streams)
Enter in Left	Enter C_s = background in-stream pollutant concentration in µg/l (assuming this is zero "0" unless there is data)
Q_d +Qd2+Q_s	Q_r = resultant in-stream flow, after discharge
Calculated on other	C_r = resultant in-stream pollutant concentration in µg/l in the stream (after complete mixing occurs)
50.12	Enter, Background Hardness above point of discharge (assumed 50 South of Birmingham and 100 North of Birmingham)
7.00 s.u.	Enter, Background pH above point of discharge
yes	Enter, Is discharge to a stream? "YES" Other option would be to a Lake. (This changes the partition coefficients for the metals)

** Using Partition Coefficients

May 20, 2020

Facility Name: Plant Barry DSN004 Low Volume Wastewater System

NPDES No.: AL0002879

				Freshwater F&W classification.	Max Daily Discharge as reported by Applicant	Freshwater Acute (µg/l) Q_s = 1Q10					Avg Daily Discharge as reported by Applicant	Freshwater Chronic (µg/l) Q_s = 7Q10				Human Health Consumption Fish only (µg/l) Carcinogen Q_s = Annual Average Non-Carcinogen Q_s = 7Q10			
ID	Pollutant	RP?	Carcinogen yes	Background from upstream source (Cd2) Daily Max	(C_{dmax})	Water Quality Criteria (C_s)	Draft Permit Limit (C_{dmax})	20% of Draft Permit Limit	RP?	Background from upstream source (Cd2) Monthly Ave	(C_{davg})	Water Quality Criteria (C_s)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?	Water Quality Criteria (C_s)	Draft Permit Limit (C_{davg})	20% of Draft Permit Limit	RP?
1	Antimony			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.05E+05	2.11E+04	No
2	Arsenic		YES	0	0	[illegible]	125580.917	25116.183	No	0	0	[illegible]	73778.198	14755.640	No	0.303	655.998	131.199	No
3	Berylium			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
4	Cadmium			0	0	[illegible]	924.070	184.814	No	0	0	[illegible]	182.078	36.415	No	-	-	-	-
5	Chromium/ Chromium III			0	1	[illegible]	326679.841	65335.968	No	0	1	[illegible]	56555.791	11311.158	No	-	-	-	-
6	Chromium/ Chromium VI			0	0	[illegible]	3392.960	678.592	No	0	0	[illegible]	3108.542	621.308	No	-	-	-	-
7	Copper			0	18	[illegible]	2999.995	599.999	No	0	18	[illegible]	3207.868	641.574	No	-	-	-	-
8	Lead			0	0	[illegible]	31107.495	6221.499	No	0	0	[illegible]	1614.378	322.876	No	-	-	-	-
9	Mercury			0	0.00147	[illegible]	506.833	101.367	No	0	0.00147	[illegible]	2.727	0.545	No	4.24E-02	1.13E+01	2.26E+00	No
10	Nickel			0	37	[illegible]	109301.940	21860.388	No	0	37	[illegible]	16050.474	3210.095	No	9.93E+02	2.80E+05	5.60E+04	No
11	Selenium			0	0.31	[illegible]	4137.781	827.556	No	0	0.31	[illegible]	1374.653	274.931	No	[illegible]	6.86E+05	1.37E+05	No
12	Silver			0	0	[illegible]	207.945	41.589	No	0	0	-	-	-	-	-	-	-	-
13	Thallium			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.73E+01	1.55E+01	No
14	Zinc			0	27	[illegible]	40875.779	8175.156	No	0	27	[illegible]	55737.824	11147.565	No	1.49E+04	4.21E+06	8.41E+05	No
15	Cyanide			0	10	[illegible]	4665.320	933.064	No	0	10	[illegible]	1468.547	293.709	No	[illegible]	2.64E+06	5.27E+05	No
16	Total Phenolic Compounds			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
17	Hardness (As CaCO3)			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
18	Acrolein			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.53E+03	3.06E+02	No
19	Acrylonitrile		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.28E+02	8.55E+01	No
20	Aldrin		YES	0	0	[illegible]	636.180	127.236	No	0	0	-	-	-	-	[illegible]	8.72E-02	1.74E-02	No
21	Benzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.58E+04	9.19E+03	No
22	Bromoform		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.34E+05	4.68E+04	No
23	Carbon Tetrachloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.84E+03	5.68E+02	No
24	Chlordane		YES	0	0	[illegible]	508.944	101.789	No	0	0	[illegible]	1.214	0.243	No	[illegible]	1.40E+00	2.81E-01	No
25	Clorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.56E+05	5.12E+04	No
26	Chlorodibromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.20E+04	4.40E+03	No
27	Chloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
28	2-Chloro-Ethylvinyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
29	ChloroForm		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.03E+05	6.06E+04	No
30	4,4' - DDD		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.36E-01	1.08E-01	No
31	4,4' - DDE		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.80E-01	7.60E-02	No
32	4,4' - DDT		YES	0	0	1.100	233.268	46.653	No	0	0	0.001	0.282	0.056	No	[illegible]	3.80E-01	7.60E-02	No
33	Dichlorobromo-Methane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.98E+04	5.96E+03	No
34	1, 1-Dichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
35	1, 2-Dichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.34E+04	1.27E+04	No
36	Trans-1, 2-Dichloro-Ethylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.67E+06	3.34E+05	No
37	1, 1-Dichloroethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.24E+07	2.47E+06	No
38	1, 2-Dichloropropane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.40E+03	4.80E+02	No
39	1, 3-Dichloro-Propylene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.47E+03	6.94E+02	No
40	Dieldrin		YES	0	0	[illegible]	50.894	10.178	No	0	0	[illegible]	15.815	3.163	No	[illegible]	9.27E-02	1.85E-02	No
41	Ethylbenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.51E+05	7.03E+04	No
42	Methyl Bromide			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.46E+05	4.92E+04	No
43	Methyl Chloride			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
44	Methylene Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.03E+06	2.05E+05	No
45	1, 1, 2, 2-Tetrachloro-Ethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.93E+03	1.39E+03	No
46	Tetrachloro-Ethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.69E+03	1.14E+03	No
47	Toluene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.46E+06	4.93E+05	No
48	Toxaphene		YES	0	0	[illegible]	154.804	30.961	No	0	0	[illegible]	0.056	0.011	No	[illegible]	4.81E-01	9.61E-02	No
49	Tributyltin (TBT)		YES	0	0	[illegible]	97.548	19.510	No	0	0	[illegible]	20.334	4.067	No	-	-	-	-
50	1, 1, 1-Trichloroethane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
51	1, 1, 2-Trichloroethane		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.70E+04	5.40E+03	No
52	Trichlorethylene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.19E+04	1.04E+04	No
53	Vinyl Chloride		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.23E+03	8.46E+02	No
54	P-Chloro-M-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
55	2-Chlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.46E+04	4.92E+03	No
56	2, 4-Dichlorophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.86E+04	9.71E+03	No
57	2, 4-Dimethylphenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.41E+06	2.81E+04	No
58	4, 6-Dinitro-O-Cresol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
59	2, 4-Dinitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.79E+05	1.76E+05	No
60	4,6-Dinitro-2-methylphenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.91E+05	9.82E+04	No
61	Dioxin (2,3,7,8-TCDD)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.92E-05	1.58E-05	No
62	2-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
63	4-Nitrophenol			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
64	Pentachlorophenol		YES	0	0	[illegible]	1849.868	369.974	No	0	0	[illegible]	1890.072	378.014	No	[illegible]	5.25E+03	1.05E+03	No
65	Phenol			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.41E+08	2.82E+07	No
66	2, 4, 6-Trichlorophenol		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.20E+03	8.40E+02	No
67	Acenaphthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.63E+05	3.27E+04	No
68	Acenaphthylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
69	Anthracene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.59E+06	1.32E+06	No
70	Benzidine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.27E-02	6.55E-03	No
71	Benzo(A)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+01	6.33E+00	No
72	Benzo(A)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+01	6.33E+00	No
73	Benzo(b)fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.01E+00	6.02E-01	No
74	Benzo(GHI)Perylene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
75	Benzo(K)Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.01E+00	6.02E-01	No
76	Bis (2-Chloroethoxy) Methane			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
77	Bis (2-Chloroethyl)-Ether		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	9.13E+02	1.83E+02	No
78	Bis (2-Chloroiso-Propyl) Ether			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.07E+07	2.13E+06	No
79	Bis (2-Ethylhexyl) Phthalate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.81E+03	7.61E+02	No
80	4-Bromophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
81	Butyl Benzyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.18E+05	6.37E+04	No
82	2-Chloronaphthalene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.61E+05	5.22E+04	No
83	4-Chlorophenyl Phenyl Ether			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
84	Chrysene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+01	6.33E+00	No
85	Di-N-Butyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.40E+05	1.48E+05	No
86	Di-N-Octyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
87	Dibenzo(A,H)Anthracene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+01	6.33E+00	No
88	1, 2-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.13E+05	4.27E+04	No
89	1, 3-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.59E+05	3.18E+04	No
90	1, 4-Dichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.18E+04	6.35E+03	No
91	3, 3-Dichlorobenzidine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.93E+01	9.87E+00	No
92	Diethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	7.22E+06	1.44E+06	No
93	Dimethyl Phthalate			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.83E+08	3.66E+07	No
94	2, 4-Dinitrotoluene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.88E+03	1.18E+03	No
95	2, 6-Dinitrotoluene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
96	1,2-Diphenylhydrazine			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.31E+01	6.62E+00	No
97	Endosulfan (alpha)		YES	0	0	[illegible]	46.653	9.331	No	0	0	[illegible]	15.615	3.163	No	[illegible]	1.54E+05	3.08E+04	No
98	Endosulfan (beta)		YES	0	0	[illegible]	46.653	9.331	No	0	0	[illegible]	15.615	3.163	No	[illegible]	1.54E+05	3.08E+04	No
99	Endosulfan sulfate		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.54E+05	3.08E+04	No
100	Endrin		YES	0	0	[illegible]	18.237	3.647	No	0	0	[illegible]	10.167	2.033	No	[illegible]	1.05E+02	2.09E+01	No
101	Endrin Aldehyde		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.23E+02	1.05E+02	No
102	Fluoranthene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.29E+04	4.58E+03	No
103	Fluorene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.79E+05	1.76E+05	No
104	Heptachlor		YES	0	0	[illegible]	110.271	22.054	No	0	0	[illegible]	1.073	0.215	No	[illegible]	1.37E-01	2.75E-02	No
105	Heptachlor Epoxide		YES	0	0	[illegible]	110.271	22.054	No	0	0	[illegible]	1.073	0.215	No	[illegible]	6.80E-02	1.36E-02	No
106	Hexachlorobenzene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	4.86E-01	9.98E-02	No
107	Hexachlorobutadiene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.19E+04	6.39E+03	No
108	Hexachlorocyclohexan (alpha)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.46E+00	1.69E+00	No
109	Hexachlorocyclohexan (beta)		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	2.96E+01	5.92E+00	No
110	Hexachlorocyclohexan (gamma)		YES	0	0	[illegible]	201.457	40.291	No	0	0	-	-	-	-	[illegible]	3.20E+03	6.39E+02	No
111	HexachlorocycloPentadiene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.82E+05	3.64E+04	No
112	Hexachloroethane			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.42E+02	1.08E+02	No
113	Indeno(1, 2, 3-CK)Pyrene		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	3.16E+01	6.33E+00	No
114	Isophorone			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.58E+05	3.17E+04	No
115	Naphthalene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
116	Nitrobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.14E+05	2.28E+04	No
117	N-Nitrosodi-N-Propylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	8.76E+02	1.75E+02	No
118	N-Nitrosodimethylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	5.22E+03	1.04E+03	No
119	N-Nitrosodiphenylamine		YES	0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.04E+04	2.08E+03	No
120	PCB-1016		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
121	PCB-1221		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
122	PCB-1232		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
123	PCB-1242		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
124	PCB-1248		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
125	PCB-1254		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
126	PCB-1260		YES	0	0	-	-	-	-	0	0	[illegible]	3.954	0.791	No	[illegible]	1.11E-01	2.22E-02	No
127	Phenanthrene			0	0	-	-	-	-	0	0	-	-	-	-	-	-	-	-
128	Pyrene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	6.59E+05	1.32E+05	No
129	1, 2, 4-Trichlorobenzene			0	0	-	-	-	-	0	0	-	-	-	-	[illegible]	1.16E+04	2.31E+03	No

Plant Barry Combined Dewatering, Low Volume Wastewater System, and Pressure Relief Wells for DSN002 Reasonable Potential

	Photic		Interstitial			Dewatering Values Utilized			Pressure Relief Wells			Total		
Pollutant	**Max**	**Average**	**Max**	**Average**		**Max**	**Average**	**Unit**	**Max**	**Average**	**Unit**	**Max**	**Average**	**Unit**
Total Antimony	0.289	0.192	6.56	3.333	ug/l	6.56	3.333	ug/l	0.223	0.16	ug/l	2.758	1.429	ug/l
Total Arsenic	1.36	0.81	12.6	5.2	ug/l	12.6	5.2	ug/l	0.933	0.476	ug/l	5.600	2.366	ug/l
Total Beryllium	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Cadmium	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Chromium	0.635	0.43	1.08	0.618	ug/l	1.08	0.618	ug/l	0.432	0.170	ug/l	0.691	0.349	ug/l
Total Copper	2	1.84	2.06	1.607	ug/l	2.06	1.84	ug/l	1.05	0.71	ug/l	1.454	1.162	ug/l
Total Lead	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Mercury	0	0	0	0	ug/l	0	0	ug/l	0.009	0.002	ug/l	0.005	0.001	ug/l
Total Nickel	3.75	2.853	4.48	2.55	ug/l	4.48	2.853	ug/l	16.8	7.36	ug/l	11.872	5.557	ug/l
Total Selenium	13.2	11.743	10.9	8.353	ug/l	13.2	11.743	ug/l	0	0	ug/l	5.280	4.697	ug/l
Total Silver	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Thallium	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Zinc	17.1	13.667	47.7	27.167	ug/l	47.7	27.167	ug/l	9.85	4.538	ug/l	24.990	13.589	ug/l
Total Cyanide	0	0	0	0	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l

***The highlighted cells were used for the Dewatering Value

Wastestream	Flow in MGD
Ash Pond Dewatering	5.76
Pressure Relief Wells	8.64
Flow Total	14.4

Combined Maximum Concentration = $\frac{F1*C1+F2*C2}{\text{Flow Total}}$

Combined Average Concentration = $\frac{F1*C1+F2*C2}{\text{Flow Total}}$

Plant Barry Combined Dewatering, Low Volume Wastewater System, and Pressure Relief Wells for DSN002 Reasonable Potential

Pollutant	Photic		Interstitial			Dewatering Values Utilized			Low Volume Wastewater System			Pressure Relief Wells			Total		
	Max	Average	Max	Average		Max	Average	Unit	Max	Average	Unit	Max	Average	Unit	Max	Average	Unit
Total Antimony	0.289	0.192	6.56	3.333	ug/l	6.560	3.333	ug/l	4.66	4.66	ug/l	0.223	0.16	ug/l	3.466	2.632	ug/l
Total Arsenic	1.36	0.81	12.6	5.2	ug/l	12.600	5.200	ug/l	80.45	8.2	ug/l	0.933	0.476	ug/l	33.465	4.538	ug/l
Total Beryllium	0	0	0	0	ug/l	0.000	0.000	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Cadmium	0	0	0	0	ug/l	0.000	0.000	ug/l	0.203	0.203	ug/l	0	0	ug/l	0.076	0.076	ug/l
Total Chromium	0.635	0.43	1.08	0.618	ug/l	1.080	0.618	ug/l	1.65	1.65	ug/l	0.432	0.170	ug/l	1.048	0.834	ug/l
Total Copper	2	1.84	2.06	1.607	ug/l	2.060	1.840	ug/l	13	13	ug/l	1.05	0.71	ug/l	5.752	5.569	ug/l
Total Lead	0	0	0	0	ug/l	0.000	0.000	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Mercury	0	0	0	0	ug/l	0.000	0.000	ug/l	0.012	0.006	ug/l	0.009	0.002	ug/l	0.008	0.003	ug/l
Total Nickel	3.75	2.853	4.48	2.55	ug/l	4.480	2.853	ug/l	2.07	2.07	ug/l	16.8	7.36	ug/l	8.223	4.259	ug/l
Total Selenium	13.2	11.743	10.9	8.353	ug/l	13.200	11.743	ug/l	22.8	22.8	ug/l	0	0	ug/l	11.802	11.437	ug/l
Total Silver	0	0	0	0	ug/l	0.000	0.000	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l
Total Thallium	0	0	0	0	ug/l	0.000	0.000	ug/l	0.208	0.208	ug/l	0	0	ug/l	0.077	0.077	ug/l
Total Zinc	17.1	13.667	47.7	27.167	ug/l	47.700	27.167	ug/l	1.67	1.67	ug/l	9.85	4.538	ug/l	16.309	9.152	ug/l
Total Cyanide	0	0	0	0	ug/l	0.000	0.000	ug/l	0	0	ug/l	0	0	ug/l	0.000	0.000	ug/l

***The highlighted cells were used for the Dewatering Value

Wastestream	Flow in MGD
Ash Pond Dewatering	5.76
Low Volume Waste System	8.54
Pressure Relief Wells	8.64
Flow Total	22.94

Combined Maximum Concentration = $\frac{F1*C1+F2*C2+F3*C3}{\text{Flow Total}}$

Combined Average Concentration = $\frac{F1*C1+F2*C2+F3*C3}{\text{Flow Total}}$

Alabama Power Plant Barry Background Instream Data in ug/l

	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
aluminum	165.43	204.62	21.77	15.11	162.54	53.73	23.83	45.72	10.37	0	13.95
antimony	0	0	0	0	0	0	0	0	0	0	0
arsenic	0.07	0.05	0.07	0.11	0.11	0.04	0.1	0.14	0.06	0.1	0.05
barium	24.53	25.55	21.6	23.85	27.13	27.6	35.83	24.95	31.89	38.72	30.37
beryllium	0	0	0	0.24	0	0	0	0	0	0	0
cadmium	0	0	0	0	0	0	0	0	0	0	0
calcium	13936.02	14707.27	14593.56	14140.95	14284.55	15677.21	17380.91	10337.47	17327.97	21128.61	17197.22
chromium	0.4	0.48	0	0	0.36	0	0.27	0.28	0	0	0
cobalt	0	0	0	0	0	0	0	0	0	0	0
copper	3.94	2.86	1.51	0.99	1.69	0.91	1.01	1.15	0.89	1.2	1.04
hardness	46.7	49.8	46.4	47.3	45.7	52.6	63.6	35.1	59.7	69.2	61.2
iron	218.45	311.21	153.1	172.72	216.38	91	35.83	216.45	81.66	79.23	109.11
lead	0	0	0	0	0	0	0	0	0	0	0
magnesium	2904.08	3193.07	2407.94	2929.36	2434.94	3269.24	4895.23	2258.03	3993.24	3997.1	4426.8
manganese	2.32	2.55	1.34	1.04	3.74	0.71	1.13	23.31	1.69	2.66	3.87
mercury	0	0.01	0.01	0	0	0	0	0.01	0	0	0
molybdenum	0.37	0.39	0.31	0.46	0.53	0.82	1.09	0.38	0.78	0.93	0.64
nickel	1.34	1.19	0	0	1.31	0	0	1.09	0	0	0
potassium	1911.26	1769.09	1556.41	1423.31	1628.91	1611.04	1735.82	1585.29	2242.79	2606.46	2326.23
selenium	0.49	0	0	0	0.21	0	0.22	0.3	0.34	0.3	0
silver	0	0	0	0	0	0	0	0	0	0	0
thallium	0	0	0	0	0	0	0	0	0	0	0
tin	0.34	0.38	0.64	0.4	0.26	1.01	0.69	0	0	0.47	0.24
titanium	6	8.76	2.48	1.76	7.03	2.58	1.08	3.39	1.08	0	1.66
zinc	1.94	1.82	3.26	0	2.71	1.98	5.05	2.12	0	1.44	1.06

Alabama Power Plant Barry Background Instream Data in ug/l

	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19
Aluminum	184.25	205.22	96.81	76.88	25.62	27.24
antimony	0.28	0	0	0	0.21	0
arsenic	0.1	0.06	0.09	0.05	0.06	0.135
barium	25.18	22.57	24.82	24.97	25.57	26.11
beryllium	0	0	0	0	0	0
cadmium	0	0	0	0	0	0
calcium	11136.88	11059.86	13959.28	15338.47	15757.27	13919.73
chromium	0.44	0.33	0.52	0	0.27	0
cobalt	0	0	0	0	0	0
copper	1.69	0.82	1	1.25	1.48	1.03
harness	38.4	38.6	47.9	54.2	50.1	45.6
iron	236.43	266.94	250.31	171.95	129.5	173.75
lead	0	0	0	0	0	0
magnesium	2575.47	2661.1	3174.14	3858.9	2616.8	2642.23
manganese	16.76	15.08	18.06	1.36	3.67	1.54
mercury	0	0	0	0	0.01	0
molybdenum	1.55	0.25	0.22	0.38	0.4	0.87
nickel	1.48	0	1.27	1.13	1.06	0
potassium	1667.82	1263.61	1511.99	1609.41	1790.9	1577.19
selenium	0.4	0	0	0	0	0
silver	0	0	0	0	0	0
thallium	0	0	0	0	0	0
tin	0.91	0.69	0.53	0.51	0.82	0.71
titanium	8.2	8.45	4.47	3.33	2.84	2.63
zinc	2.53	2.38	1.4	1.34	4.14	1.58

Alabama Power Plant Barry Background Instream Data in ug/l

	MAX	AVERAGE
aluminum	205.22	78.417
antimony	0.28	0.029
arsenic	0.14	0.082
barium	38.72	27.132
beryllium	0.24	0.014
cadmium	0.00	0.000
calcium	21128.61	14816.661
chromium	0.52	0.197
cobalt	0.00	0.000
copper	3.94	1.439
hardness	69.20	50.124
iron	311.21	171.413
lead	0.00	0.000
magnesium	4895.23	3190.451
manganese	23.31	5.931
mercury	0.01	0.002
molybdenum	1.55	0.610
nickel	1.48	0.581
potassium	2606.46	1753.972
selenium	0.49	0.133
silver	0.00	0.000
thallium	0.00	0.000
tin	1.01	0.506
titanium	8.76	3.867
zinc	5.05	2.044

MS. SUSAN B. COMENSKY
VP ENVIRONMENTAL AFFAIRS
ALABAMA POWER COMPANY
BARRY STEAM ELECTRIC PLANT
P.O. BOX 2641 BIN 12N-0830
BIRMINGHAM AL 35291

600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291

Alabama Power

November 25, 2019

RECEIVED
NOV 25 2019
IND/MUN BRANCH

Mr. Jeff Kitchens
Alabama Department of
Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

Re: **Alabama Power Company – Barry Steam Plant: NPDES Permit No. AL0002879; Updated NPDES Permit Renewal Application for Plant Barry**

Dear Mr. Kitchens:

Please find enclosed the updated NPDES permit renewal application for Plant Barry. Alabama Power Company (APC) submitted a complete and timely NPDES permit renewal application for Plant Barry on April 30, 2013. Accordingly, the existing NPDES permit for the facility has been administratively continued and remains in effect. The enclosed updated application is being submitted due to recent and anticipated changes to plant operation stemming from the CWA 316 (a) and 316(b) Rule, the Effluent Limitations Guidelines Rule (ELGs), and the Coal Combustion Residuals from Electric Utilities Rule (CCR Rule).

ADEM Form 187, EPA Forms 1, 2C, 2D, 2E, and 2F are included in this submittal, along with the supplementary information requested by the enclosed Forms, such as site maps, plant flow schematics, and available 316(a) and 316(b) compliance information. This application includes the required sampling analysis at the following locations: the water intake and discharge points 001, 001A, 002, 002A, and 010. This data is representative of current wastewater and stormwater discharges from the plant site. Historical data used in developing this application ranged from 2013 to 2019. Form 2D includes best engineering estimates for data related to the low volume wastewater, coal pile runoff, FGD wastewater, and landfill leachate (anticipated after the completion of the ash pond closure). Form 2E includes data from the internal monitoring point for sanitary wastewater effluent (DSN002A), pressure relief well effluent (anticipated to be used during ash pond closure activities) as well as data from the Plant's Fire Protection System Water. Form 2F describes both the current stormwater discharge points and anticipated future stormwater points needed to support the closure of the Barry ash pond.

APC would appreciate consideration of the following in the development of the renewed NPDES permit for this facility:

Compliance with Section 316(a) and 316(b) of the Clean Water Act

In accordance with 40 CFR 122.21(r)(1)(ii)(A), the information required under paragraphs (r)(2), (r)(3), and the applicable provisions of paragraph (r)(5) is enclosed with this application. APC requests that, in accordance with 40 CFR § 125.98(b)(6) and/or 40 CFR 125.95(a)(2), an alternate schedule for the submission of the information required by 40 CFR 122.21(r)(4), (r)(6), (r)(7), (r)(8), (r)(9), (r)(10), (r)(11), and (r)(12) be established in the NPDES permit to allow time for the compilation of this information.

Operational Changes for Environmental Compliance

Compliance with the ELGs

The enclosed updated permit application includes representative data and descriptions of the current configuration of the wastewater treatment systems and corresponding flows at Plant Barry, as well as the description of potential re-routing of wastewater streams that may eventually be necessary to comply with the ELGs.

The 2015 ELGs include an array of effluent limitations applicable to wastewater streams generated at steam electric power generating facilities. As originally promulgated, the ELGs require facilities to comply with certain effluent limitations, including the limitations associated with FGD wastewater, "as soon as possible beginning November 1, 2018, but no later than December 31, 2023." On August 11, 2017, the EPA Administrator issued a letter announcing his decision to conduct a rulemaking to potentially revise the new, more stringent Best Available Technology (BAT) effluent limitations standards in the 2015 rule that apply to bottom ash transport water (BATW) and flue gas desulfurization (FGD) wastewater. To allow adequate time for this reconsideration process, EPA also finalized a rule postponing the earliest compliance dates for the BAT effluent limitations for BATW and FGD wastewater in the 2015 Rule from November 1, 2018, to November 1, 2020. EPA's proposed reconsideration rulemaking for the 2015 ELG rule was published in the Federal Register on November 22, 2019, and EPA plans to issue a final rule sometime in 2020.

Internal monitoring point 004e is being requested for inclusion in this permit pursuant to the ELGs as an internal sampling point for FGD wastewater. It would be needed if the FGD wastewater limits from the ELGs are incorporated into the new permit to ensure the blowdown from the FGD treatment system meets the ELGs effluent limitations prior to mixing with other treated wastewater streams.

Due to the current uncertainties associated with the ELGs, APC specifically reserves its right to revise and/or supplement this permit application following resolution of EPA's latest administrative action, including any judicial appeal of same.

Compliance with the CCR rule

In accordance with the CCR rule, Plant Barry's ash pond underwent evaluations per the closure demonstrations. It was determined that the ash pond required closure. All existing wastewater streams were removed from the pond and pond closure began in early 2019.

Although the ash pond is undergoing closure, discharge point 002 will remain in use to allow for dewatering of the pond. An updated proposed dewatering plan for Plant Barry was submitted to ADEM on October 18, 2019. Following the completion of the closure project, discharge point 002 will continue to be used as the discharge point for effluent from a newly constructed low volume wastewater system designed to handle remaining wastewaters generated at the plant.

Miscellaneous

Plant Barry has a Best Management Practices (BMP) Plan that has been prepared in accordance with Part IV.B. of the NPDES permit. This plan is available for review upon your request.

If you have any additional questions, comments, or concerns, please contact Zach Ryals at (205) 257-3213.

Sincerely,

Mike Godfrey, Manager
Environmental Compliance

:ZTR

cc: Theo Pinson
Daphne Lutz
Scott Ramsey

Alabama Power

NPDES PERMIT APPLICATION
BARRY STEAM PLANT

AL-0002879

NOVEMBER 2019

COMPILED BY
ALABAMA POWER COMPANY
ENVIRONMENTAL AFFAIRS DEPARTMENT

Alabama Power Company NPDES Permit Application

The following documents are enclosed in this NPDES permit application:

- ADEM Form 187
- EPA Form 1
- EPA Form 2C
- EPA Form 2D
- EPA Form 2E
- EPA Form 2F
- Additional pertinent information

Supplementary information (i.e. describing any assumptions made when calculating average flows or detailing specific discharge points) can be found on the General Comments page immediately preceding each Form.

This permit application includes representative data and descriptions of the current configuration of the wastewater treatment systems and corresponding flows at Plant Barry, as well as the best currently available data and descriptions of anticipated treatment systems and respective flows that would exist at the facility following implementation of EPA's Effluent Limitations Guidelines for the Steam Electric Power Generating Point Source Category (ELG or ELGs) promulgated in 2015 and due to ash pond closure pursuant to federal and state regulations (Ala. Admin. Code r. 335-13-15; 40 C.F.R. § 257.101(a)(1)) (CCR Regulations).

Notably, on April 12, 2017, EPA announced its plan to reconsider the ELGs. On April 25, 2017, EPA published in the Federal Register notification of an indefinite stay of all ELG compliance dates that had not yet passed until such time that the pending judicial challenges to the rule were fully resolved and/or EPA's reconsideration of the rule was completed. On September 18, 2017, EPA published a final rule in the Federal Register postponing the earliest compliance dates for the new, more stringent, best available technology economically achievable ("BAT") effluent limitations and pretreatment standards for existing sources ("PSES") for flue gas desulfurization ("FGD") wastewater and bottom ash transport water ("BATW") in the 2015 Rule for a period of two years.

The agency took this 2017 interim action in light of the substantial investments required by the steam electric power industry to comply with the BAT limitations for BATW and FGD wastewaters, recognizing that certainty regarding the limitations and standards deserves prominent consideration by the Agency when these limitations and standards may change. EPA postponed this date to November 1, 2020, because, at the time, EPA projected it would take approximately three years to propose and finalize a new rule (Fall 2020).

Following up on these 2017 actions, EPA's Administrator signed the proposed "reconsideration rulemaking" on November 9, 2019, and it was published in the Federal Register on November 22, 2019. In this latest document, EPA proposes, among other things, to change the model technology (i.e., best available technology economically achievable) upon which the effluent limitations are formulated for FGD wastewater, extend the possible "no later than" date of the "as soon as possible" compliance timeframe for FGD wastewater until December 31, 2025, and also to add a "retirement exemption" that would allow an electric generating unit or units—in lieu of retrofitting for compliance with the new effluent limitations—to continue to operate without new treatment technologies if the owner certifies the unit or units will be retired by December 31, 2028. EPA still plans to issue a new final rule sometime in 2020.

Due to the uncertainty associated with the ultimate outcome of EPA's reconsideration of the 2015 ELGs, Alabama Power specifically reserves its right to revise and/or supplement this permit application following resolution of the pending judicial challenges to the ELGs and/or EPA's administrative action, including any judicial appeal of the same.

ADEM Form 187

General Comments – Form 187

Section C. Question 2b.

The highest monthly average flow from the ash pond over the last 12 months was taken from the monthly flows recorded between September 1, 2018 and August 31, 2019. A low volume wastewater treatment system (LVWW) was installed and commissioned in late 2018 to manage and treat plant wastewater once the ash pond was no longer a usable treatment pathway. This system was tested to develop adequate treatment strategies and brought online in early 2019 to coincide with the cessation of discharges to the ash pond. There is limited flow data (i.e. less than 12 months); therefore, the flow data provided is an estimated average flow expected once the system has been operating under full load for an extended period of time.

The monthly average of the highest flow year from the ash pond of the last 5 years was taken from the monthly flows recorded each year for the 5-year period beginning September 1, 2014 and August 31, 2019. The highest flow of the last 5 years provided for the LVWW represents the total capacity of the system, not actual flows. The LVWW system is designed with reserve capacity and is therefore expected to run at less than the total capacity. See the details provided for Section C. Question 5, below.

The ash pond dewatering estimated maximum flow is based on a preliminary engineering study. Ash pond closure activities began at Plant Barry in April 2019; dewatering will be necessary as a part of this process in the foreseeable future. See the details provided for Section C. Question 5, below.

The flow for Pressure Relief Wells (PRWs) was obtained from engineering assessments and is based on the estimated flow rate and number of wells that may be needed to achieve desired working conditions during ash pond closure. See Form 2C General Comments for more information.

Section C. Question 5.

The projects described below (both proposed and underway) have the potential to or will alter wastewater volumes and characteristics at Plant Barry in the coming years. These projects stem from EPA's 2015 ELGs, as well as the CCR Regulations.

As previously mentioned, on September 18, 2017, EPA published a final rule in the Federal Register postponing the earliest compliance dates for the new, more stringent, BAT effluent limitations and PSES for FGD wastewater and BATW in the 2015 Rule for a period of two years to allow the agency time to reconsider aspects of the rulemaking. EPA has now initiated a rulemaking to potentially revise the BAT effluent limitations and PSES for BATW and FGD wastewater. Despite these facts, APC has included in this permit application the discharge points it would eventually need to comply with the ELGs.

All wastewater streams have been removed from the ash pond pursuant to the CCR Regulations. Design and engineering to re-route existing wastewater streams was performed and as previously mentioned the LVWW system was constructed and brought online.

The 2015 ELGs established a no discharge requirement for BATW, with limited exceptions to this no discharge limitation: 1) for low volume, short duration discharges of wastewater from minor leaks (e.g., leaks from valve packing, pipe flanges, or piping) or minor maintenance events (e.g., replacement of valves or pipe sections) from the treatment system; and 2) if the wastewater is used as makeup water in the scrubber vessel. As a result of this requirement and the potential implications of the CCR Regulations, Plant Barry commenced design and engineering of a system to re-route the plant's existing wet bottom ash sluicing system from the ash pond to a closed-cycle system. APC will be requesting a compliance date beyond November 1, 2020, for the application of the BATW effluent limitations set out in the 2015 ELG Rule to Plant Barry because of EPA's anticipated reconsideration of these standards. This later applicability date will be requested: 1) to ensure the limitations included in the new final permit for Plant Barry are consistent with the standards set for the steam electric generating industry; and 2) because Plant Barry intends to maintain the compliance option to utilize BATW as makeup water in the scrubber vessel, meaning the applicability date for BATW compliance is tied to the applicability date for compliance with the FGD wastewater limitations.

The ELGs also set effluent limitations on the FGD wastewater stream. As previously mentioned, the earliest applicability date of the Rule for this wastewater stream has been postponed by two years for EPA to complete its ongoing reconsideration of the limitations and possibly revise other aspects of the rule. Due to the possibility of a rule revision, APC will therefore request a compliance date beyond November 1, 2020, for the application of the ELG's limitations for FGD wastewater at Plant Barry.

APC is submitting "future" water use diagrams with this permit application detailing the anticipated changes to the wastewater flow paths resulting from these projects.

Section D – Water Supply

The surface water intake volume is given as the maximum design withdrawal capacity of the intake system. This is the peak withdrawal rate permitted through Certificate of Use #61 by the Alabama Department of the Economic and Community Affairs (ADECA).

Section D – Cooling Water Intake Structure Information

The percentage of water used exclusively for cooling purposes over a 12-month period was calculated based on the amount of water withdrawn and discharged from May 1, 2017, to April 30, 2018.

The actual intake flow (AIF) as defined in 40 CFR 125.92(a) was calculated by averaging intake flows recorded in the 2016, 2017, and 2018 calendar years.

Section E – Waste Storage and Disposal Information

All used oil, oil contaminated solids, and hazardous wastes are handled, stored, and disposed of in accordance with ADEM regulations.

Used oils and oil contaminated solids generated by the plant are temporarily stored onsite in the designated storage areas. The storage containers provide secondary containment and are accounted for in the plant's Integrated Pollution Prevention (IPP) Plan. The plant has contracted with an offsite vendor for the ultimate disposal.
Used oil generated by the plant is disposed of through:

Aaron Oil Company
PO Box 2304
Mobile, AL 36652
(251) 479-1616

Oil-contaminated solid waste generated from Plant Barry is disposed of at either of the two landfills listed below:

Advanced Disposal
Turkey Trott Landfill
2328 Mannish Ryan Rd.
Citronelle, AL 36522

Section F – Coastal Zone Information

The question regarding the discharge being located within the 10-foot elevation contour and within the limits of Mobile or Baldwin County is checked "no" due to the ADEM regulations designating this portion of the Mobile River as "non-coastal".

Water Use Diagram

Refer to Form 2C Section II. Part B. 2b to obtain the average flow associated with each discharge point.

The water use diagram flows may not balance because some of the flows indicated on the water use diagram are based on the results of flow measurements at selected outfalls within the last three years and other flows were estimated based on pump capacities and pump logs. Due to varying operating conditions over the period of flow measurements, coupled with varying pump conditions, the water flows reported are estimates of representative discharge rates at selected points in time and will vary over time with varying plant operating conditions.

The Water Use Diagram only reflects plant wastewater flow paths and discharge points under current operating conditions. Future scenarios discussed in this application will be carried out, and revised Water Use Diagrams are being submitted to the agency via this updated application.

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (ADEM)
NPDES INDIVIDUAL PERMIT APPLICATION
SUPPLEMENTARY INFORMATION FOR INDUSTRIAL FACILITIES

Instructions: This form should be used to submit the required supplementary information for an application for an NPDES individual permit for industrial facilities. The completed application should be submitted to ADEM in duplicate. If insufficient space is available to address any item, please continue on an attached sheet of paper. Please mark "N/A" in the appropriate box when an item is not applicable to the applicant. **Please type or print legibly in blue or black ink.** Mail the completed application to:

ADEM-Water Division
Industrial Section
P O Box 301463
Montgomery, AL 36130-1463

PURPOSE OF THIS APPLICATION

- ☐ Initial Permit Application for New Facility*
- ☐ Initial Permit Application for Existing Facility*
- ☐ Modification of Existing Permit
- ☒ Reissuance of Existing Permit
- ☐ Revocation & Reissuance of Existing Permit

* *An application for participation in the ADEM's Electronic Environmental (E2) Reporting must be submitted to allow permittee to electronically submit reports as required.*

SECTION A – GENERAL INFORMATION

1. Facility Name: Alabama Power Company - Barry Steam Electric Plant

   a. Operator Name: ALABAMA POWER COMPANY

   b. Is the operator identified in A.1.a, the owner of the facility? ☒ Yes ☐ No
   If no, provide name and address of the operator and submit information indicating the operator's scope of responsibility for the facility.

2. NPDES Permit Number: AL 0 0 0 2 8 7 9 (not applicable if initial permit application)

3. SID Permit Number (if applicable): IU ___ - ___ - ___

4. NPDES General Permit Number (if applicable): ALG ___

5. Facility Physical Location: (**Attach a map with location marked; street, route no. or other specific identifier**)

   Street: 15300 Highway 43 North

   City: Bucks County: Mobile State: Alabama Zip: 36512

   Facility Location (Front Gate): Latitude: 31-01-06 Longitude: 88-01-33

6. Facility Mailing Address: P.O. Box 2641; BIN 12N-0830

   City: Birmingham County: Jefferson State: Alabama Zip: 35291

7. Responsible Official (as described on the last page of this application):

   Name and Title: Susan B. Comensky, Vice President - Environmental Affairs

   Address: P.O. Box 2641; BIN 12N-0830

   City: Birmingham State: Alabama Zip: 35291

   Phone Number: (205) 257-0298 Email Address: scomensk@southernco.com

8. Designated Facility Contact:

   Name and Title: John M. (Mike) Godfrey, Manager - Environmental Affairs

   Phone Number: (205) 257-6131 Email Address: jgodfrey@southernco.com

9. Designated Discharge Monitoring Report (DMR) Contact:

Name and Title: Zachary T. Ryals, Senior Engineer

Phone Number: (205) 257-3213 Email Address: ztryals@southernco.com

10. Type of Business Entity:

☒ Corporation ☐ General Partnership ☐ Limited Partnership ☐ Limited Liability Company ☐ Sole Proprietorship
☐ Other (Please Specify)__________

11. Complete this section if the Applicant's business entity is a Corporation

a) Location of Incorporation:

Address: 600 North 18th Street

City: Birmingham County: Jefferson State: Alabama Zip: 35203

b) Parent Corporation of Applicant:

Name: Southern Company

Address: 30 Ivan Allen Jr. Boulevard NW

City: Atlanta State: Georgia Zip: 30308

c) Subsidiary Corporation(s) of Applicant:

Name: See Attachment A

Address:

City: State: Zip:

d) Corporate Officers:

Name: See Attachment A

Address:

City: State: Zip:

Name:

Address:

City: State: Zip:

e) Agent designated by the corporation for purposes of service:

Name: Teresa G. Minor, Risk Services Director

Address: P.O. Box 2641

City: Birmingham State: Alabama Zip: 35291

12. If the Applicant's business entity is a Partnership, please list the general partners.

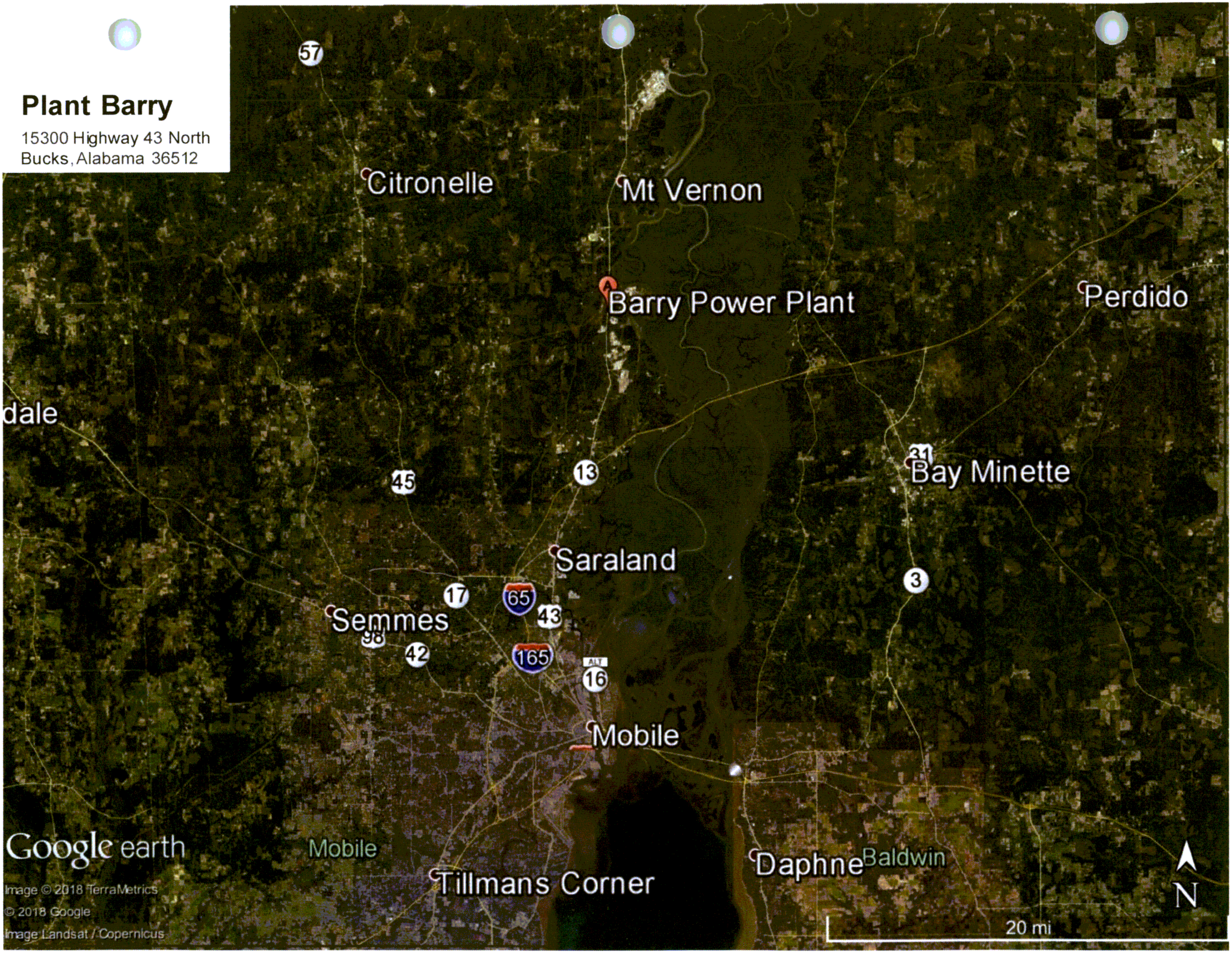
Name: Name:

Address: Address:

City: State: Zip: City: State: Zip:

Plant Barry

15300 Highway 43 North
Bucks, Alabama 36512



13. If the Applicant's business entity is a Proprietorship, please enter the proprietor's information.

Name: ____________________

Address: ____________________

City: ____________ State: ____________ Zip: ____________

14. Permit numbers for Applicant's previously issued NPDES Permits and identification of any other State of Alabama Environmental Permits presently held by the Applicant, its parent corporation, or subsidiary corporations within the State of Alabama:

Permit Name	Permit Number	Held By
See Attachment B		

15. Identify all Administrative Complaints, Notices of Violation, Directives, Administrative Orders, or Litigation concerning water pollution, if any, against the Applicant, its parent corporation or subsidiary corporations within the State of Alabama within the past five years (attach additional sheets if necessary):

Facility Name	Permit Number	Type of Action	Date of Action

SECTION B – BUSINESS ACTIVITY

1. Indicate applicable Standard Industrial Classification (SIC) Codes for all processes. If more than one applies, list in order of importance:

a. 4911 - Electric Services

b. ____________

c. ____________

d. ____________

e. ____________

f. ____________

2. If your facility conducts or will be conducting any of the processes listed below (regardless of whether they generate wastewater, waste sludge, or hazardous waste), place a check beside the category of business activity (check all that apply):

Industrial Categories

- ☐ Aluminum Forming
- ☐ Asbestos Manufacturing
- ☐ Battery Manufacturing
- ☐ Can Making
- ☐ Canned and Preserved Fruit and Vegetables
- ☐ Canned and Preserved Seafood
- ☐ Cement Manufacturing
- ☐ Centralized Waste Treatment
- ☐ Carbon Black
- ☐ Coal Mining
- ☐ Coil Coating
- ☐ Copper Forming
- ☐ Electric and Electronic Components Manufacturing
- ☐ Electroplating
- ☐ Explosives Manufacturing
- ☐ Feedlots
- ☐ Ferroalloy Manufacturing
- ☐ Fertilizer Manufacturing
- ☐ Foundries (Metal Molding and Casting)
- ☐ Glass Manufacturing
- ☐ Grain Mills
- ☐ Gum and Wood Chemicals Manufacturing
- ☐ Inorganic Chemicals
- ☐ Iron and Steel
- ☐ Leather Tanning and Finishing
- ☐ Metal Finishing
- ☐ Meat Products
- ☐ Metal Molding and Casting
- ☐ Metal Products
- ☐ Nonferrous Metals Forming
- ☐ Nonferrous Metals Manufacturing
- ☐ Oil and Gas Extraction
- ☐ Organic Chemicals Manufacturing
- ☐ Paint and Ink Formulating
- ☐ Paving and Roofing Manufacturing
- ☐ Pesticides Manufacturing
- ☐ Petroleum Refining
- ☐ Phosphate Manufacturing
- ☐ Photographic
- ☐ Pharmaceutical
- ☐ Plastic & Synthetic Materials
- ☐ Plastics Processing Manufacturing
- ☐ Porcelain Enamel
- ☐ Pulp, Paper, and Fiberboard Manufacturing
- ☐ Rubber
- ☐ Soap and Detergent Manufacturing
- ☒ Steam and Electric
- ☐ Sugar Processing
- ☐ Textile Mills
- ☐ Timber Products
- ☐ Transportation Equipment Cleaning
- ☐ Waste Combustion
- ☐ Other (specify)____________________

A facility with processes inclusive in these business areas may be covered by Environmental Protection (EPA) categorical standards. These facilities are termed "categorical users" and should skip to question 2 of Section C.

3. Give a brief description of all operations at this facility including primary products or services (attach additional sheets if necessary):

Alabama Power Company operates two (2) gas units, two (2) coal-fired units and two (2) combined cycle units (CCs) at Barry. These are designated as Units 1 & 2 (gas), 4 & 5 (coal-fired) and 6 & 7 (CC). The nameplate ratings of these units are 85 MW, 85 MW, 350MW, 770MW, 566MW, and 566MW, respectively. The gas and coal-fired units are cooled with once-through cooling and the CCs are cooled by closed-cycle cooling. Gypsum, from the Unit 5 scrubber, is stored in the gypsum storage pond.

SECTION C – WASTEWATER DISCHARGE INFORMATION

Facilities that checked activities in B.2 and are considered Categorical Industrial Users should skip to C.2 of this section.

1. **For Non-Categorical Users Only**: Provide wastewater flows for each of the processes or proposed processes. Using the process flow schematic (Figure 1), enter the description that corresponds to each process. **(The flow schematic should include all treatment units as well as monitoring and discharge points).** [New facilities should provide estimates for each discharge.]

Process Description	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow	Discharge Type (batch, continuous, intermittent)

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ____________ per day

b. Average discharge per batch: ____________ (GPD)

c. Time of batch discharges ____________ at ____________
(days of week) (hours of day)

d. Flow rate: ____________ gallons/minute

e. Percent of total discharge: ____________

Non-Process Discharges (e.g. non-contact cooling water)	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow

2. **Complete this Section only if you are subject to Categorical Standards and plan to directly discharge the associated wastewater to a water of the State.** If Categorical wastewater is discharged exclusively via an indirect discharge to a public or privately-owned treatment works, check "Yes" in the appropriate space below and proceed directly to part 2.c .

☐ Yes

For Categorical Users: Provide the wastewater discharge flows or production (whichever is applicable by the effluent guidelines) for each of your processes or proposed processes. Using the process flow schematic (Figure 1, pg 14), enter the description that corresponds to each process. [New facilities should provide estimates for each discharge.]

2a.

Regulated Process	Applicable Category	Applicable Subpart	Type of Discharge Flow (batch, continuous, intermittent)
Ash Pond Discharge	40 CFR 423	423.12	Intermittent
Pretreated Chemical Metal Cleaning WW	40 CFR 423	423.12	Intermittent
Low Volume Wastewater	40 CFR 423	423.12	Continuous

2b.

Process Description	Last 12 Months (gals/day), (lbs/day), etc. Highest Month Average*	Highest Flow Year of Last 5 (gals/day), (lbs/day), etc. Monthly Average*	Discharge Type (batch, continuous, intermittent)
Ash Pond Discharge	17,930,000 gals/day	29,800,000 gals/day	Intermittent
Pretreated Chemical Metal Cleaning WW	0	0	Intermittent
Low Volume Wastewater	8,540,000 gals/day	11,232,000 gals/day (design maximum)	Continuous

*** Reported values should be expressed in units of the applicable Federal production-based standard. For example, flow (MGD), production (pounds per day), etc.**

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ____________ per day

b. Average discharge per batch: ____________ (GPD)

c. Time of batch discharges ____________ at ____________
(days of week) (hours of day)

d. Flow rate: ____________ gallons/minute

e. Percent of total discharge: ____________

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ________________ per day

b. Average discharge per batch: ________________ (GPD)

c. Time of batch discharges ________________ at ________________
(days of week) (hours of day)

d. Flow rate: ________________ gallons/minute

e. Percent of total discharge: ________________

Non-Process Discharges (e.g. non-contact cooling water)	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow

2. **Complete this Section only if you are subject to Categorical Standards and plan to directly discharge the associated wastewater to a water of the State.** If Categorical wastewater is discharged exclusively via an indirect discharge to a public or privately-owned treatment works, check "Yes" in the appropriate space below and proceed directly to part 2.c .

☐ Yes

For Categorical Users: Provide the wastewater discharge flows or production (whichever is applicable by the effluent guidelines) for each of your processes or proposed processes. Using the process flow schematic (Figure 1, pg 14), enter the description that corresponds to each process. [New facilities should provide estimates for each discharge.]

2a.

Regulated Process	Applicable Category	Applicable Subpart	Type of Discharge Flow (batch, continuous, intermittent)
Cooling Tower Blowdown	40 CFR 423	423.12	Intermittent
Ash Pond Dewatering	40 CFR 423	423.12	Continuous
Landfill Leachate	40 CFR 423	423.12	Continuous

2b.

Process Description	Last 12 Months (gals/day), (lbs/day), etc. Highest Month Average*	Highest Flow Year of Last 5 (gals/day), (lbs/day), etc. Monthly Average*	Discharge Type (batch, continuous, intermittent)
Cooling Tower Blowdown	2,830,000 gals/day (calculated)		Intermittent
Ash Pond Dewatering	5,760,000 gals/day (estimated)		Continuous
Landfill Leachate	0 gals/day		Continuous

*** Reported values should be expressed in units of the applicable Federal production-based standard. For example, flow (MGD), production (pounds per day), etc.**

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ________________ per day

b. Average discharge per batch: ________________ (GPD)

c. Time of batch discharges ________________ at ________________
(days of week) (hours of day)

d. Flow rate: ________________ gallons/minute

e. Percent of total discharge: ________________

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ____________ per day

b. Average discharge per batch: ____________ (GPD)

c. Time of batch discharges ____________ (days of week) at ____________ (hours of day)

d. Flow rate: ____________ gallons/minute

e. Percent of total discharge: ____________

Non-Process Discharges (e.g. non-contact cooling water)	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow

2. **Complete this Section only if you are subject to Categorical Standards and plan to directly discharge the associated wastewater to a water of the State.** If Categorical wastewater is discharged exclusively via an indirect discharge to a public or privately-owned treatment works, check "Yes" in the appropriate space below and proceed directly to part 2.c .

☐ Yes

For Categorical Users: Provide the wastewater discharge flows or production (whichever is applicable by the effluent guidelines) for each of your processes or proposed processes. Using the process flow schematic (Figure 1, pg 14), enter the description that corresponds to each process. [New facilities should provide estimates for each discharge.]

2a.

Regulated Process	Applicable Category	Applicable Subpart	Type of Discharge Flow (batch, continuous, intermittent)
Coal Pile Runoff	40 CFR 423	423.12	Intermittent

2b.

Process Description	Last 12 Months (gals/day), (lbs/day), etc. Highest Month Average*	Highest Flow Year of Last 5 (gals/day), (lbs/day), etc. Monthly Average*	Discharge Type (batch, continuous, intermittent)
Coal Pile Runoff	900,000 gals/day (estimated)		Intermittent

*** Reported values should be expressed in units of the applicable Federal production-based standard. For example, flow (MGD), production (pounds per day), etc.**

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ____________ per day

b. Average discharge per batch: ____________ (GPD)

c. Time of batch discharges ____________ (days of week) at ____________ (hours of day)

d. Flow rate: ____________ gallons/minute

e. Percent of total discharge: ____________

2c.

Non categorical Process Description	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow	Discharge Type (batch, continuous, intermittent)

If batch discharge occurs or will occur, indicate: [new facilities may estimate.]

a. Number of batch discharges: ____________ per day

b. Average discharge per batch: ____________ (GPD)

c. Time of batch discharges ____________ (days of week) at ____________ (hours of day)

d. Flow rate: ____________ gallons/minute

e. Percent of total discharge: ____________

2d.

Non-Process Discharges (e.g. non-contact cooling water)	Last 12 Months (gals/day) Highest Month Avg. Flow	Highest Flow Year of Last 5 (gals/day) Monthly Avg. Flow
Once-Through Cooling Water (DSN001)	695,200,000 gals/day	1,013,000,000 gals/day
Sanitary Wastewater (DSN002A)	8,640 gals/day	
Pressure Relief Wells (groundwater)	8,640,000 gals/day (estimated)	

All Applicants must complete C.3 – C.6.

3. Do you share an outfall with another facility? ☐ Yes ☒ No (If no, continue to C.4)
For each shared outfall, provide the following:

Applicant's Outfall No.	**Name of Other Permittee/Facility**	**NPDES Permit No.**	**Where is sample collected by Applicant?**

4. Do you have, or plan to have, automatic sampling equipment or continuous wastewater flow metering equipment at this facility?

Current:	Flow Metering	☒ Yes	☐ No	☐ N/A
	Sampling Equipment	☐ Yes	☒ No	☐ N/A
Planned:	Flow Metering	☒ Yes	☐ No	☐ N/A
	Sampling Equipment	☐ Yes	☒ No	☐ N/A

If so, please attach a schematic diagram of the sewer system indicating the present or future location of this equipment and describe the equipment below:

____

5. Are any process changes or expansions planned during the next three years that could alter wastewater volumes or characteristics?
☒ Yes ☐ No (If no, continue to C.6)

Briefly describe these changes and their anticipated effects on the wastewater volume and characteristics:

Potential Process changes are described in the General Comments that precede this Form 187.

6. List the trade name and chemical composition of all biocides and corrosion inhibitors used:

Trade Name	Chemical Composition
See Attachment C	

For each biocide and/or corrosion inhibitor used, please include the following information:

(1) 96-hour median tolerance limit data for organisms representative of the biota of the waterway into which the discharge will ultimately reach,
(2) quantities to be used,
(3) frequencies of use,
(4) proposed discharge concentrations, and
(5) EPA registration number, if applicable

SECTION D – WATER SUPPLY

Water Sources (check as many as are applicable):

☐ Private Well
☒ Surface Water
☒ Municipal Water Utility (Specify City): MCB Water Authority, Mount Vernon
☐ Other (Specify): ______

IF MORE THAN ONE WELL OR SURFACE INTAKE, PROVIDE DATA FOR EACH ON AN ATTACHMENT

City: 0.075 MGD* Well: N/A MGD* Well Depth: N/A Ft. Latitude: N/A Longitude: N/A

Surface Intake Volume: 1137 MGD* Intake Elevation in Relation to Bottom: 0.0 Ft.

Intake Elevation: 18.0 Ft. Latitude: 31-00-24 Longitude: -88-00-41

Name of Surface Water Source: Mobile River

*** MGD – Million Gallons per Day**

Cooling Water Intake Structure Information

Complete D.1 and D.2 if your water supply is provided by an outside source and not by an onsite water intake structure? (e.g., another industry, municipality, etc…)

1. Does the provider of your source water operate a surface water intake? Yes ☐ No ☐
(If yes, continue, if no, go to Section E.)

a) Name of Provider: ______ b) Location of Provider: ______

c) Latitude: ______ Longitude: ______

2. Is the provider a public water system (defined as a system which provides water to the public for human consumption or which provides only treated water, not raw water)? ☐ Yes ☐ No (If yes, go to Section E, if no, continue.)

Only to be completed if you have a cooling water intake structure or the provider of your water supply uses an intake structure and does not treat the raw water.

3. Is any water withdrawn from the source water used for cooling? ☒ Yes ☐ No

4. Using the average monthly measurements over any 12-month period, approximately what percentage of water withdrawn is used exclusively for cooling purposes? 98 %

5. Does the cooling water consist of treated effluent that would otherwise be discharged? ☐ Yes ☒ No (See additional information attached in 316(b) Section.)
(If yes, go to Section E, if no, complete D.6 – D.17)

6. a. Is the cooling water used in a once-through cooling system? ☒ Yes ☐ No (See additional information attached.)

b. Is the cooling water used in a closed cycle cooling system? ☒ Yes ☐ No

7. When was the intake installed? Units 1 & 2 - 1954; Units 4 & 5 - 1969
(Please provide dates for all major construction/installation of intake components including screens)

8. What is the maximum intake volume? 1,137,000,000 gals/day
(maximum pumping capacity in gallons per day)

9. What is the average intake volume? 660,000,000 gals/day
(average intake pump rate in gallons per day average in any 30-day period)

10. What is the actual intake flow (AIF) as defined in 40 CFR §125.92(a)? 623 MGD

11. How is the intake operated? (e.g., continuously, intermittently, batch) Continuously

12. What is the mesh size of the screen on your intake? See additional information attached.

13. What is the intake screen flow-through area? Units 1 & 2: 562.77 ft^2 Units 4 & 5: 495.14 ft^2

14. What is the through-screen design intake flow velocity? 0.66 ft/sec for Units 1 & 2; and 2.09 ft/sec for Units 4 & 5

15. What is the through-screen actual velocity (in ft/sec)? 0.23 ft/sec for Units 1 & 2; and 1.63 ft/sec for Units 4 & 5

16. What is the mechanism for cleaning the screen? (e.g., does it rotate for cleaning) Rotating screen with spray wash.

17. Do you have any additional fish detraction technology on your intake? ☐ Yes ☒ No

18. Have there been any studies to determine the impact of the intake on aquatic organisms? ☒ Yes ☐ No (If yes, please provide.) Information for r(2), r(3), r(5) are provided with this application. All other studies are ongoing.

19. Attach a site map showing the location of the water intake in relation to the facility, shoreline, water depth, etc.

SECTION E – WASTE STORAGE AND DISPOSAL INFORMATION

Provide a description of the location of all sites involved in the storage of solids or liquids that could be accidentally discharged to a water of the state, either directly or indirectly via such avenues as storm water drainage, municipal wastewater systems, etc., which are located at the facility for which the NPDES application is being made. Where possible, the location should be noted on a map and included with this application:

Description of Waste	Description of Storage Location
Small amounts of used oil and lead-containing wastes may be	Storage of these wastes will be in accordance with
generated and stored onsite in approved areas for short	ADEM regulations.
periods of time.	

Provide a description of the location of the ultimate disposal sites of solid or liquid waste by-products (such as sludges) from any wastewater treatment system located at the facility.

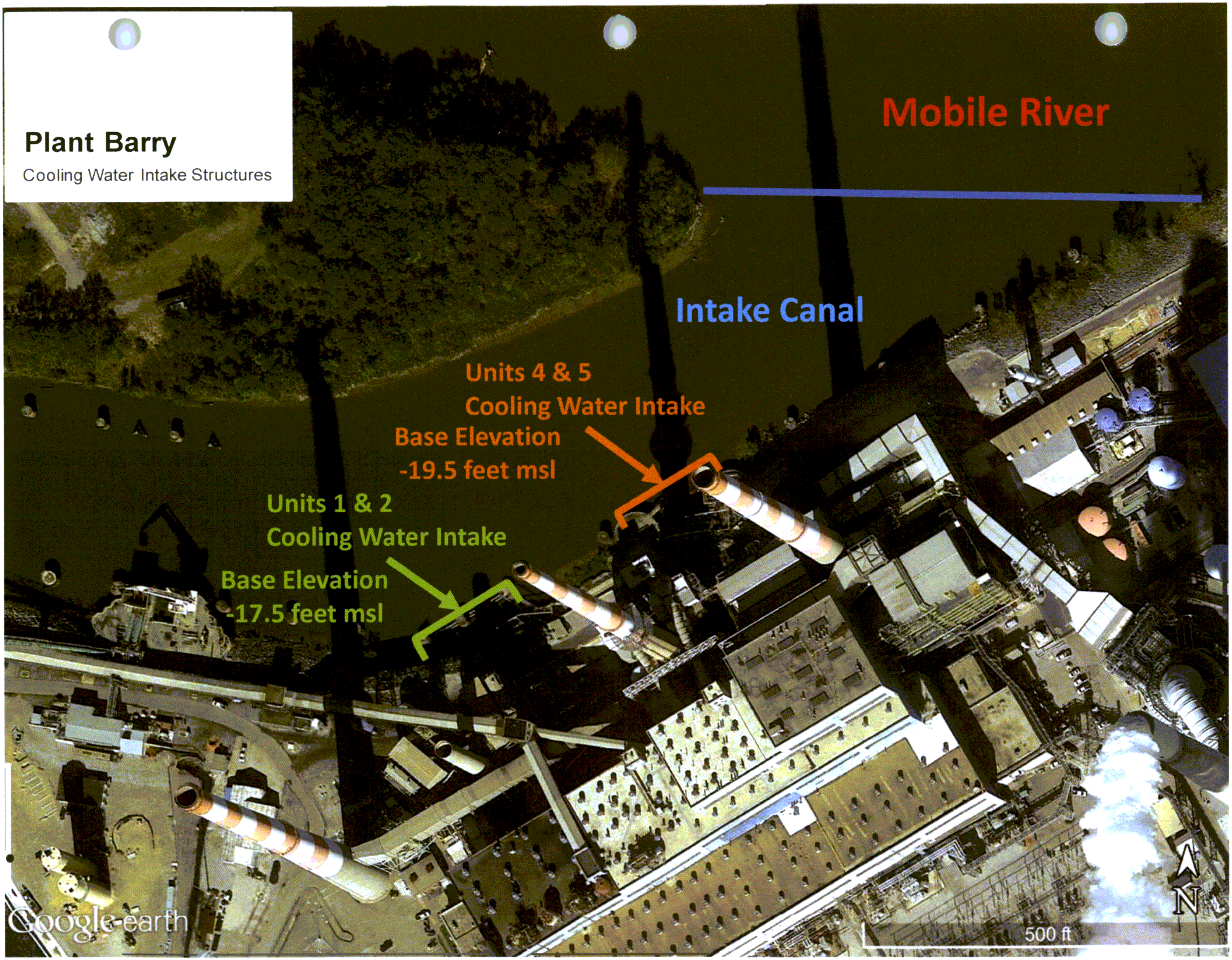
Description of Waste	Quantity (lbs/day)	Disposal Method*
Metal Cleaning Wastes	0	Pumped by contractor and hauled offsite.
Sanitary Wastes and Sludges from STP.	Varies	Hauled offsite by a contractor
Sludges from water treatment plant and cooling towers	Varies	Hauled offsite by a contractor

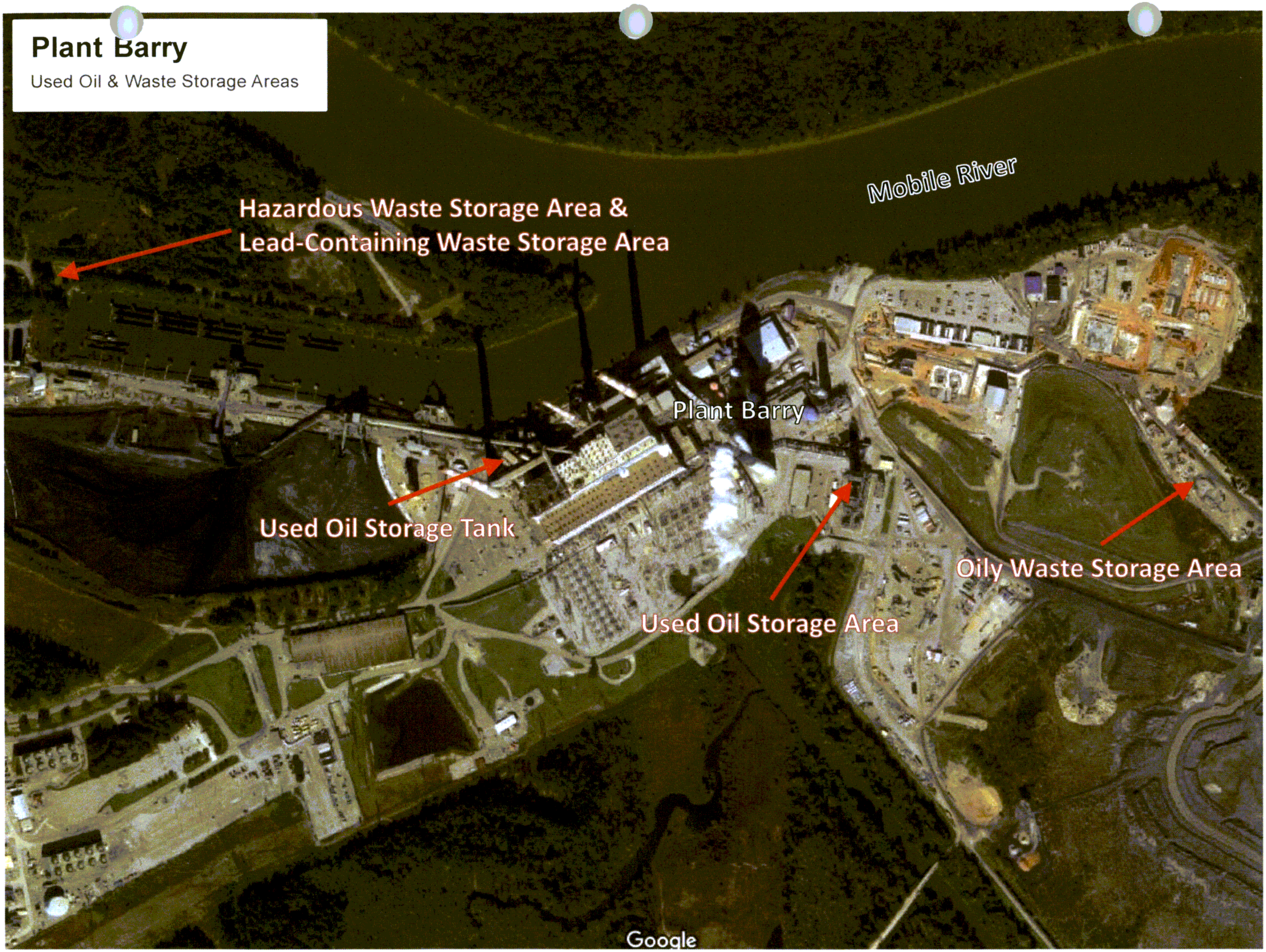
***Indicate which wastes identified above are disposed of at an off-site treatment facility and which are disposed of on-site. If any wastes are sent to an off-site centralized waste treatment facility, identify the waste and the facility.**

SECTION F – COASTAL ZONE INFORMATION

Is the discharge(s) located within the 10-foot elevation contour and within the limits of Mobile or Baldwin County? ☐ Yes ☒ No
If yes, complete items F.1 – F.12:

	Yes	No
1. Does the project require new construction?	☐	☐
2. Will the project be a source of new air emissions?	☐	☐


Plant Barry
Cooling Water Intake Structures
Mobile River
Intake Canal
Units 4 & 5
Cooling Water Intake
Base Elevation
-19.5 feet msl
Units 1 & 2
Cooling Water Intake
Base Elevation
-17.5 feet msl
Google earth
500 ft
N



Plant Barry
Used Oil & Waste Storage Areas
Mobile River
Hazardous Waste Storage Area &
Lead-Containing Waste Storage Area
Plant Barry
Used Oil Storage Tank
Oily Waste Storage Area
Used Oil Storage Area
Google

		Yes	No
3.	Does the project involve dredging and/or filling of a wetland area or water way?	☐	☐
	If Yes, has the Corps of Engineers (COE) permit been received?	☐	☐
	COE Project No. ____________________		
4.	Does the project involve wetlands and/or submersed grassbeds?	☐	☐
5.	Are oyster reefs located near the project site?	☐	☐
	If Yes, include a map showing project and discharge location with respect to oyster reefs		
6.	Does the project involve the site development, construction and operation of an energy facility as defined in ADEM Admin. Code r. 335-8-1-.02(bb)?	☐	☐
7.	Does the project involve mitigation of shoreline or coastal area erosion?	☐	☐
8.	Does the project involve construction on beaches or dune areas?	☐	☐
9.	Will the project interfere with public access to coastal waters?	☐	☐
10.	Does the project lie within the 100-year floodplain?	☐	☐
11.	Does the project involve the registration, sale, use, or application of pesticides?	☐	☐
12.	Does the project propose or require construction of a new well or to alter an existing groundwater well to pump more than 50 gallons per day (GPD)?	☐	☐
	If yes, has the applicable permit for groundwater recovery or for groundwater well installation been obtained?	☐	☐

SECTION G – ANTI-DEGRADATION EVALUATION

In accordance with 40 CFR §131.12 and the ADEM Admin. Code r. 335-6-10-.04 for anti-degradation, the following information must be provided, if applicable. It is the applicant's responsibility to demonstrate the social and economic importance of the proposed activity. If further information is required to make this demonstration, attach additional sheets to the application.

1. Is this a new or increased discharge that began after April 3, 1991? ☐ Yes ☒ No
   If yes, complete G.2 below. If no, go to Section H.

2. Has an Anti-Degradation Analysis been previously conducted and submitted to the Department for the new or increased discharge referenced in G.1? ☒ Yes ☐ No

   If yes, do not complete this section. If no, and the discharge is to a Tier II waterbody as defined in ADEM Admin. Code r. 335-6-10-.12(4), complete G.2.A – G.2.F below and ADEM Forms 311 and 313 (attached). ADEM Form 313 must be provided for each alternative considered technically viable.

   Information required for new or increased discharges to high quality waters:

   A. What environmental or public health problem will the discharger be correcting?

   ____

   B. How much will the discharger be increasing employment (at its existing facility or as the result of locating a new facility)?

   ____

   C. How much reduction in employment will the discharger be avoiding?

   ____

   D. How much additional state or local taxes will the discharger be paying?

   ____

   E. What public service to the community will the discharger be providing?

   ____

   F. What economic or social benefit will the discharger be providing to the community?

   ____

SECTION H – EPA Application Forms

All Applicants must submit EPA permit application forms. More than one application form may be required from a facility depending on the number and types of discharges or outfalls found. The EPA application forms are found on the Department's website at http://www.adem.alabama.gov/programs/water/waterforms.cnt . The EPA application forms must be submitted in duplicate as follows:

1. All applicants must submit Form 1.
2. Applicants for existing industrial facilities (including manufacturing facilities, commercial facilities, mining activities, and silvicultural activities) which discharge process wastewater must submit Form 2C.
3. Applicants for new industrial facilities which propose to discharge process wastewater must submit Form 2D.
4. Applicants for new and existing industrial facilities which discharge only non-process wastewater (i.e., non-contact cooling water and/or sanitary wastewater) must submit Form 2E.
5. Applicants for new and existing facilities whose discharge is composed entirely of storm water associated with industrial activity must submit Form 2F, unless exempted by § 122.26(c)(1)(ii). If the discharge is composed of storm water and non-storm water, the applicant must also submit Forms 2C, 2D, and/or 2E, as appropriate (in addition to Form 2F).

SECTION I – ENGINEERING REPORT/BMP PLAN REQUIREMENTS

See ADEM 335-6-6-.08(i) & (j)

SECTION J– RECEIVING WATERS

Outfall No.	Receiving Water(s)	303(d) Segment?		Included in TMDL?*	
001, 002, 003,	Mobile River	☒ Yes	☐ No	☐ Yes	☒ No
004, 010, 011,		☐ Yes	☐ No	☐ Yes	☐ No
012, 013, 019,		☐ Yes	☐ No	☐ Yes	☐ No
020, 021, 022		☐ Yes	☐ No	☐ Yes	☐ No
		☐ Yes	☐ No	☐ Yes	☐ No

*If a TMDL Compliance Schedule is requested, the following should be attached as supporting documentation:

(1) Justification for the requested Compliance Schedule (e.g. time for design and installation of control equipment, etc.);

(2) Monitoring results for the pollutant(s) of concern which have not previously been submitted to the Department (sample collection dates, analytical results (mass and concentration), methods utilized, MDL/ML, etc. should be submitted as available);

(3) Requested interim limitations, if applicable;

(4) Date of final compliance with the TMDL limitations; and,

(5) Any other additional information available to support requested compliance schedule.

SECTION K – APPLICATION CERTIFICATION

The information contained in this form must be certified by a responsible official as defined in ADEM Administrative Code r. 335-6-6-.09 "signatories to permit applications and reports" (see below).

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Signature of Responsible Official: Susan Comensky Date Signed: 1/8/2020

Name and Title: Susan B. Comensky, Vice President of Environmental Affairs

If the Responsible Official signing this application is not identified in Section A.7, provide the following information:

Mailing Address: 600 N 18th Street; Bin 12N-0830

City: Birmingham State: AL Zip: 35291

Phone Number: (205) 257-0298 Email Address: scomensk@southernco.com

335-6-6-.09 SIGNATORIES TO PERMIT APPLICATIONS AND REPORTS.

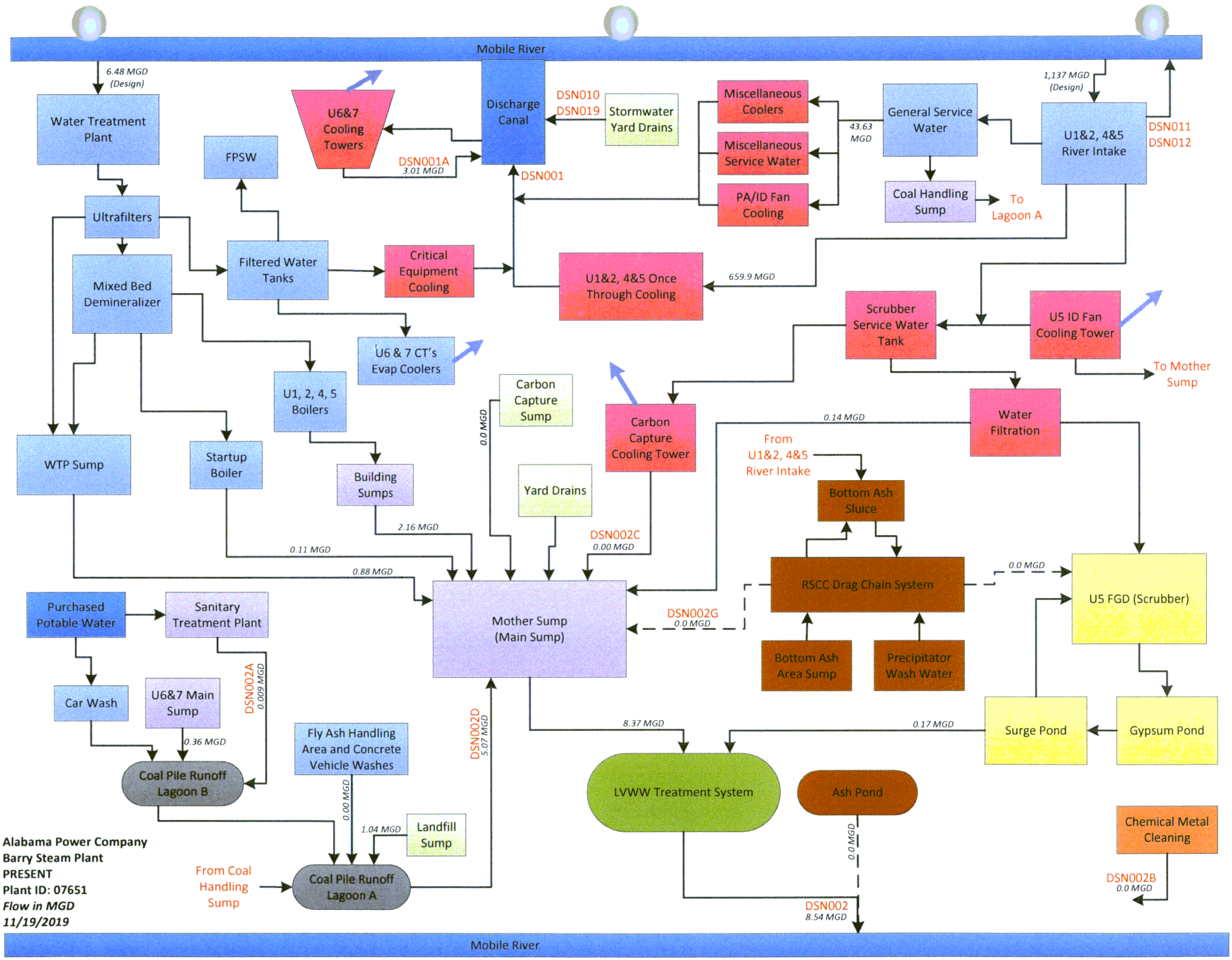
(1) The application for an NPDES permit shall be signed by a responsible official, as indicated below:

(a) In the case of a corporation, by a principal executive officer of at least the level of vice president, or a manager assigned or delegated in accordance with corporate procedures, with such delegation submitted in writing if required by the Department, who is responsible for manufacturing, production, or operating facilities and is authorized to make management decisions which govern the operation of the regulated facility;

(b) In the case of a partnership, by a general partner;

(c) In the case of a sole proprietorship, by the proprietor; or

(d) In the case of a municipal, state, federal, or other public entity, by either a principal executive officer, or ranking elected official.


Mobile River
6.48 MGD (Design)
Water Treatment Plant
Ultrafilters
Mixed Bed Demineralizer
WTP Sump
FPSW
Filtered Water Tanks
U6&7 Cooling Towers
DSN001A 3.01 MGD
Discharge Canal
DSN001
DSN010
DSN019
Stormwater Yard Drains
Miscellaneous Coolers
Miscellaneous Service Water
PA/ID Fan Cooling
43.63 MGD
General Service Water
Coal Handling Sump
To Lagoon A
1,137 MGD (Design)
U1&2, 4&5 River Intake
DSN011
DSN012
Critical Equipment Cooling
U1&2, 4&5 Once Through Cooling
659.9 MGD
U6 & 7 CT's Evap Coolers
U1, 2, 4, 5 Boilers
Startup Boiler
Building Sumps
Scrubber Service Water Tank
U5 ID Fan Cooling Tower
To Mother Sump
Carbon Capture Sump
0.0 MGD
Carbon Capture Cooling Tower
Yard Drains
Water Filtration
0.14 MGD
From U1&2, 4&5 River Intake
Bottom Ash Sluice
2.16 MGD
0.11 MGD
0.88 MGD
DSN002C 0.00 MGD
RSCC Drag Chain System
0.0 MGD
U5 FGD (Scrubber)
Purchased Potable Water
Sanitary Treatment Plant
Mother Sump (Main Sump)
DSN002G 0.0 MGD
Bottom Ash Area Sump
Precipitator Wash Water
Car Wash
U6&7 Main Sump
DSN002A 0.009 MGD
0.36 MGD
Coal Pile Runoff Lagoon B
Fly Ash Handling Area and Concrete Vehicle Washes
0.00 MGD
DSN002D 5.07 MGD
8.37 MGD
0.17 MGD
Surge Pond
Gypsum Pond
LVWW Treatment System
Ash Pond
0.0 MGD
Chemical Metal Cleaning
DSN002B 0.0 MGD
1.04 MGD
Landfill Sump
From Coal Handling Sump
Coal Pile Runoff Lagoon A
DSN002 8.54 MGD
Alabama Power Company
Barry Steam Plant
PRESENT
Plant ID: 07651
Flow in MGD
11/19/2019

EPA Form 1

Please print or type in the unshaded areas only. Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL — EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
GENERAL INFORMATION
Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S		T/A	C
F	ALD082148800		D
1	2 13	14	15

LABEL ITEMS	
I. EPA I.D. NUMBER	PLEASE PLACE LABEL IN THIS SPACE
III. FACILITY NAME	
V. FACILITY MAILING ADDRESS	
VI. FACILITY LOCATION	

GENERAL INSTRUCTIONS
If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)	16	X 17	18
B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)	19	X 20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X 22	23	X 24
D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)	X 25	26	X 27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	28	X 29	30
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)	31	X 32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	34	X 35	36
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	37	X 38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	40	X 41	42
J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)	43	X 44	45

III. NAME OF FACILITY

C	SKIP	
1		Alabama Power Company - Barry Steam Plant
15	16 - 29	30 69

IV. FACILITY CONTACT

C	A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2	Godfrey, Mike, Environmental Affairs Manager	(205) 257-6131
15	16 45	46 48 49 51 52- 55

V. FACILTY MAILING ADDRESS

C	A. STREET OR P.O. BOX
3	P.O. Box 2641; BIN 12N-0830
15	16 45

C	B. CITY OR TOWN	C. STATE	D. ZIP CODE
4	Birmingham	AL	35291
15	16 40	41 42	47 51

VI. FACILITY LOCATION

C	A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER
5	15300 US Highway 43 N
15	16 45

B. COUNTY NAME
Mobile
46 70

C	C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6	Bucks	AL	36512	
15	16 40	41 42	47 51	52 -54

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

	A. FIRST		B. SECOND
7 4911	*(specify)* Electric Power Services	7	*(specify)*

	C. THIRD		D. FOURTH
7	*(specify)*	7	*(specify)*

VIII. OPERATOR INFORMATION

A. NAME	B. Is the name listed in Item VIII-A also the owner?
8 ALABAMA POWER COMPANY	☒ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box: if "Other," specify.)*			D. PHONE *(area code & no.)*
F = FEDERAL S = STATE P = PRIVATE M = PUBLIC *(other than federal or state)* O = OTHER *(specify)*	P	*(specify)*	A (205) 257-3213

E. STREET OR P.O. BOX
P.O. Box 2641; BIN 12N-0830

F. CITY OR TOWN	G. STATE	H. ZIP CODE	IX. INDIAN LAND
B Birmingham	AL	35291	Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	D. PSD *(Air Emissions from Proposed Sources)*	
9 N SEE ATTACHMENT B	9 P SEE ATTACHMENT B	
B. UIC *(Underground Injection of Fluids)*	**E. OTHER** *(specify)*	
9 U SEE ATTACHMENT B	9 SEE ATTACHMENT B	*(specify)* WATER SUPPLY PERMITS
C. RCRA *(Hazardous Wastes)*	**E. OTHER** *(specify)*	
9 R N/A	9 SEE ATTACHMENT B	*(specify)* LANDFILL PERMITS

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

GENERATION OF ELECTRICITY

XIII. CERTIFICATION *(see instructions)*

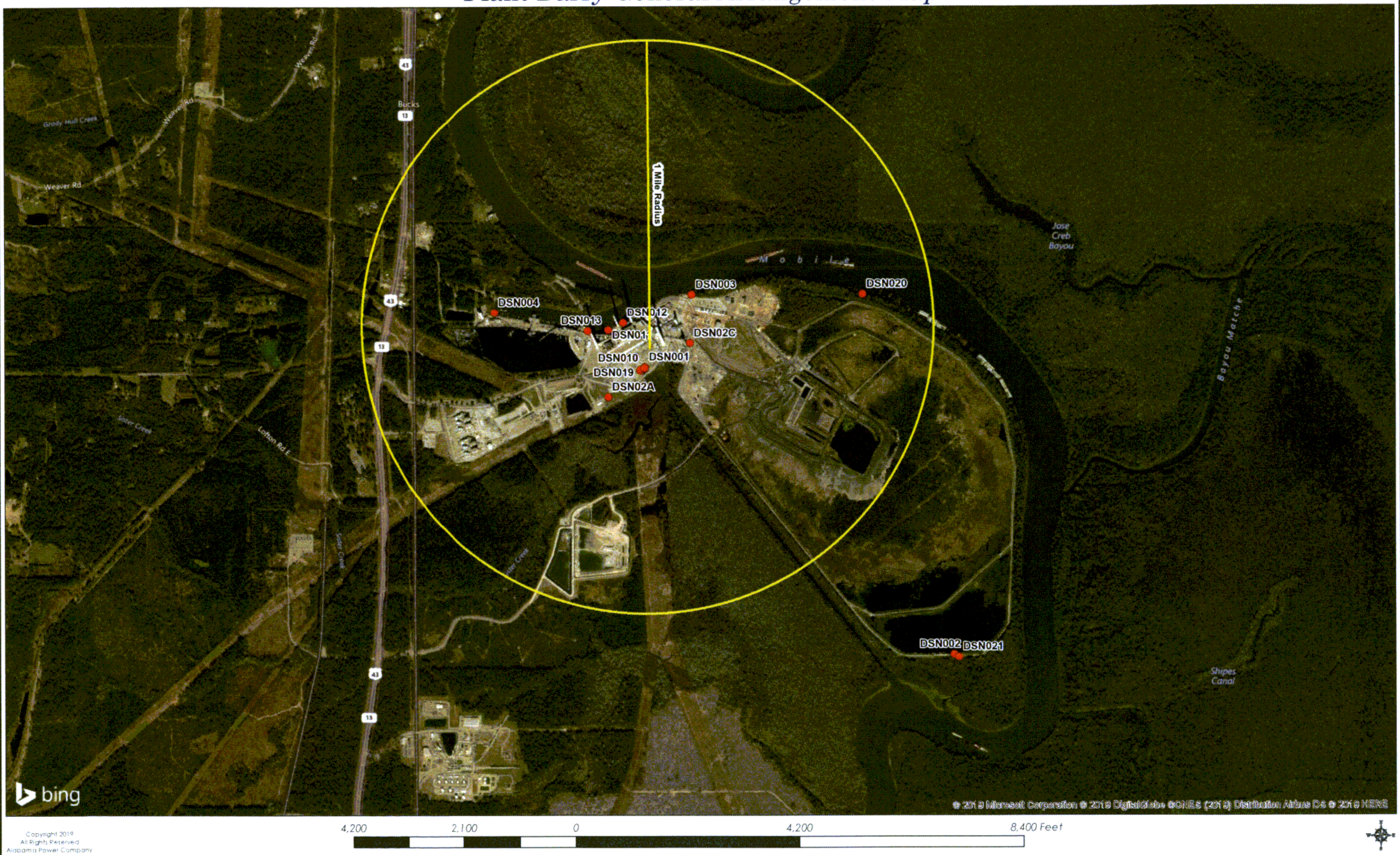
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
Susan B. Comensky VP - Environmental Affairs	Susan Comensky	1/8/2020

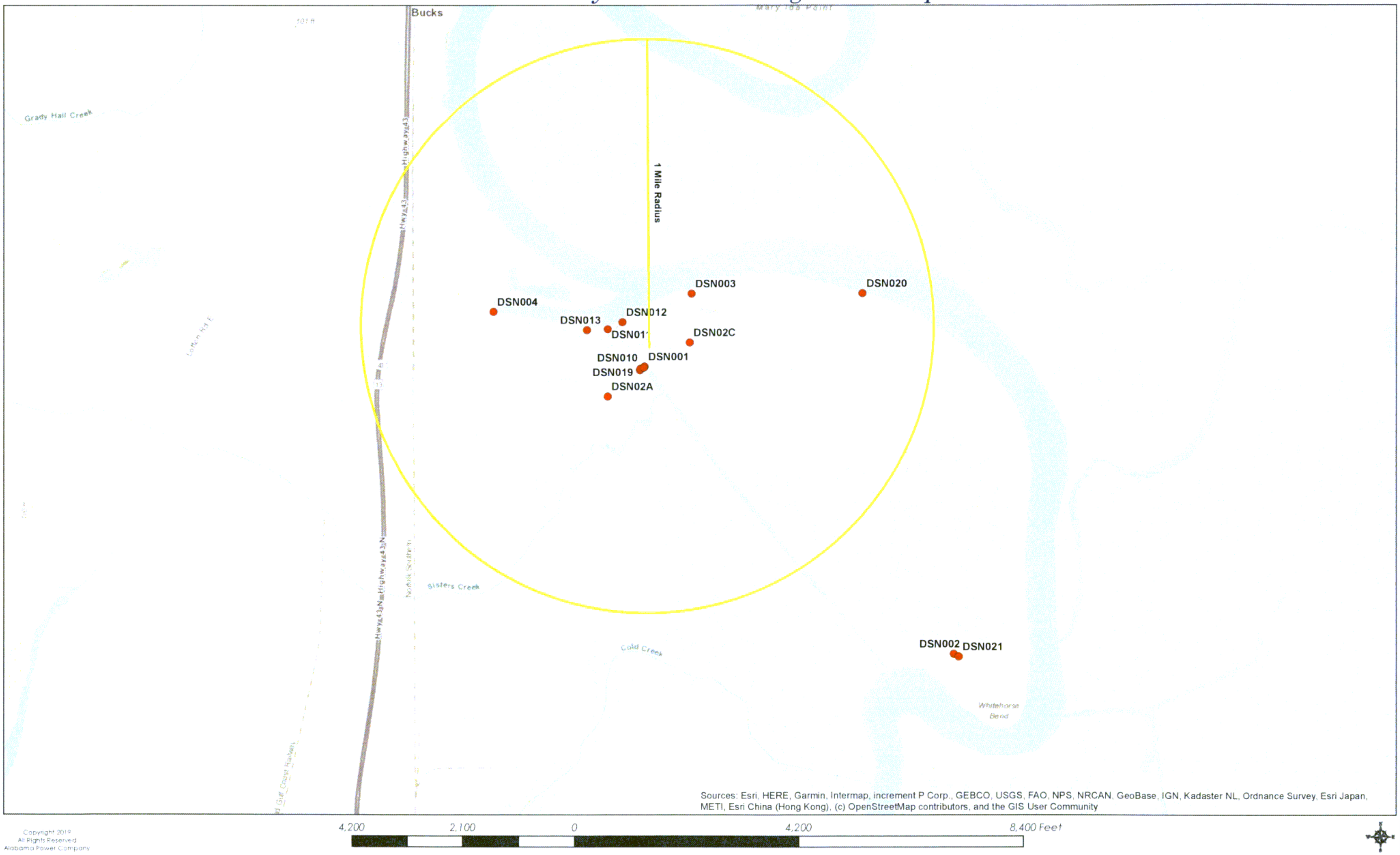
COMMENTS FOR OFFICIAL USE ONLY

C

Plant Barry General Arrangement Map



Plant Barry General Arrangement Map



EPA Form 2C

RECEIVED
NOV 25 2019
IND/MUN BRANCH

General Comments – Form 2C

All existing process wastewater discharge points to be included in this NPDES permit have been provided in Form 2C. Specific details regarding each outfall are included in the following information, including references to the current requirements of the ELGs, even though the fate of certain effluent limitations promulgated as a part of the rulemaking are being revisited by EPA.

For DMR reporting purposes, APC requests the existing discharge points retain their current discharge number designation and the new discharge points be assigned sequential numbering where possible.

Section II. Part A.

Refer to Form 2C. Section II. Part B. 2b. for the flow associated with each discharge point.

Section II. Part B. 1

001 Once-Through Cooling Water

This point should continue in the new permit. Once-through cooling water for units 1, 2, 4, & 5 discharges through this outfall into the discharge canal. We are requesting a continuation of the existing 316(a) thermal variance, in accordance with 40 CFR Part 125, Subpart H and with Section 122.21(m)(6), based on the following: 1) Unit 3 has been removed from service and demolished, resulting in a reduced cooling water intake flow rate; otherwise, Plant operating design conditions and associated thermal discharges have not changed and are expected to remain the same for the duration of the permit; 2) there have been no changes to this facility's discharges which would prevent this thermal variance from not being protective of the fish and wildlife population; and 3) we are not aware of any changes to the biotic community at our facility which would impact the previous 316(a) determination. See 316(a) tab for details.

001A - Cooling Tower Blowdown

This point should continue in the new permit. The cooling tower blowdown from the Units 6 & 7 cooling towers discharges through this outfall into the discharge canal.

002 – Final Discharge

Effluent from this discharge point is treated plant process wastewater, including ash transport water, low-volume wastewater, miscellaneous cooling water, cooling tower blowdown, coal pile runoff, treated sanitary wastewater, FGD wastewater, vehicle rinse water, some stormwater streams from the plant as well as ash pond dewatering, PRW effluent, and landfill leachate in the future. This wastewater stream was analyzed according to the Form 2C requirements. In April 2019, pursuant to the CCR Regulations, all wastewater flows to the ash pond were ceased; therefore, the ash pond now only flows intermittently due to rainfall.

The Dry Fly Ash Conversion project was completed at the plant. All fly ash in now being handled through this dry system. Bottom ash transport water (BATW) was also previously routed to the ash pond;

however, prior to ceasing flow to the ash pond, a remote submerged chain conveyor (RSCC) system was constructed to handle BATW from Units 4 & 5. This system now handles all BATW flows, except as described in the RSCC Overflow (002G) description below.

Ash Pond Dewatering

This point will be used to dewater the ash pond to facilitate closure pursuant to the CCR Regulations. A mechanical treatment system will be utilized to ensure appropriate treatment of the wastewater in the ash pond prior to discharge. The effluent from the ash pond dewatering system will be combined with the treated effluent from the LVWW prior to discharging through 002.

Following ash pond closure, the 002 location will continue to be used as the discharge point for stormwater effluent from the closed and capped ash pond (this discharge point will become stormwater outfall 021 once ash pond closure is complete; see Form 2F for more details).

Pressure Relief Well Effluent (Form 2E)

Pressure relief wells (PRWs) are being evaluated as part of the ash pond closure process. If utilized, the PRWs will be installed around the edge of the ash pond dike at varying screen intervals and pumped at varying rates/frequencies while ash excavation and consolidation are occurring. The purpose of the PRWs is to reduce the fluctuation of groundwater elevations that result from changes in river elevation throughout the year. This will provide more consistent subsurface pressures and favorable working conditions during ash pond closure. This discharge will consist of only groundwater and will be routed through a separate treatment system, the effluent of which will be routed to the ash pond discharge structure at 002. Following ash pond closure, this discharge will no longer be needed. An EPA Form 2E has been prepared for this proposed discharge point (See Form 2E General Comments included with this application).

002A – Treated Sanitary Wastewater (Form 2E)

This is an internal monitoring point for treated sanitary wastewater. This waste stream was previously discharged to the ash pond but has now been routed to the LVWW which discharges through 002. An EPA Form 2E has been prepared for this effluent stream (See General Comments – 2E included with this application).

002B – Pre-treated Chemical Metal Cleaning Wastes

This is an internal monitoring point for pre-treated chemical metal cleaning wastes. Chemical metal cleaning wastes are generated only on a periodic basis; therefore, limits associated with this waste should be conditional. Given that Plant Barry has not recently generated any chemical metal cleaning waste, this wastewater stream was not available for sample collection and analysis. Should Plant Barry generate chemical metal cleaning waste, it will be collected on-site and either disposed of through an approved vendor or treated to ELG limitations prior to being routed to the LVWW for final discharge through 002.

002C – Cooling Tower Blowdown from Carbon Capture Process

The carbon capture process is currently not in service at Plant Barry. In the event the system is again operational, cooling tower blowdown will discharge from this internal monitoring point to the LVWW for discharge through 002.

002D – Coal Pile Runoff (see Form 2D)

Current:

This is an internal monitoring point of the effluent from the coal pile runoff ponds (Lagoons A & B) which is routed to the LVWW and then to the river through 002.

Future:

Upon construction of a new outfall (designated as Outfall 004 in Form 2D comments), the effluent from the coal pile runoff ponds will be re-routed to a new discharge point in the barge canal. An EPA Form 2D has been prepared for this proposed discharge point (See General Comments – 2D included with this application for more details).

002E – FGD Wastewater (see Form 2D)

This point currently does not exist but would be needed in the future as an internal sampling point to ensure the effluent from the FGD system meets the ELG limitations prior to mixing with other treated wastewater streams for discharge.

002F – Closed Ash Pond Leachate (see Form 2D)

APC is requesting the inclusion of this point in the NPDES permit in the event leachate collection and treatment from the capped and closed ash pond is needed in the future.

This proposed discharge point does not currently exist and has not been located; therefore, the location and latitude/longitude are not shown in this application. Additionally, APC has not currently determined the type, size, treatment capabilities, or discharge configuration of the treatment system that will be needed to treat leachate. APC is uncertain if this point will be needed as a primary outfall or potentially as an internal monitoring point. More information and the potential water flow diagram are provided in EPA Form 2D.

002G – RSCC Overflow

This is an internal monitoring point for wastewater flows from the RSCC system.

Current:

Flows from the RSCC system to the LVWW are very low in volume and are rare, only occurring during system optimization and other infrequent maintenance activities. These discharges will continue until the ELG BATW BAT limitations are applicable to the facility. This wastewater is routed to the LVWW system and discharged through 002.

Future:

This outfall will be needed as an internal sampling point for low volume, short duration discharges of wastewater from minor leaks (e.g. leaks from valve packing, pipe flanges, or piping) or minor maintenance events (e.g., replacement of valves or pipe sections) originating from the RSCC system. These flows constitute low volume wastewater, according to the 2015 ELGs materials. This wastewater would be routed to the LVWW which discharges through 002.

011 – Intake Screen Backwash for Units 1 & 2

There are no pollutants added to this discharge stream. The effluent discharged from this point consists of uncontaminated river water that is used to remove debris from the travelling intake screens located at the river intake.

012 – Intake Screen Backwash for Units 4 & 5

There are no pollutants added to this discharge stream. The effluent discharged from this point consists of uncontaminated river water that is used to remove debris from the travelling intake screens located at the river intake.

022 –Ash Pond Closure Emergency Overflow Spillway

This overflow does not currently exist but is planned as part of the ash pond closure activities. Discharge from this point would only occur during an upset condition in which stormwater caused the ash pond to overflow. Prior to complete ash pond closure, the effluent from this point would be treated ash pond water, and similar to the effluent from outfall 002.

After closure, this outfall may be removed from service; however, if the outfall remains in service, the effluent from this outfall will consist of only stormwater and will be similar to discharge from the planned stormwater outfall 021 (see Form 2F).

Fire Protection System Water

The source of water for the Fire Protection System Water (FPSW) is, raw river water from Mobile River that is filtered and chlorinated. The system is periodically tested in accordance with Federal and State regulations. As such, there is a potential for FPSW to be discharged from any of the permitted Plant Barry NPDES discharge points.

Section II. Part B. 2b.

Due to the fluctuating demand for electricity and the ability to operate various combinations of the generating units at the plant, the discharge flows associated with electrical generation vary greatly. For this reason, the average flows (i.e. excluding stormwater flows) listed in this section were calculated from actual values reported at NPDES discharge locations (other than no flow or no discharge values) for the time period between September 1, 2017, and April 30, 2018, with the exception of the LVWW flow, which is an estimated average.

Section IV.

1. Identification of Condition, Agreement, etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	a. No.	b. Source of Discharge		a. Required	b. Projected
APC is closing the ash pond wastewater treatment system. ADEM Administrative Order No. 18-094-GW relates to this issue.	DSN002	Ash pond discharge, including sanitary wastewater, pretreated metal cleaning wastes, low volume wastes, and coal pile runoff.	The ash pond wastewater treatment system will be closed, and a new wastewater treatment system designed to treat remaining wastewater flows has been constructed.	N/A	The new wastewater treatment system designed to treat remaining wastewater flows has been operational since March 2019. The current estimate for completion of closure of the ash pond at Plant Barry is May 2031. However, this date is only an estimate and is subject to change for several reasons: - The date of completion is dependent on factors beyond APC's direct control, including levels of precipitation during the closure process, construction scheduling, and construction contingencies. - Dewatering the ash pond is subject to ADEM review and approval, which remains outstanding. - Closure of the ash pond is subject to ADEM permitting, and the permit application is pending.

Section V.

The format used for data reporting is similar to previously submitted APC NPDES permits. Since continuous flow monitors were not used, the calculations were not "weighted by flow" and are reported as straight averages.

"Less than" (<) values result when the detectable concentration of a sample is less than the reporting limit of the sufficiently sensitive test method used to analyze the sample. "Less than" data in this report will be computed as follows:

To calculate a mean when a "less than" value appears in the data, for all parameters except flow, the resultant of below detection was changed to a zero and added to other data and used to calculate the average value.

All long-term average data and minimum and maximum pH values were acquired from NPDES permit compliance samples collected between September 1, 2018 and August 31, 2019. The maximum value for each parameter was acquired from either the repermitting sampling (performed in February 2018) or the aforementioned compliance sampling data set, whichever was higher.

Section V. Part B

Per correspondence with ADEM, Escherichia Coli (E. Coli) was sampled in place of Fecal Coliform. Fecal Coliform should be removed from the form and replaced with E. Coli.

Radioactivity was not sampled as part of this application as it is believed absent, except for naturally occurring radioactive material.

Section V. Part C

Dioxin was not sampled as part of this application because this site does not use or manufacture one of the following compounds:

- 2, 4, 5-trichlorophenoxy acetic acid, (2, 4, 5-T);
- 2-(2, 4, 5-trichlorophenoxy) propanoic acid, (Silvex, 2, 4, 5-TP);
- 2-(2, 4, 5-trichlorophenoxy) ethyl 2, 2-dichloropropionate, (Erbon);
- 0, 0-dimethyl 0-(2, 4, 5-trichlorophenyl) phosphorothioate, (Ronnel);
- 2, 4, 5-trichlorophenol, (TCP); or
- Hexachlorophene, (HCP)

Per the list of toxic pollutants listed on 40 CFR 122, Appendix D, Table II, the list of volatiles which require sampling have been reduced and no longer includes 4V. Bis (*Chloromethyl*) Ether, 13V. Dichlorodifluoromethane, and 30V. Trichlorodifluoromethane. An "n/a" has been shown on the form next to these volatiles.

Per the requirements of 40 CFR 122, Appendix D, Table I and Note 1: c. 5, the testing of GC/MS Pesticide Fractions and GC/MS Base/Neutral Fractions in Once through Cooling Water, Fly Ash and Bottom Ash Transport Water has been suspended from the steam electric power generating industry category.

Per the requirements of 40 CFR 122, Appendix D, Table I, the testing requirements of GC/MS Pesticide Fractions has been suspended from the steam electric power generating industry category. For each discharge point, an “n/a” has been shown on the form next to the corresponding pollutants to indicate the suspension of the testing requirements.

The Certificate of Analysis, which contains the analytical results of both the grab and composite samples, are attached following the data provided for each discharge point presented in Part V.

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM **2C** NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	31	00	24	88	00	41	Mobile River
002	31	00	24	88	00	41	Mobile River

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Once-through cooling	659.9 MGD	Discharge to Surface Waters	4-A	
	water (U1&2,U4&5) and				
	Fire Protection System				
	Water (FPSW)				
	001A - Cooling tower	3.01 MGD	Disinfection (sodium hypochlorite)	2-F	
	Blowdown		Dechlorination	2-E	
			Discharge to Surface Waters	4-A	
002	Final Discharge	8.54 MGD	Sedimentation (Settling), Mixing	1-U	2-C
	containing:	(Up to 22.9 MGD incl.	Chemical Precipitation,	2-K	4-A
	Ash Transport Water	dewatering and PRWs)	Neutralization, Flocculation	1-O	1-G
	FPSW		Multimedia Filtration	1-Q	
	Low Volume Wastewater(LVWW)	8.54 MGD	Chlorination		
			Discharge to Surface Waters		
	Vehicle Rinse Water				
	Misc. non-contact				
	cooling waters				
	Ash Pond Dewatering	5.76 MGD (Form 2D)			
	Pressure Relief Well Eff	8.64 MGD (Form 2E)			
	002A - Treated Sanitary	0.009 MGD			
	wastewater				
	002B - Pre-treated	0.0 MGD			
	Chemical metal				
	cleaning wastes				

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
002 (cont.)	31	00	24	88	00	41	Mobile River
011	31	00	24	88	00	41	Mobile River
012	31	00	24	88	00	41	Mobile River
022	31	00	24	88	00	41	Mobile River

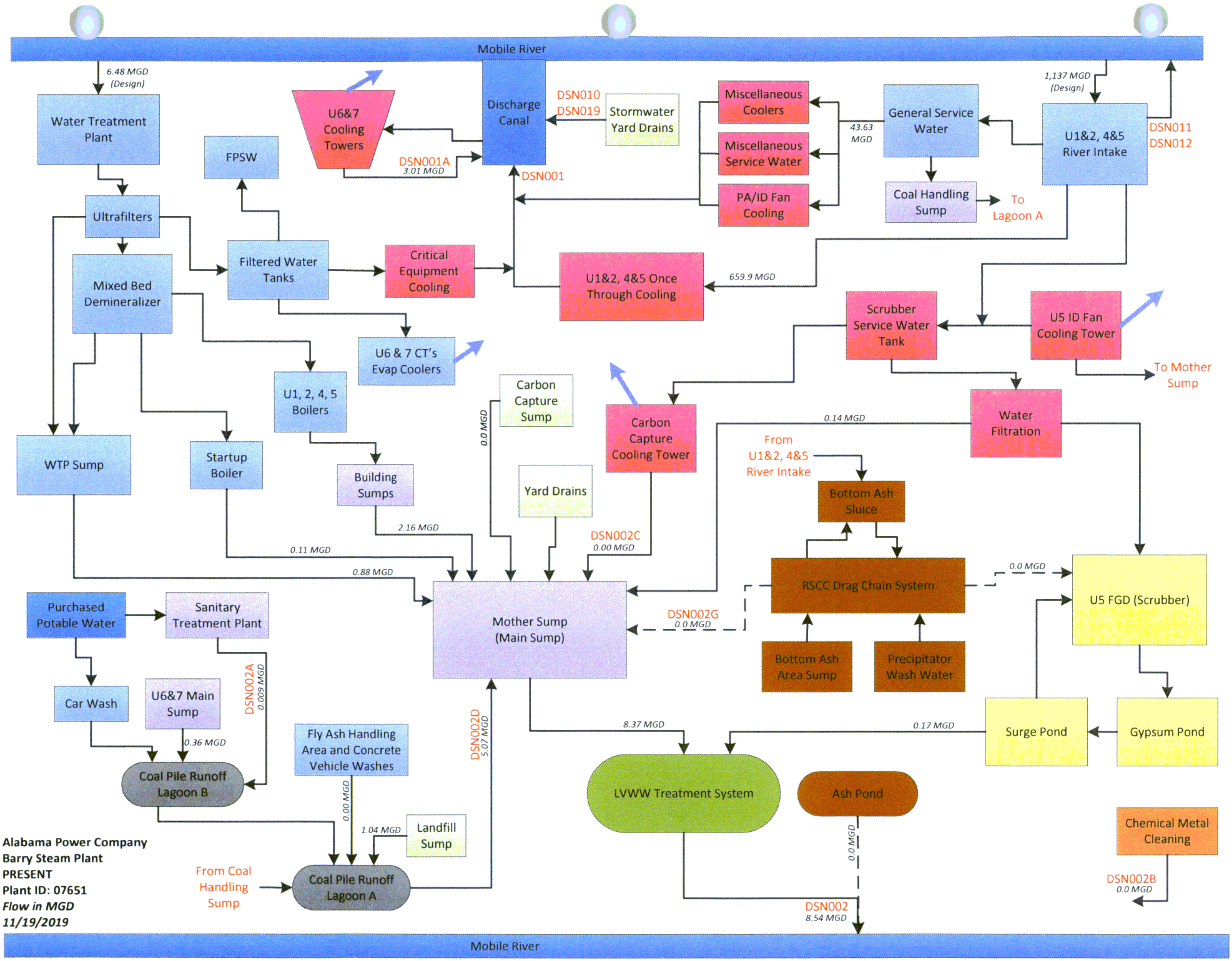
II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW: a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	3. TREATMENT: a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
002 cont.)	002C - Cooling Tower	0.0 MGD			
	Blowdown - Carbon				
	Capture Process				
	002D - Coal Pile Runoff	5.07 MGD			
	002E - FGD Wastewater	0.17 MGD			
	002F - Closed Ash Pond	0.72 MGD			
	Leachate				
	002G - RSCC Overflow	0.0004 MGD			
011	Intake Screen Backwash	2.14 MGD	Discharge to Surface Water	4-A	
	Water (U1 & 2) and				
	FPSW				
012	Intake Screen Backwash	2.14 MGD	Discharge to Surface Water	4-A	
	Water (U4 & 5) and				
	FPSW				
	(Similar to 011)				
022	Ash Pond Closure	0 MGD			
	Emergency Overflow				
	Spillway				

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)



Mobile River
6.48 MGD (Design)
Water Treatment Plant
U6&7 Cooling Towers
Discharge Canal
DSN010
DSN019
Stormwater Yard Drains
Miscellaneous Coolers
Miscellaneous Service Water
PA/ID Fan Cooling
43.63 MGD
General Service Water
1,137 MGD (Design)
U1&2, 4&5 River Intake
DSN011
DSN012
FPSW
DSN001A
3.01 MGD
DSN001
Coal Handling Sump
To Lagoon A
Ultrafilters
Filtered Water Tanks
Critical Equipment Cooling
U1&2, 4&5 Once Through Cooling
659.9 MGD
Mixed Bed Demineralizer
Scrubber Service Water Tank
U5 ID Fan Cooling Tower
U6 & 7 CT's Evap Coolers
To Mother Sump
U1, 2, 4, 5 Boilers
Carbon Capture Sump
0.0 MGD
Carbon Capture Cooling Tower
Water Filtration
0.14 MGD
WTP Sump
Startup Boiler
Building Sumps
From U1&2, 4&5 River Intake
Yard Drains
Bottom Ash Sluice
2.16 MGD
0.11 MGD
DSN002C
0.00 MGD
0.88 MGD
RSCC Drag Chain System
0.0 MGD
U5 FGD (Scrubber)
Purchased Potable Water
Sanitary Treatment Plant
Mother Sump (Main Sump)
DSN002G
0.0 MGD
Bottom Ash Area Sump
Precipitator Wash Water
Car Wash
U6&7 Main Sump
DSN002A
0.009 MGD
0.36 MGD
DSN002D
5.07 MGD
8.37 MGD
0.17 MGD
Surge Pond
Gypsum Pond
Coal Pile Runoff Lagoon B
Fly Ash Handling Area and Concrete Vehicle Washes
LVWW Treatment System
Ash Pond
0.00 MGD
1.04 MGD
Landfill Sump
0.0 MGD
Chemical Metal Cleaning
Alabama Power Company
Barry Steam Plant
PRESENT
Plant ID: 07651
Flow in MGD
11/19/2019
From Coal Handling Sump
Coal Pile Runoff Lagoon A
DSN002B
0.0 MGD
DSN002
8.54 MGD
Mobile River

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

[X] YES (*complete the following table*) [ ] NO (*go to Section III*)

1. OUTFALL NUMBER (*list*)	2. OPERATION(s) CONTRIBUTING FLOW (*list*)	3. FREQUENCY a. DAYS PER WEEK (*specify average*)	3. FREQUENCY b. MONTHS PER YEAR (*specify average*)	4. FLOW a. FLOW RATE (*in mgd*) 1. LONG TERM AVERAGE	4. FLOW a. FLOW RATE (*in mgd*) 2. MAXIMUM DAILY	4. FLOW B. TOTAL VOLUME (*specify with units*) 1. LONG TERM AVERAGE	4. FLOW B. TOTAL VOLUME (*specify with units*) 2. MAXIMUM DAILY	C. DURATION (*in days*)
001A	Cooling Tower Blowdown			3.01 MGD				
002B	Pre-treated Chemical Metal Cleaning Waste	0	0					
002C	Carbon Capture Cooling Tower Blowdown	0	0					

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

[X] YES (*complete Item III-B*) [ ] NO (*go to Section IV*)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (*or other measure of operation*)?

[ ] YES (*complete Item III-C*) [X] NO (*go to Section IV*)

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (*specify*)	2. AFFECTED OUTFALLS (*list outfall numbers*)

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operations of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

[X] YES (*complete the following table*) [ ] NO (*go to Item IV-B*)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS a. NO.	2. AFFECTED OUTFALLS b. SOURCE OF DISCHARGE	3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE a. REQUIRED	4. FINAL COMPLIANCE DATE b. PROJECTED
See Form 2C General Comments					

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (*or other environmental projects which may affect your discharges*) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

[ ] MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

 CONTINUE ON PAGE 3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
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CONTINUED FROM PAGE 2

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
Vanadium	Present in trace amounts in coal.		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES (*list all such pollutants below*) ☒ NO (*go to Item VI-B*)

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

[X] YES (*identify the test(s) and describe their purposes below*) [ ] NO (*go to Section VIII*)

Toxicity testing of the Ash Pond discharge as required by the current NPDES Permit.

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

[X] YES (*list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below*) [ ] NO (*go to Section IX*)

A. NAME	B. ADDRESS	C. TELEPHONE (*area code & no.*)	D. POLLUTANTS ANALYZED (*list*)
Pace Analytical Services (previously TTL)	3516 Greensboro Avenue Tuscaloosa, AL 35401	(205)614-6630	Refer to enclosed Certificates of Analyses
Auburn Environmental Lab	6485 Lee Road 54 Auburn, AL 36830	(334)745-0055	WET Testing

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (*type or print*)	B. PHONE NO. (*area code & no.*)
Susan B. Comensky, Vice President of Environmental Affairs	(205) 257-0298
C. SIGNATURE Susan Comensky	D. DATE SIGNED 1/8/2020

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

V. INTAKE AND EFFLUENT CHARACTERISTICS (*continued from page 3 of Form 2-C*)

OUTFALL NO.
001

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	1.2						1	mg/L		0.8		1
b. Chemical Oxygen Demand (*COD*)	31.5						1	mg/L		13.9		1
c. Total Organic Carbon (*TOC*)	5.67						1	mg/L		5.72		1
d. Total Suspended Solids (*TSS*)	59.5						1	mg/L		62.4		1
e. Ammonia (*as N*)	<0.3				<0.06		5	mg/L		<0.3		1
f. Flow	VALUE 904.62		VALUE 695.2		VALUE 525.2		365	MGD		VALUE 617.93		1
g. Temperature (*winter*)	VALUE 25.9		VALUE 20.5		VALUE 17.6		109	°C		VALUE 8.6		121
h. Temperature (*summer*)	VALUE 43.2		VALUE 38.1		VALUE 31.5		244	°C		VALUE 26.1		244
i. pH	MINIMUM 6.4	MAXIMUM 7.6	MINIMUM	MAXIMUM			12	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)			<0.08						1	mg/L		<0.08		1
b. Chlorine, Total Residual			<0.05		<0.05		<0.05		365	mg/L		<0.05		1
c. Color			13.0						1	ADMI		12.0		1
d. Fecal Coliform			137.6						1	MPN/100mL		167.0		1
e. Fluoride (16984-48-8)			0.06						1	mg/L		0.06		1
f. Nitrate-Nitrite (*as N*)			0.32						1	mg/L		0.33		1

CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)			<1						1	mg/L		<0.1		1
h. Oil and Grease			<5						1	mg/L		<5		1
i. Phosphorus (as P), Total (7723-14-0)			0.094				0.0613		5	mg/L		0.085		1
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (*as* SO_4) (14808-79-8)			17.0						1	mg/L		17.0		1
l. Sulfide (*as S*)			<0.01						1	mg/L		<0.01		1
m. Sulfite (*as* SO_3) (14265-45-3)			<4						1	mg/L		<4		1
n. Surfactants			<0.05						1	mg/L		<0.05		1
o. Aluminum, Total (7429-90-5)			1.22						1	mg/L		1.35		1
p. Barium, Total (7440-39-3)			0.0425						1	mg/L		0.0426		1
q. Boron, Total (7440-42-8)			<0.1015						1	mg/L		<0.1015		1
r. Cobalt, Total (7440-48-4)			0.000865						1	mg/L		0.000960		1
s. Iron, Total (7439-89-6)			2.20						1	mg/L		2.35		1
t. Magnesium, Total (7439-95-4)			3.30						1	mg/L		3.27		1
u. Molybdenum, Total (7439-98-7)			0.000318						1	mg/L		0.000315		1
v. Manganese, Total (7439-96-5)			0.107						1	mg/L		0.120		1
w. Tin, Total (7440-31-5)			<0.000203						1	mg/L		<0.000203		1
x. Titanium, Total (7440-32-6)			0.0181						1	mg/L		0.0195		1

CONTINUE ON PAGE V-3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	001

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			<0.000203						1	mg/L		<0.000203		1
2M. Arsenic, Total (7440-38-2)	X			0.00107						1	mg/L		0.00107		1
3M. Beryllium, Total (7440-41-7)	X			<0.000203						1	mg/L		<0.000203		1
4M. Cadmium, Total (7440-43-9)	X			<0.000203						1	mg/L		<0.000203		1
5M. Chromium, Total (7440-47-3)	X			0.00226						1	mg/L		0.00238		1
6M. Copper, Total (7440-50-8)	X			0.0101		0.010		0.002		25	mg/L		0.00199		1
7M. Lead, Total (7439-92-1)	X			0.00155						1	mg/L		0.00160		1
8M. Mercury, Total (7439-97-6)	X			10.6						1	ng/L		9.11		1
9M. Nickel, Total (7440-02-0)	X			0.00232						1	mg/L		0.00244		1
10M. Selenium, Total (7782-49-2)	X			0.000476						1	mg/L		0.000469		1
11M. Silver, Total (7440-22-4)	X			<0.000203						1	mg/L		<0.000203		1
12M. Thallium, Total (7440-28-0)	X			<0.000203						1	mg/L		<0.000203		1
13M. Zinc, Total (7440-66-6)	X			0.0189		0.0104		0.0021		25	mg/L		0.00798		1
14M. Cyanide, Total (57-12-5)	X			<0.010						1	mg/L		<0.010		1
15M. Phenols, Total	X			<0.10						1	mg/L		<0.10		1
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)				DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X			<0.100						1	mg/L		<0.100		1
2V. Acrylonitrile (107-13-1)	X			<0.100						1	mg/L		<0.100		1
3V. Benzene (71-43-2)	X			<0.005						1	mg/L		<0.005		1
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				N/A						0			N/A		0
5V. Bromoform (75-25-2)	X			<0.005						1	mg/L		<0.005		1
6V. Carbon Tetrachloride (56-23-5)	X			<0.005						1	mg/L		<0.005		1
7V. Chlorobenzene (108-90-7)	X			<0.005						1	mg/L		<0.005		1
8V. Chlorodi-bromomethane (124-48-1)	X			<0.005						1	mg/L		<0.005		1
9V. Chloroethane (75-00-3)	X			<0.010						1	mg/L		<0.010		1
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			<0.010						1	mg/L		<0.010		1
11V. Chloroform (67-66-3)	X			<0.005						1	mg/L		<0.005		1
12V. Dichloro-bromomethane (75-27-4)	X			<0.005						1	mg/L		<0.005		1
13V. Dichloro-difluoromethane (75-71-8)				N/A						0					
14V. 1,1-Dichloro-ethane (75-34-3)	X			<0.005						1	mg/L		<0.005		1
15V. 1,2-Dichloro-ethane (107-06-2)	X			<0.005						1	mg/L		<0.005		1
16V. 1,1-Dichloro-ethylene (75-35-4)	X			<0.005						1	mg/L		<0.005		1
17V. 1,2-Dichloro-propane (78-87-5)	X			<0.005						1	mg/L		<0.005		1
18V. 1,3-Dichloro-propylene (542-75-6)	X			<0.005						1	mg/L		<0.005		1
19V. Ethylbenzene (100-41-4)	X			<0.005						1	mg/L		<0.005		1
20V. Methyl Bromide (74-83-9)	X			<0.010						1	mg/L		<0.010		1
21V. Methyl Chloride (74-87-3)	X			<0.005						1	mg/L		<0.005		1

CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X			<0.005						1	mg/L		<0.005		1
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			<0.005						1	mg/L		<0.005		1
24V. Tetrachloro-ethylene (127-18-4)	X			<0.005						1	mg/L		<0.005		1
25V. Toluene (108-88-3)	X			<0.005						1	mg/L		<0.005		1
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			<0.005						1	mg/L		<0.005		1
27V. 1,1,1-Trichloro-ethane (71-55-6)	X			<0.005						1	mg/L		<0.005		1
28V. 1,1,2-Trichloro-ethane (79-00-5)	X			<0.005						1	mg/L		<0.005		1
29V Trichloro-ethylene (79-01-6)	X			<0.005						1	mg/L		<0.005		1
30V. Trichloro-fluoromethane (75-69-4)				N/A						0			N/A		0
31V. Vinyl Chloride (75-01-4)	X			<0.002						1	mg/L		<0.002		1
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			<0.009						1	mg/L		<0.009		1
2A. 2,4-Dichloro-phenol (120-83-2)	X			<0.009						1	mg/L		<0.009		1
3A. 2,4-Dimethyl-phenol (105-67-9)	X			<0.009						1	mg/L		<0.009		1
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			<0.047						1	mg/L		<0.047		1
5A. 2,4-Dinitro-phenol (51-28-5)	X			<0.047						1	mg/L		<0.047		1
6A. 2-Nitrophenol (88-75-5)	X			<0.009						1	mg/L		<0.009		1
7A. 4-Nitrophenol (100-02-7)	X			<0.047						1	mg/L		<0.047		1
8A. P-Chloro-M-Cresol (59-50-7)	X			<0.009						1	mg/L		<0.009		1
9A. Pentachloro-phenol (87-86-5)	X			<0.023						1	mg/L		<0.024		1
10A. Phenol (108-95-2)	X			<0.009						1	mg/L		<0.009		1
11A. 2,4,6-Trichloro-phenol (88-05-2)	X			<0.009						1	mg/L		<0.009		1

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)				N/A						0	mg/L		<0.009		1
2B. Acenaphtylene (208-96-8)				N/A						0	mg/L		<0.009		1
3B. Anthracene (120-12-7)				N/A						0	mg/L		<0.009		1
4B. Benzidine (92-87-5)				N/A						0	mg/L		<0.047		1
5B. Benzo (*a*) Anthracene (56-55-3)				N/A						0	mg/L		<0.009		1
6B. Benzo (*a*) Pyrene (50-32-8)				N/A						0	mg/L		<0.009		1
7B. 3,4-Benzo-fluoranthene (205-99-2)				N/A						0	mg/L		<0.009		1
8B. Benzo (*ghi*) Perylene (191-24-2)				N/A						0	mg/L		<0.009		1
9B. Benzo (*k*) Fluoranthene (207-08-9)				N/A						0	mg/L		<0.009		1
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)				N/A						0	mg/L		<0.009		1
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)				N/A						0	mg/L		<0.009		1
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)				N/A						0	mg/L		<0.009		1
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)				N/A						0	mg/L		<0.009		1
14B. 4-Bromophenyl Phenyl Ether (101-55-3)				N/A						0	mg/L		<0.009		1
15B. Butyl Benzyl Phthalate (85-68-7)				N/A						0	mg/L		<0.009		1
16B. 2-Chloro-naphthalene (91-58-7)				N/A						0	mg/L		<0.009		1
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)				N/A						0	mg/L		<0.009		1
18B. Chrysene (218-01-9)				N/A						0	mg/L		<0.009		1
19B. Dibenzo (*a,h*) Anthracene (53-70-3)				N/A						0	mg/L		<0.009		1
20B. 1,2-Dichloro-benzene (95-50-1)				N/A						0	mg/L		<0.005		1
21B. 1,3-Di-chloro-benzene (541-73-1)				N/A						0	mg/L		<0.005		1

CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. MARK "X" b. BELIEVED PRESENT	2. MARK "X" c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (*optional*) b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)				N/A						0	mg/L		<0.005		1
23B. 3,3-Dichloro-benzidine (91-94-1)				N/A						0	mg/L		<0.019		1
24B. Diethyl Phthalate (84-66-2)				N/A						0	mg/L		<0.009		1
25B. Dimethyl Phthalate (131 -11-3)				N/A						0	mg/L		<0.009		1
26B. Di-N-Butyl Phthalate (84-74-2)				N/A						0	mg/L		<0.009		1
27B. 2,4-Dinitro-toluene (121-14-2)				N/A						0	mg/L		<0.009		1
28B. 2,6-Dinitro-toluene (606-20-2)				N/A						0	mg/L		<0.009		1
29B. Di-N-Octyl Phthalate (117-84-0)				N/A						0	mg/L		<0.009		1
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)				N/A						0	mg/L		<0.047		1
31B. Fluoranthene (206-44-0)				N/A						0	mg/L		<0.009		1
32B. Fluorene (86-73-7)				N/A						0	mg/L		<0.009		1
33B. Hexachloro-benzene (118-74-1)				N/A						0	mg/L		<0.009		1
34B. Hexachloro-butadiene (87-68-3)				N/A						0	mg/L		<0.009		1
35B. Hexachloro-cyclopentadiene (77-47-4)				N/A						0	mg/L		<0.009		1
36B Hexachloro-ethane (67-72-1)				N/A						0	mg/L		<0.009		1
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)				N/A						0	mg/L		<0.009		1
38B. Isophorone (78-59-1)				N/A						0	mg/L		<0.009		1
39B. Naphthalene (91-20-3)				N/A						0	mg/L		<0.009		1
40B. Nitrobenzene (98-95-3)				N/A						0	mg/L		<0.009		1
41B. N-Nitro-sodimethylamine (62-75-9)				N/A						0	mg/L		<0.009		1
42B. N-Nitrosodi-N-Propylamine (621-64-7)				N/A						0	mg/L		<0.009		1

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. b. BELIEVED PRESENT	2. c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. a. (2) MASS	3. b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. b. (2) MASS	3. c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. c. (2) MASS	3. d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. a. (2) MASS	5. b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)				N/A						0	mg/L		<0.009		1
44B. Phenanthrene (85-01-8)				N/A						0	mg/L		<0.009		1
45B. Pyrene (129-00-0)				N/A						0	mg/L		<0.009		1
46B. 1,2,4-Tri-chlorobenzene (120-82-1)				N/A						0	mg/L		<0.009		1
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				N/A						0			N/A		0
2P. α-BHC (319-84-6)				N/A						0			N/A		0
3P. β-BHC (319-85-7)				N/A						0			N/A		0
4P. γ-BHC (58-89-9)				N/A						0			N/A		0
5P. δ-BHC (319-86-8)				N/A						0			N/A		0
6P. Chlordane (57-74-9)				N/A						0			N/A		0
7P. 4,4'-DDT (50-29-3)				N/A						0			N/A		0
8P. 4,4'-DDE (72-55-9)				N/A						0			N/A		0
9P. 4,4'-DDD (72-54-8)				N/A						0			N/A		0
10P. Dieldrin (60-57-1)				N/A						0			N/A		0
11P. α-Enosulfan (115-29-7)				N/A						0			N/A		0
12P. β-Endosulfan (115-29-7)				N/A						0			N/A		0
13P. Endosulfan Sulfate (1031-07-8)				N/A						0			N/A		0
14P. Endrin (72-20-8)				N/A						0			N/A		0
15P. Endrin Aldehyde (7421-93-4)				N/A						0			N/A		0
16P. Heptachlor (76-44-8)				N/A						0			N/A		0

CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	001

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)				N/A						0			N/A		0
18P. PCB-1242 (53469-21-9)				N/A						0			N/A		0
19P. PCB-1254 (11097-69-1)				N/A						0			N/A		0
20P. PCB-1221 (11104-28-2)				N/A						0			N/A		0
21P. PCB-1232 (11141-16-5)				N/A						0			N/A		0
22P. PCB-1248 (12672-29-6)				N/A						0			N/A		0
23P. PCB-1260 (11096-82-5)				N/A						0			N/A		0
24P. PCB-1016 (12674-11-2)				N/A						0			N/A		0
25P. Toxaphene (8001-35-2)				N/A						0			N/A		0

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
(205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR001R
Sample Date/Time : 13-Feb-18 9:10 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry OTCW
DSN001 Repermitting

Laboratory ID Number: AY03738

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Metals, Cyanide, Total Phenols									
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245.7		1	0.9	5	10.6	ng/L
Cyanide, Total, by TTL	MTL	2/19/2018	SM 4500-CN CE		1		0.01	< 0.010	mg/L
Phenol, Total, by TTL	KMC	3/2/2018	SM 5330		1		0.1	< 0.10	mg/L
General Characteristics									
Flow (MGD)	JBH/L	2/13/2018	Field Data		1			595	MGD
Field Temperature	JBH/L	2/13/2018	SM-2550		1			18.8	Deg C
Field pH	JBH/L	2/13/2018	SM-4500H		1			7.23	SU
Field Sulfite	JBH/L	2/13/2018	HACH 8216		1	4		Not Detected	mg/l
Chlorine, Total Residual	JBH/L	2/13/2018	Field Test		1	0.05		Not Detected	mg/L
* Escherichia Coli (E. Coli)	CES	2/14/2018	SM 9223B		1	1		137.6	MPN/100ml
* Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1.4	5	< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

* Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: Cyanide, Total and Phenol, Total analyses performed by Tuscaloosa Testing Laboratory._fkk 2/14/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control [signature] Supervision [signature]

Reported 3/5/2018
Version 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR001R
Sample Date/Time : 14-Feb-18 9:27 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry OTCW
DSN001 Repermitting 2C

Laboratory ID Number: AY03856

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____________________ Supervision ____________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR001R
Sample Date/Time : 14-Feb-18 9:27 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry OTCW
DSN001 Repermitting 2C

Laboratory ID Number: AY03856

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01		< 0.010	mg/l
Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
Metals, Cyanide, Total Phenols										
Total, Low Level Prep Date	JHK	2/15/2018	EPA 1638		1				2/15/2018	DATE
* Aluminum, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.033799	0.1015		1.22	mg/L
* Antimony, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
* Arsenic, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00107	mg/L
Barium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0425	mg/L
Beryllium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
* Boron, Total	HRG	2/15/2018	EPA 200.7		1.015	0.033799	0.1015	U	Not Detected	mg/L
* Cadmium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
* Chromium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00226	mg/L
* Cobalt, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000865	mg/L
* Copper, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00945	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
"^X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

ɩo: TV Davis
Barry Steam Plant

Customer Account : NBAR001R
Sample Date/Time : 14-Feb-18 9:27 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry OTCW
DSN001 Repermitting 2C

Laboratory ID Number: AY03856

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Iron, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.00545	0.016341		2.20	mg/L
*	Lead, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00155	mg/L
	Magnesium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.169505	0.5075		3.30	mg/L
*	Manganese, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.107	mg/L
*	Molybdenum, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000318	mg/L
*	Nickel, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00232	mg/L
*	Selenium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000476	mg/L
*	Silver, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
*	Thallium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
	Tin, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
	Titanium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.0181	mg/L
*	Zinc, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.0104	mg/L
	General Characteristics										
*	Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5		59.5	mg/L
	'iochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	0			1.2	mg/L
	ɜOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1				0805	
*	Bromide	CES	2/19/2018	EPA 300.0		1	0.04	0.08		< 0.08	mg/L
*	Fluoride	CES	2/19/2018	EPA 300.0		1	0.01	0.04		0.06	mg/L
*	Sulfate	CES	2/19/2018	EPA 300.0		1	0.04	1		17.0	mg/L
	Color, by TTL	TRT	2/15/2018	SM 2120 E		1		10		13.0	ADMI
*	Nitrogen, Nitrate/Nitrite	ABB	2/20/2018	EPA 353.2		1	0.1	0.3	R	0.32	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
`X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

ɪo: TV Davis
Barry Steam Plant

Customer Account : NBAR001R
Sample Date/Time : 14-Feb-18 9:27 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry OTCW
DSN001 Repermitting 2C

Laboratory ID Number: AY03856

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Nitrogen, Total Organic	GMW	3/9/2018	EPA 351.3		1	0.1			< 1	mg/l as N
Sulfide, by TTL	TRT	2/20/2018	SM4500 S2 D		1		0.01		< 0.01	mg/l
Surfactants (Foaming Agents), by TTL	KJG	2/15/2018	SM 5540C		1		0.05		< 0.05	mg/l
* Phosphorus, Total	CNJ	2/22/2018	SM 4500PE-TP		1	0.01	0.03		0.094	mg/L
* Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		1	0.1	0.3	U	Not Detected	mg/L as N
* Nitrogen, Total Kjeldahl	GMW	3/7/2018	EPA 351.2		1	0.156	1		< 1	mg/L as N
Total Organic Carbon	DLJ	2/19/2018	SM 5310 B		1	0.5	2		5.67	mg/L
Chemical Oxygen Demand, by TTL	TLM	2/20/2018	SM 5220 D		1		5		31.5	mg/L
Acid Compounds										
2-Chlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/l
2,4-Dichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
2,4-Dimethylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
4,6-Dinitro-2-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
2,4-Dinitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
4-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
4-chloro-3-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
Pentachlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.023		< 0.023	mg/L
Phenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
2,4,6-Trichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control ______ Supervision ______

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

Definitions

Alabama Power
Lab & Field Services

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range.
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

V. INTAKE AND EFFLUENT CHARACTERISTICS (*continued from page 3 of Form 2-C*)

OUTFALL NO.
001A

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	2.9						1	mg/L				
b. Chemical Oxygen Demand (*COD*)	87.3						1	mg/L				
c. Total Organic Carbon (*TOC*)	18.4						1	mg/L				
d. Total Suspended Solids (*TSS*)	294						1	mg/L				
e. Ammonia (*as N*)	<0.3						1	mg/L				
f. Flow	VALUE 4.55		VALUE		VALUE		1	mg/L		VALUE		
g. Temperature (*winter*)	VALUE 29.7		VALUE		VALUE		1	°C		VALUE		
h. Temperature (*summer*)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM 7.1	MAXIMUM 7.1	MINIMUM	MAXIMUM			1	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)			1.02						1	mg/L				
b. Chlorine, Total Residual			<0.05						1	mg/L				
c. Color			110						1	ADMI				
d. Fecal Coliform			160.7						1	MPN/100				
e. Fluoride (16984-48-8)			0.23						1	mg/L				
f. Nitrate-Nitrite (*as N*)			1.27						1	mg/L				

 CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)			1.53						1	mg/L				
h. Oil and Grease			<5						1	mg/L				
i. Phosphorus (as P), Total (7723-14-0)			0.430						1	mg/L				
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (*as SO_4*) (14808-79-8)			169						1	mg/L				
l. Sulfide (*as S*)			<0.01						1	mg/L				
m. Sulfite (*as SO_3*) (14265-45-3)			<4						1	mg/L				
n. Surfactants			<0.05						1	mg/L				
o. Aluminum, Total (7429-90-5)			4.88						1	mg/L				
p. Barium, Total (7440-39-3)			0.155						1	mg/L				
q. Boron, Total (7440-42-8)			<0.1015						1	mg/L				
r. Cobalt, Total (7440-48-4)			0.00346						1	mg/L				
s. Iron, Total (7439-89-6)			8.14						1	mg/L				
t. Magnesium, Total (7439-95-4)			11.0						1	mg/L				
u. Molybdenum, Total (7439-98-7)			0.00118						1	mg/L				
v. Manganese, Total (7439-96-5)			0.420						1	mg/L				
w. Tin, Total (7440-31-5)			<0.000203						1	mg/L				
x. Titanium, Total (7440-32-6)			0.0328						1	mg/L				

CONTINUE ON PAGE V-3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	001A

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. (2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			0.00139						1	mg/L				
2M. Arsenic, Total (7440-38-2)	X			0.00384						1	mg/L				
3M. Beryllium, Total (7440-41-7)	X			0.000588						1	mg/L				
4M. Cadmium, Total (7440-43-9)	X			<0.000203						1	mg/L				
5M. Chromium, Total (7440-47-3)	X			0.00845						1	mg/L				
6M. Copper, Total (7440-50-8)	X			0.0134						1	mg/L				
7M. Lead, Total (7439-92-1)	X			0.00597						1	mg/L				
8M. Mercury, Total (7439-97-6)	X			20.2						1	ng/L				
9M. Nickel, Total (7440-02-0)	X			0.00941						1	mg/L				
10M. Selenium, Total (7782-49-2)	X			0.00159						1	mg/L				
11M. Silver, Total (7440-22-4)	X			<0.000203						1	mg/L				
12M. Thallium, Total (7440-28-0)	X			<0.000203						1	mg/L				
13M. Zinc, Total (7440-66-6)	X			0.0547						1	mg/L				
14M. Cyanide, Total (57-12-5)	X			<0.010						1	mg/L				
15M. Phenols, Total	X			<0.10						1	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)				DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X			<0.100						1	mg/L				
2V. Acrylonitrile (107-13-1)	X			<0.100						1	mg/L				
3V. Benzene (71-43-2)	X			<0.005						1	mg/L				
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				N/A						0					
5V. Bromoform (75-25-2)	X			<0.005						1	mg/L				
6V. Carbon Tetrachloride (56-23-5)	X			<0.005						1	mg/L				
7V. Chlorobenzene (108-90-7)	X			<0.005						1	mg/L				
8V. Chlorodi-bromomethane (124-48-1)	X			<0.005						1	mg/L				
9V. Chloroethane (75-00-3)	X			<0.010						1	mg/L				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			<0.010						1	mg/L				
11V. Chloroform (67-66-3)	X			<0.005						1	mg/L				
12V. Dichloro-bromomethane (75-27-4)	X			<0.005						1	mg/L				
13V. Dichloro-difluoromethane (75-71-8)				N/A						0					
14V. 1,1-Dichloro-ethane (75-34-3)	X			<0.005						1	mg/L				
15V. 1,2-Dichloro-ethane (107-06-2)	X			<0.005						1	mg/L				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			<0.005						1	mg/L				
17V. 1,2-Dichloro-propane (78-87-5)	X			<0.005						1	mg/L				
18V. 1,3-Dichloro-propylene (542-75-6)	X			<0.005						1	mg/L				
19V. Ethylbenzene (100-41-4)	X			<0.005						1	mg/L				
20V. Methyl Bromide (74-83-9)	X			<0.010						1	mg/L				
21V. Methyl Chloride (74-87-3)	X			<0.005						1	mg/L				

CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X			<0.005						1	mg/L				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			<0.005						1	mg/L				
24V. Tetrachloro-ethylene (127-18-4)	X			<0.005						1	mg/L				
25V. Toluene (108-88-3)	X			<0.005						1	mg/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			<0.005						1	mg/L				
27V. 1,1,1-Trichloro-ethane (71-55-6)	X			<0.005						1	mg/L				
28V. 1,1,2-Trichloro-ethane (79-00-5)	X			<0.005						1	mg/L				
29V Trichloro-ethylene (79-01-6)	X			<0.005						1	mg/L				
30V. Trichloro-fluoromethane (75-69-4)				N/A						0					
31V. Vinyl Chloride (75-01-4)	X			<0.002						1	mg/L				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			<0.010						1	mg/L				
2A. 2,4-Dichloro-phenol (120-83-2)	X			<0.010						1	mg/L				
3A. 2,4-Dimethyl-phenol (105-67-9)	X			<0.010						1	mg/L				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			<0.048						1	mg/L				
5A. 2,4-Dinitro-phenol (51-28-5)	X			<0.048						1	mg/L				
6A. 2-Nitrophenol (88-75-5)	X			<0.010						1	mg/L				
7A. 4-Nitrophenol (100-02-7)	X			<0.048						1	mg/L				
8A. P-Chloro-M-Cresol (59-50-7)	X			<0.010						1	mg/L				
9A. Pentachloro-phenol (87-86-5)	X			<0.024						1	mg/L				
10A. Phenol (108-95-2)	X			<0.010						1	mg/L				
11A. 2,4,6-Trichloro-phenol (88-05-2)	X			<0.010						1	mg/L				

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)	X			<0.010						1	mg/L				
2B. Acenaphtylene (208-96-8)	X			<0.010						1	mg/L				
3B. Anthracene (120-12-7)	X			<0.010						1	mg/L				
4B. Benzidine (92-87-5)	X			<0.048						1	mg/L				
5B. Benzo (*a*) Anthracene (56-55-3)	X			<0.010						1	mg/L				
6B. Benzo (*a*) Pyrene (50-32-8)	X			<0.010						1	mg/L				
7B. 3,4-Benzo-fluoranthene (205-99-2)	X			<0.010						1	mg/L				
8B. Benzo (*ghi*) Perylene (191-24-2)	X			<0.010						1	mg/L				
9B. Benzo (*k*) Fluoranthene (207-08-9)	X			<0.010						1	mg/L				
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)	X			<0.010						1	mg/L				
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)	X			<0.010						1	mg/L				
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)	X			<0.010						1	mg/L				
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)	X			<0.010						1	mg/L				
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	X			<0.010						1	mg/L				
15B. Butyl Benzyl Phthalate (85-68-7)	X			<0.010						1	mg/L				
16B. 2-Chloro-naphthalene (91-58-7)	X			<0.010						1	mg/L				
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)	X			<0.010						1	mg/L				
18B. Chrysene (218-01-9)	X			<0.010						1	mg/L				
19B. Dibenzo (*a,h*) Anthracene (53-70-3)	X			<0.010						1	mg/L				
20B. 1,2-Dichloro-benzene (95-50-1)	X			<0.005						1	mg/L				
21B. 1,3-Di-chloro-benzene (541-73-1)	X			<0.005						1	mg/L				

 CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)	X			<0.005						1	mg/L				
23B. 3,3-Dichloro-benzidine (91-94-1)	X			<0.019						1	mg/L				
24B. Diethyl Phthalate (84-66-2)	X			<0.010						1	mg/L				
25B. Dimethyl Phthalate (131 -11-3)	X			<0.010						1	mg/L				
26B. Di-N-Butyl Phthalate (84-74-2)	X			<0.010						1	mg/L				
27B. 2,4-Dinitro-toluene (121-14-2)	X			<0.010						1	mg/L				
28B. 2,6-Dinitro-toluene (606-20-2)	X			<0.010						1	mg/L				
29B. Di-N-Octyl Phthalate (117-84-0)	X			<0.010						1	mg/L				
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)	X			<0.048						1	mg/L				
31B. Fluoranthene (206-44-0)	X			<0.010						1	mg/L				
32B. Fluorene (86-73-7)	X			<0.010						1	mg/L				
33B. Hexachloro-benzene (118-74-1)	X			<0.010						1	mg/L				
34B. Hexachloro-butadiene (87-68-3)	X			<0.010						1	mg/L				
35B. Hexachloro-cyclopentadiene (77-47-4)	X			<0.010						1	mg/L				
36B Hexachloro-ethane (67-72-1)	X			<0.010						1	mg/L				
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X			<0.010						1	mg/L				
38B. Isophorone (78-59-1)	X			<0.010						1	mg/L				
39B. Naphthalene (91-20-3)	X			<0.010						1	mg/L				
40B. Nitrobenzene (98-95-3)	X			<0.010						1	mg/L				
41B. N-Nitro-sodimethylamine (62-75-9)	X			<0.010						1	mg/L				
42B. N-Nitrosodi-N-Propylamine (621-64-7)	X			<0.010						1	mg/L				

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)	X			<0.010						1	mg/L				
44B. Phenanthrene (85-01-8)	X			<0.010						1	mg/L				
45B. Pyrene (129-00-0)	X			<0.010						1	mg/L				
46B. 1,2,4-Tri-chlorobenzene (120-82-1)	X			<0.010						1	mg/L				
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				N/A						0					
2P. α-BHC (319-84-6)				N/A						0					
3P. β-BHC (319-85-7)				N/A						0					
4P. γ-BHC (58-89-9)				N/A						0					
5P. δ-BHC (319-86-8)				N/A						0					
6P. Chlordane (57-74-9)				N/A						0					
7P. 4,4'-DDT (50-29-3)				N/A						0					
8P. 4,4'-DDE (72-55-9)				N/A						0					
9P. 4,4'-DDD (72-54-8)				N/A						0					
10P. Dieldrin (60-57-1)				N/A						0					
11P. α-Enosulfan (115-29-7)				N/A						0					
12P. β-Endosulfan (115-29-7)				N/A						0					
13P. Endosulfan Sulfate (1031-07-8)				N/A						0					
14P. Endrin (72-20-8)				N/A						0					
15P. Endrin Aldehyde (7421-93-4)				N/A						0					
16P. Heptachlor (76-44-8)				N/A						0					

 CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	001A

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)				N/A						0					
18P. PCB-1242 (53469-21-9)				N/A						0					
19P. PCB-1254 (11097-69-1)				N/A						0					
20P. PCB-1221 (11104-28-2)				N/A						0					
21P. PCB-1232 (11141-16-5)				N/A						0					
22P. PCB-1248 (12672-29-6)				N/A						0					
23P. PCB-1260 (11096-82-5)				N/A						0					
24P. PCB-1016 (12674-11-2)				N/A						0					
25P. Toxaphene (8001-35-2)				N/A						0					

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 13-Feb-18 8:50 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting

Laboratory ID Number: AY03739

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
	Metals, Cyanide, Total Phenols									
*	Mercury, Total by CVAF	ABB	2/20/2018	EPA 245.7		1	0.9	5	20.2	ng/L
	Cyanide, Total, by TTL	MTL	2/19/2018	SM 4500-CN CE		1		0.01	< 0.010	mg/L
	Phenol, Total, by TTL	KMC	3/2/2018	SM 5330		1		0.1	< 0.10	mg/L
	General Characteristics									
	Flow (MGD)	JBH/L	2/13/2018	Field Data		1			4.55	MGD
	Field Temperature	JBH/L	2/13/2018	SM-2550		1			29.7	Deg. C
	Field pH	JBH/L	2/13/2018	SM-4500H		1			7.08	SU
	Field Sulfite	JBH/L	2/13/2018	HACH 8216		1	4		Not Detected	mg/l
	Chlorine, Total Residual	JBH/L	2/13/2018	Field Test		1	0.05		Not Detected	mg/L
*	Escherichia Coli (E. Coli)	CES	2/14/2018	SM 9223B		1	1		160.7	MPN/100ml
*	Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1.4	5	< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: Cyanide, Total and Phenol, Total analyses performed by Tuscaloosa Testing Laboratory._fkk 2/14/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control [signature] **Supervision** [signature]

Reported:3/5/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________ Supervision ______________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	1,2-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01		< 0.010	mg/l
	Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,4-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	2/15/2018	EPA 1638		1				2/15/2018	DATE
	Aluminum, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.033799	0.1015	R	4.88	mg/L
	Antimony, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	R	0.00139	mg/L
*	Arsenic, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00384	mg/L
*	Barium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.155	mg/L
*	Beryllium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000588	mg/L
*	Boron, Total	HRG	2/15/2018	EPA 200.7		1.015	0.033799	0.1015		< 0.1015	mg/L
*	Cadmium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision**______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field Services

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
* Chromium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00845	mg/L
* Cobalt, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00346	mg/L
* Copper, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0134	mg/L
Iron, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.00545	0.016341	R	8.14	mg/L
* Lead, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00597	mg/L
Magnesium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.169505	0.5075		11.0	mg/L
* Manganese, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.420	mg/L
* Molybdenum, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00118	mg/L
* Nickel, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00941	mg/L
* Selenium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00159	mg/L
* Silver, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
* Thallium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
Tin, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	R	Not Detected	mg/L
Titanium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015	R	0.0328	mg/L
Zinc, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.0547	mg/L
General Characteristics										
* Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5		294	mg/L
* Biochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	2			2.9	mg/L
BOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1				0805	
* Bromide	CES	2/19/2018	EPA 300.0		1	0.04	0.08		1.02	mg/L
* Fluoride	CES	2/19/2018	EPA 300.0		1	0.01	0.04		0.23	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
˙X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

ıo: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
*	Sulfate	CES	2/19/2018	EPA 300.0		2	0.08	2		169	mg/L
	Color, by TTL	TRT	2/15/2018	SM 2120 E		1		10		110	ADMI
*	Nitrogen, Nitrate/Nitrite	ABB	2/20/2018	EPA 353.2		1	0.1	0.3		1.27	mg/L as N
	Nitrogen, Total Organic	GMW	3/9/2018	EPA 351.3		1	0.1			1.53	mg/l as N
	Sulfide, by TTL	TRT	2/20/2018	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	KJG	2/15/2018	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	CNJ	2/22/2018	SM 4500PE-TP		1	0.01	0.03		0.430	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		1	0.1	0.3	U	Not Detected	mg/L as N
*	Nitrogen, Total Kjeldahl	GMW	3/7/2018	EPA 351.2		1	0.156	1		1.53	mg/L as N
	Total Organic Carbon	DLJ	2/19/2018	SM 5310 B		1	0.5	2		18.4	mg/L
	Chemical Oxygen Demand, by TTL	TLM	2/20/2018	SM 5220 D		1		5		87.3	mg/L
	Base/Neutral Compounds										
	Acenaphthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L
	Acenaphthylene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L
	nthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/l
	denzidine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.048		< 0.048	mg/l
	Benz(a)anthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L
	Benzo(a)pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L
	Benzo(b)fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L
	Benzo(g,h,i)perylene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/l
	Benzo(k)fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01		< 0.010	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control ____________________ Supervision ____________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Bis(2-chloroethoxy)methane, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
Bis(2-chloroethyl)ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
Bis(2-chloroisopropyl)ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
Bis(2-ethylhexyl)phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
4-Bromophenyl phenyl ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
Butyl benzyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
2-Chloronaphthalene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
4-Chlorophenyl phenyl ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
Chrysene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Dibenzo(a,h)anthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
3,3-Dichlorobenzidine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.019	< 0.019	mg/L
Diethyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Dimethyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Di-n-butyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
2,4-Dinitrotoluene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
2,6-Dinitrotoluene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Di-n-octyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
1,2-Diphenylhydrazine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.048	< 0.048	mg/L
Fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Fluorene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Hexachlorobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Hexachlorobutadiene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Hexachlorocyclopentadiene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Hexachloroethane, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Indeno(1,2,3-cd)pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Isophorone, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Naphthalene, TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Nitrobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
N-Nitrosodimethylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
N-Nitrosodi-n-propylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
N-Nitrosodiphenylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Phenanthrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
1,2,4-Trichlorobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Acid Compounds									
2-Chlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/l
2,4-Dichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
2,4-Dimethylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
4,6-Dinitro-2-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.048	< 0.048	mg/L
2,4-Dinitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.048	< 0.048	mg/L
2-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
4-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.048	< 0.048	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision**______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR01AR
Sample Date/Time : 14-Feb-18 9:45 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Cooling Tower BD
DSN001A Repermitting 2C

Laboratory ID Number: AY03858

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
4-chloro-3-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
Pentachlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.024	< 0.024	mg/L
Phenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L
2,4,6-Trichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.01	< 0.010	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
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Quality Control ____________ Supervision ____________

Reported:3/13/2018
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Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

Definitions

Alabama Power
Lab& Field SERVICES

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit, minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit, lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range
J	Reported value is an estimate because concentration is less than reporting limit
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
002-LVWW Effluent

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	0.9						1	mg/L				
b. Chemical Oxygen Demand (*COD*)	11.0						1	mg/L				
c. Total Organic Carbon (*TOC*)	3.18						1	mg/L				
d. Total Suspended Solids (*TSS*)	3.0				0.7		13	mg/L				
e. Ammonia (*as N*)	0.32				0.08		5	mg/L				
f. Flow	VALUE		VALUE		VALUE 8.54 (estimated avg.)		1	MGD		VALUE		
g. Temperature (*winter*)	VALUE 14.0		VALUE		VALUE		1	°C		VALUE		
h. Temperature (*summer*)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM 7.0	MAXIMUM 8.5	MINIMUM	MAXIMUM			12	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)			0.54						1	mg/L				
b. Chlorine, Total Residual			<0.05						1	mg/L				
c. Color			<10						1	ADMI				
d. Fecal Coliform			93.3						1	MPN/100mL				
e. Fluoride (16984-48-8)			0.41						1	mg/L				
f. Nitrate-Nitrite (*as N*)			0.40						1	mg/L				

CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)			<1						1	mg/L				
h. Oil and Grease			<5				<4.4		13	mg/L				
i. Phosphorus (as P), Total (7723-14-0)			<0.03				<0.02		5	mg/L				
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (*as SO_4*) (14808-79-8)			55.0						1	mg/L				
l. Sulfide (*as S*)			<0.01						1	mg/L				
m. Sulfite (*as SO_3*) (14265-45-3)			<4						1	mg/L				
n. Surfactants			0.07						1	mg/L				
o. Aluminum, Total (7429-90-5)			0.153						1	mg/L				
p. Barium, Total (7440-39-3)			0.211						1	mg/L				
q. Boron, Total (7440-42-8)			0.989						1	mg/L				
r. Cobalt, Total (7440-48-4)			<0.000203						1	mg/L				
s. Iron, Total (7439-89-6)			0.155						1	mg/L				
t. Magnesium, Total (7439-95-4)			7.79						1	mg/L				
u. Molybdenum, Total (7439-98-7)			0.0873						1	mg/L				
v. Manganese, Total (7439-96-5)			0.0250						1	mg/L				
w. Tin, Total (7440-31-5)			<0.000203						1	mg/L				
x. Titanium, Total (7440-32-6)			0.00586						1	mg/L				

CONTINUE ON PAGE V-3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	002-LVWW Effluent

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			0.00466						1	mg/L				
2M. Arsenic, Total (7440-38-2)	X			0.00901	1.41	0.00901	1.41	0.00044	0.003	25	mg/L	ppd			
3M. Beryllium, Total (7440-41-7)	X			<0.000203						1	mg/L				
4M. Cadmium, Total (7440-43-9)	X			<0.000203						1	mg/L				
5M. Chromium, Total (7440-47-3)	X			0.00165						1	mg/L				
6M. Copper, Total (7440-50-8)	X			0.0013						1	mg/L				
7M. Lead, Total (7439-92-1)	X			<0.000203						1	mg/L				
8M. Mercury, Total (7439-97-6)	X			0.0119				0.002		5	ug/L				
9M. Nickel, Total (7440-02-0)	X			0.00207						1	mg/L				
10M. Selenium, Total (7782-49-2)	X			0.0228						1	mg/L				
11M. Silver, Total (7440-22-4)	X			<0.000203						1	mg/L				
12M. Thallium, Total (7440-28-0)	X			0.000208						1	mg/L				
13M. Zinc, Total (7440-66-6)	X			0.00167						1	mg/L				
14M. Cyanide, Total (57-12-5)	X			<0.010						1	mg/L				
15M. Phenols, Total	X			<0.10						1	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)				DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X			<0.100						1	mg/L				
2V. Acrylonitrile (107-13-1)	X			<0.100						1	mg/L				
3V. Benzene (71-43-2)	X			<0.005						1	mg/L				
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				N/A						0					
5V. Bromoform (75-25-2)	X			<0.005						1	mg/L				
6V. Carbon Tetrachloride (56-23-5)	X			<0.005						1	mg/L				
7V. Chlorobenzene (108-90-7)	X			<0.005						1	mg/L				
8V. Chlorodi-bromomethane (124-48-1)	X			<0.005						1	mg/L				
9V. Chloroethane (75-00-3)	X			<0.010						1	mg/L				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			<0.010						1	mg/L				
11V. Chloroform (67-66-3)	X			<0.005						1	mg/L				
12V. Dichloro-bromomethane (75-27-4)	X			<0.005						1	mg/L				
13V. Dichloro-difluoromethane (75-71-8)				N/A						0					
14V. 1,1-Dichloro-ethane (75-34-3)	X			<0.005						1	mg/L				
15V. 1,2-Dichloro-ethane (107-06-2)	X			<0.005						1	mg/L				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			<0.005						1	mg/L				
17V. 1,2-Dichloro-propane (78-87-5)	X			<0.005						1	mg/L				
18V. 1,3-Dichloro-propylene (542-75-6)	X			<0.005						1	mg/L				
19V. Ethylbenzene (100-41-4)	X			<0.005						1	mg/L				
20V. Methyl Bromide (74-83-9)	X			<0.010						1	mg/L				
21V. Methyl Chloride (74-87-3)	X			<0.005						1	mg/L				

CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X			<0.005						1	mg/L				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			<0.005						1	mg/L				
24V. Tetrachloro-ethylene (127-18-4)	X			<0.005						1	mg/L				
25V. Toluene (108-88-3)	X			<0.005						1	mg/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			<0.005						1	mg/L				
27V. 1,1,1-Trichloro-ethane (71-55-6)	X			<0.005						1	mg/L				
28V. 1,1,2-Trichloro-ethane (79-00-5)	X			<0.005						1	mg/L				
29V Trichloro-ethylene (79-01-6)	X			<0.005						1	mg/L				
30V. Trichloro-fluoromethane (75-69-4)				N/A						0					
31V. Vinyl Chloride (75-01-4)	X			<0.002						1	mg/L				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			<0.009						1	mg/L				
2A. 2,4-Dichloro-phenol (120-83-2)	X			<0.009						1	mg/L				
3A. 2,4-Dimethyl-phenol (105-67-9)	X			<0.009						1	mg/L				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			<0.047						1	mg/L				
5A. 2,4-Dinitro-phenol (51-28-5)	X			<0.047						1	mg/L				
6A. 2-Nitrophenol (88-75-5)	X			<0.009						1	mg/L				
7A. 4-Nitrophenol (100-02-7)	X			<0.047						1	mg/L				
8A. P-Chloro-M-Cresol (59-50-7)	X			<0.009						1	mg/L				
9A. Pentachloro-phenol (87-86-5)	X			<0.023						1	mg/L				
10A. Phenol (108-95-2)	X			<0.009						1	mg/L				
11A. 2,4,6-Trichloro-phenol (88-05-2)	X			<0.009						1	mg/L				

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)				N/A						0					
2B. Acenaphtylene (208-96-8)				N/A						0					
3B. Anthracene (120-12-7)				N/A						0					
4B. Benzidine (92-87-5)				N/A						0					
5B. Benzo (*a*) Anthracene (56-55-3)				N/A						0					
6B. Benzo (*a*) Pyrene (50-32-8)				N/A						0					
7B. 3,4-Benzo-fluoranthene (205-99-2)				N/A						0					
8B. Benzo (*ghi*) Perylene (191-24-2)				N/A						0					
9B. Benzo (*k*) Fluoranthene (207-08-9)				N/A						0					
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)				N/A						0					
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)				N/A						0					
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)				N/A						0					
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)				N/A						0					
14B. 4-Bromophenyl Phenyl Ether (101-55-3)				N/A						0					
15B. Butyl Benzyl Phthalate (85-68-7)				N/A						0					
16B. 2-Chloro-naphthalene (91-58-7)				N/A						0					
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)				N/A						0					
18B. Chrysene (218-01-9)				N/A						0					
19B. Dibenzo (*a,h*) Anthracene (53-70-3)				N/A						0					
20B. 1,2-Dichloro-benzene (95-50-1)				N/A						0					
21B. 1,3-Di-chloro-benzene (541-73-1)				N/A						0					

CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)				N/A						0					
23B. 3,3-Dichloro-benzidine (91-94-1)				N/A						0					
24B. Diethyl Phthalate (84-66-2)				N/A						0					
25B. Dimethyl Phthalate (131 -11-3)				N/A						0					
26B. Di-N-Butyl Phthalate (84-74-2)				N/A						0					
27B. 2,4-Dinitro-toluene (121-14-2)				N/A						0					
28B. 2,6-Dinitro-toluene (606-20-2)				N/A						0					
29B. Di-N-Octyl Phthalate (117-84-0)				N/A						0					
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)				N/A						0					
31B. Fluoranthene (206-44-0)				N/A						0					
32B. Fluorene (86-73-7)				N/A						0					
33B. Hexachloro-benzene (118-74-1)				N/A						0					
34B. Hexachloro-butadiene (87-68-3)				N/A						0					
35B. Hexachloro-cyclopentadiene (77-47-4)				N/A						0					
36B Hexachloro-ethane (67-72-1)				N/A						0					
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)				N/A						0					
38B. Isophorone (78-59-1)				N/A						0					
39B. Naphthalene (91-20-3)				N/A						0					
40B. Nitrobenzene (98-95-3)				N/A						0					
41B. N-Nitro-sodimethylamine (62-75-9)				N/A						0					
42B. N-Nitrosodi-N-Propylamine (621-64-7)				N/A						0					

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)				N/A						0					
44B. Phenanthrene (85-01-8)				N/A						0					
45B. Pyrene (129-00-0)				N/A						0					
46B. 1,2,4-Tri-chlorobenzene (120-82-1)				N/A						0					
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				N/A						0					
2P. α-BHC (319-84-6)				N/A						0					
3P. β-BHC (319-85-7)				N/A						0					
4P. γ-BHC (58-89-9)				N/A						0					
5P. δ-BHC (319-86-8)				N/A						0					
6P. Chlordane (57-74-9)				N/A						0					
7P. 4,4'-DDT (50-29-3)				N/A						0					
8P. 4,4'-DDE (72-55-9)				N/A						0					
9P. 4,4'-DDD (72-54-8)				N/A						0					
10P. Dieldrin (60-57-1)				N/A						0					
11P. α-Enosulfan (115-29-7)				N/A						0					
12P. β-Endosulfan (115-29-7)				N/A						0					
13P. Endosulfan Sulfate (1031-07-8)				N/A						0					
14P. Endrin (72-20-8)				N/A						0					
15P. Endrin Aldehyde (7421-93-4)				N/A						0					
16P. Heptachlor (76-44-8)				N/A						0					

CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	002-LVWW Effluent

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)				N/A						0					
18P. PCB-1242 (53469-21-9)				N/A						0					
19P. PCB-1254 (11097-69-1)				N/A						0					
20P. PCB-1221 (11104-28-2)				N/A						0					
21P. PCB-1232 (11141-16-5)				N/A						0					
22P. PCB-1248 (12672-29-6)				N/A						0					
23P. PCB-1260 (11096-82-5)				N/A						0					
24P. PCB-1016 (12674-11-2)				N/A						0					
25P. Toxaphene (8001-35-2)				N/A						0					

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'?05) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR002R
Sample Date/Time : 13-Feb-18 8:50 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Ash Pond Discharge
DSN002 Repermitting

Laboratory ID Number: AY03740

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
	Metals, Cyanide, Total Phenols									
*	Mercury, Total by CVAF	ABB	2/20/2018	EPA 245 7		1	0.9	5	11.9	ng/L
	Cyanide, Total, by TTL	MTL	2/19/2018	SM 4500-CN CE		1		0.01	< 0.010	mg/L
	Phenol, Total, by TTL	KMC	3/2/2018	SM 5330		1		0.1	< 0.10	mg/L
	General Characteristics									
	Flow (MGD)	GFH/	2/13/2018	Field Data		1			18.7	MGD
	Field Temperature	GFH/	2/13/2018	SM-2550		1			14.0	Deg C
	Field pH	GFH/	2/13/2018	SM-4500H		1			7.76	SU
	Field Sulfite	GFH/	2/13/2018	HACH 8216		1	4		Not Detected	mg/l
	Chlorine, Total Residual	GFH/	2/13/2018	Field Test		1	0.05		Not Detected	mg/L
*	Escherichia Coli (E. Coli)	CES	2/14/2018	SM 9223B		1	1		93.3	MPN/100ml
*	Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1.4	5	< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: Cyanide, Total and Phenol, Total analyses performed by Tuscaloosa Testing Laboratory._fkk 2/14/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ________ Supervision ________

Reported:3/6/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
¯*X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

ɪo: TV Davis
Barry Steam Plant

Customer Account : NBAR002R
Sample Date/Time : 14-Feb-18 9:01 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Ash Pond Discharge
DSN002 Repermitting 2C

Laboratory ID Number: AY03860

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
ˈrans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

To: TV Davis
Barry Steam Plant

Customer Account : NBAR002R
Sample Date/Time : 14-Feb-18 9:01 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Ash Pond Discharge
DSN002 Repermitting 2C

Laboratory ID Number: AY03860

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01		< 0.010	mg/l
	Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	2/15/2018	EPA 1638		1				2/15/2018	DATE
*	Aluminum, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.003379	0.01015		0.153	mg/L
*	Antimony, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00466	mg/L
*	Arsenic, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00901	mg/L
	Barium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.211	mg/L
	Beryllium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
*	Boron, Total	HRG	2/15/2018	EPA 200.7		1.015	0.033799	0.1015		0.989	mg/L
*	Cadmium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
*	Chromium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00165	mg/L
*	Cobalt, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
*	Copper, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00132	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision**____________________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR002R
Sample Date/Time : 14-Feb-18 9:01 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Ash Pond Discharge
DSN002 Repermitting 2C

Laboratory ID Number: AY03860

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Iron, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000545	0.001634		0.155	mg/L
* Lead, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
Magnesium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.169505	0.5075		7.79	mg/L
* Manganese, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0250	mg/L
* Molybdenum, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0873	mg/L
* Nickel, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00207	mg/L
* Selenium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0228	mg/L
* Silver, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
* Thallium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000208	mg/L
Tin, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
Titanium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00586	mg/L
* Zinc, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00167	mg/L
General Characteristics										
* Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5		< 2.5	mg/L
Biochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	0			0.9	mg/L
BOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1				0805	
* Bromide	CES	2/20/2018	EPA 300.0		1	0.04	0.08		0.54	mg/L
* Fluoride	CES	2/20/2018	EPA 300.0		1	0.01	0.04		0.41	mg/L
* Sulfate	CES	2/20/2018	EPA 300.0		1	0.04	1		55.0	mg/L
Color, by TTL	TRT	2/15/2018	SM 2120 E		1		10		< 10	ADMI
* Nitrogen, Nitrate/Nitrite	ABB	2/20/2018	EPA 353.2		1	0.1	0.3		0.40	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____________________ **Supervision**____________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR002R
Sample Date/Time : 14-Feb-18 9:01 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Ash Pond Discharge
DSN002 Repermitting 2C

Laboratory ID Number: AY03860

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Nitrogen, Total Organic	GMW	3/9/2018	EPA 351.3		1	0.1			< 1	mg/l as N
Sulfide, by TTL	TRT	2/20/2018	SM4500 S2 D		1		0.01		< 0.01	mg/l
Surfactants (Foaming Agents), by TTL	KJG	2/15/2018	SM 5540C		1		0.05		0.07	mg/l
* Phosphorus, Total	CNJ	2/22/2018	SM 4500PE-TP		1	0.01	0.03		< 0.03	mg/L
* Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		1	0.1	0.3	R	Not Detected	mg/L as N
* Nitrogen, Total Kjeldahl	GMW	3/7/2018	EPA 351.2		1	0.156	1		< 1	mg/L as N
Total Organic Carbon	DLJ	2/19/2018	SM 5310 B		1	0.5	2		3.18	mg/L
Chemical Oxygen Demand, by TTL	TLM	2/20/2018	SM 5220 D		1		5		11.0	mg/L
Acid Compounds										
2-Chlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/l
2,4-Dichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
2,4-Dimethylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
4,6-Dinitro-2-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
2,4-Dinitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
2-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
4-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/L
4-chloro-3-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
Pentachlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.023		< 0.023	mg/L
Phenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
2,4,6-Trichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control [signature] Supervision [signature]

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

Definitions

Alabama Power
Lab & Field Services

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range.
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

V. INTAKE AND EFFLUENT CHARACTERISTICS (*continued from page 3 of Form 2-C*)

OUTFALL NO.
002-Dewatering Photic

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	<2.0				<2.0		3	mg/L				
b. Chemical Oxygen Demand (*COD*)	16.2				15.2		3	mg/L				
c. Total Organic Carbon (*TOC*)	<1				<1		3	mg/L				
d. Total Suspended Solids (*TSS*)	<2.5				<2.5		3	mg/L				
e. Ammonia (*as N*)	<0.15				<0.15		3	mg/L				
f. Flow	VALUE 5.76		VALUE		VALUE 5.76		System Design Flow	MGD		VALUE		
g. Temperature (*winter*)	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature (*summer*)	VALUE 22.2		VALUE		VALUE 22.2		3	°C		VALUE		
i. pH	MINIMUM 6.4	MAXIMUM 6.7	MINIMUM	MAXIMUM			3	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)			2.81				2.30		3	mg/L				
b. Chlorine, Total Residual		X												
c. Color			22.0				18.0		3	ADMI				
d. Fecal Coliform			1.0				<1.0		3	MPN/100				
e. Fluoride (16984-48-8)			0.45				0.42		3	mg/L				
f. Nitrate-Nitrite (*as N*)			0.35				0.12		3	mg/L				

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)			0.0				0.0		3	mg/L				
h. Oil and Grease			<5				<5		3	mg/L				
i. Phosphorus (as P), Total (7723-14-0)			<0.03				<0.03		3	mg/L				
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (*as SO_4*) (14808-79-8)			128				101.1		3	mg/L				
l. Sulfide (*as S*)			<0.01				<0.01		3	mg/L				
m. Sulfite (*as SO_3*) (14265-45-3)			2				1.6		3	mg/L				
n. Surfactants			<0.05				<0.05		3	mg/L				
o. Aluminum, Total (7429-90-5)			<0.013				<0.013		3	mg/L				
p. Barium, Total (7440-39-3)			0.181				0.149		3	mg/L				
q. Boron, Total (7440-42-8)			1.4				1.07		3	mg/L				
r. Cobalt, Total (7440-48-4)			0.00031				0.00020		3	mg/L				
s. Iron, Total (7439-89-6)			0.332				0.197		3	mg/L				
t. Magnesium, Total (7439-95-4)			8.21				6.69		3	mg/L				
u. Molybdenum, Total (7439-98-7)			0.0169				0.008		3	mg/L				
v. Manganese, Total (7439-96-5)			0.208				0.129		3	mg/L				
w. Tin, Total (7440-31-5)			0.00743				0.00350		3	mg/L				
x. Titanium, Total (7440-32-6)			<0.001				<0.001		3	mg/L				

 CONTINUE ON PAGE V-3

	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
CONTINUED FROM PAGE 3 OF FORM 2-C	ALD082148800	002-Dewatering Photic

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			0.000289				0.000192		3	mg/L				
2M. Arsenic, Total (7440-38-2)	X			0.00136				0.00081		3	mg/L				
3M. Beryllium, Total (7440-41-7)	X			<0.0002				<0.0002		3	mg/L				
4M. Cadmium, Total (7440-43-9)	X			<0.0002				<0.0002		3	mg/L				
5M. Chromium, Total (7440-47-3)	X			0.000635				0.00043		3	mg/L				
6M. Copper, Total (7440-50-8)	X			0.002				0.00184		3	mg/L				
7M. Lead, Total (7439-92-1)	X			<0.0002				<0.0002		3	mg/L				
8M. Mercury, Total (7439-97-6)	X			<0.000005				<0.000005		3	mg/L				
9M. Nickel, Total (7440-02-0)	X			0.00375				0.0029		3	mg/L				
10M. Selenium, Total (7782-49-2)	X			0.0132				0.0117		3	mg/L				
11M. Silver, Total (7440-22-4)	X			<0.0002				<0.0002		3	mg/L				
12M. Thallium, Total (7440-28-0)	X			<0.0002				<0.0002		3	mg/L				
13M. Zinc, Total (7440-66-6)	X			0.0171				0.0137		3	mg/L				
14M. Cyanide, Total (57-12-5)	X			<0.010				<0.010		3	mg/L				
15M. Phenols, Total	X			<0.10				<0.10		3	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X			<0.100				<0.100		3	mg/L				
2V. Acrylonitrile (107-13-1)	X			<0.100				<0.100		3	mg/L				
3V. Benzene (71-43-2)	X			<0.005				<0.005		3	mg/L				
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				N/A						0					
5V. Bromoform (75-25-2)	X			<0.005				<0.005		3	mg/L				
6V. Carbon Tetrachloride (56-23-5)	X			<0.005				<0.005		3	mg/L				
7V. Chlorobenzene (108-90-7)	X			<0.005				<0.005		3	mg/L				
8V. Chlorodi-bromomethane (124-48-1)	X			<0.005				<0.005		3	mg/L				
9V. Chloroethane (75-00-3)			X												
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			<0.010				<0.010		3	mg/L				
11V. Chloroform (67-66-3)	X			<0.005				<0.005		3	mg/L				
12V. Dichloro-bromomethane (75-27-4)	X			<0.005				<0.005		3	mg/L				
13V. Dichloro-difluoromethane (75-71-8)				N/A						0					
14V. 1,1-Dichloro-ethane (75-34-3)	X			<0.005				<0.005		3	mg/L				
15V. 1,2-Dichloro-ethane (107-06-2)	X			<0.005				<0.005		3	mg/L				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			<0.005				<0.005		3	mg/L				
17V. 1,2-Dichloro-propane (78-87-5)	X			<0.005				<0.005		3	mg/L				
18V. 1,3-Dichloro-propylene (542-75-6)	X			<0.005				<0.005		3	mg/L				
19V. Ethylbenzene (100-41-4)	X			<0.005				<0.005		3	mg/L				
20V. Methyl Bromide (74-83-9)	X			<0.010				<0.010		3	mg/L				
21V. Methyl Chloride (74-87-3)			X												

 CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X			<0.005				<0.005		3	mg/L				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			<0.005				<0.005		3	mg/L				
24V. Tetrachloro-ethylene (127-18-4)	X			<0.005				<0.005		3	mg/L				
25V. Toluene (108-88-3)	X			<0.005				<0.005		3	mg/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			<0.005				<0.005		3	mg/L				
27V. 1,1,1-Trichloro-ethane (71-55-6)	X			<0.005				<0.005		3	mg/L				
28V. 1,1,2-Trichloro-ethane (79-00-5)	X			<0.005				<0.005		3	mg/L				
29V Trichloro-ethylene (79-01-6)	X			<0.005				<0.005		3	mg/L				
30V. Trichloro-fluoromethane (75-69-4)				N/A						0					
31V. Vinyl Chloride (75-01-4)	X			<0.002				<0.002		3	mg/L				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			<0.010				<0.0098		3	mg/L				
2A. 2,4-Dichloro-phenol (120-83-2)	X			<0.010				<0.0098		3	mg/L				
3A. 2,4-Dimethyl-phenol (105-67-9)	X			<0.010				<0.0098		3	mg/L				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			<0.010				<0.0098		3	mg/L				
5A. 2,4-Dinitro-phenol (51-28-5)	X			<0.030				<0.030		3	mg/L				
6A. 2-Nitrophenol (88-75-5)	X			<0.010				<0.0098		3	mg/L				
7A. 4-Nitrophenol (100-02-7)	X			<0.010				<0.0098		3	mg/L				
8A. P-Chloro-M-Cresol (59-50-7)	X			<0.010				<0.0098		3	mg/L				
9A. Pentachloro-phenol (87-86-5)	X			<0.020				<0.020		3	mg/L				
10A. Phenol (108-95-2)	X			<0.010				<0.0098		3	mg/L				
11A. 2,4,6-Trichloro-phenol (88-05-2)	X			<0.010				<0.0098		3	mg/L				

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)				N/A						0					
2B. Acenaphtylene (208-96-8)				N/A						0					
3B. Anthracene (120-12-7)				N/A						0					
4B. Benzidine (92-87-5)				N/A						0					
5B. Benzo (*a*) Anthracene (56-55-3)				N/A						0					
6B. Benzo (*a*) Pyrene (50-32-8)				N/A						0					
7B. 3,4-Benzo-fluoranthene (205-99-2)				N/A						0					
8B. Benzo (*ghi*) Perylene (191-24-2)				N/A						0					
9B. Benzo (*k*) Fluoranthene (207-08-9)				N/A						0					
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)				N/A						0					
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)				N/A						0					
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)				N/A						0					
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)				N/A						0					
14B. 4-Bromophenyl Phenyl Ether (101-55-3)				N/A						0					
15B. Butyl Benzyl Phthalate (85-68-7)				N/A						0					
16B. 2-Chloro-naphthalene (91-58-7)				N/A						0					
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)				N/A						0					
18B. Chrysene (218-01-9)				N/A						0					
19B. Dibenzo (*a,h*) Anthracene (53-70-3)				N/A						0					
20B. 1,2-Dichloro-benzene (95-50-1)				N/A						0					
21B. 1,3-Di-chloro-benzene (541-73-1)				N/A						0					

 CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)				N/A						0					
23B. 3,3-Dichloro-benzidine (91-94-1)				N/A						0					
24B. Diethyl Phthalate (84-66-2)				N/A						0					
25B. Dimethyl Phthalate (131 -11-3)				N/A						0					
26B. Di-N-Butyl Phthalate (84-74-2)				N/A						0					
27B. 2,4-Dinitro-toluene (121-14-2)				N/A						0					
28B. 2,6-Dinitro-toluene (606-20-2)				N/A						0					
29B. Di-N-Octyl Phthalate (117-84-0)				N/A						0					
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)				N/A						0					
31B. Fluoranthene (206-44-0)				N/A						0					
32B. Fluorene (86-73-7)				N/A						0					
33B. Hexachloro-benzene (118-74-1)				N/A						0					
34B. Hexachloro-butadiene (87-68-3)				N/A						0					
35B. Hexachloro-cyclopentadiene (77-47-4)				N/A						0					
36B Hexachloro-ethane (67-72-1)				N/A						0					
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)				N/A						0					
38B. Isophorone (78-59-1)				N/A						0					
39B. Naphthalene (91-20-3)				N/A						0					
40B. Nitrobenzene (98-95-3)				N/A						0					
41B. N-Nitro-sodimethylamine (62-75-9)				N/A						0					
42B. N-Nitrosodi-N-Propylamine (621-64-7)				N/A						0					

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)				N/A						0					
44B. Phenanthrene (85-01-8)				N/A						0					
45B. Pyrene (129-00-0)				N/A						0					
46B. 1,2,4-Tri-chlorobenzene (120-82-1)				N/A						0					
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				N/A						0					
2P. α-BHC (319-84-6)				N/A						0					
3P. β-BHC (319-85-7)				N/A						0					
4P. γ-BHC (58-89-9)				N/A						0					
5P. δ-BHC (319-86-8)				N/A						0					
6P. Chlordane (57-74-9)				N/A						0					
7P. 4,4'-DDT (50-29-3)				N/A						0					
8P. 4,4'-DDE (72-55-9)				N/A						0					
9P. 4,4'-DDD (72-54-8)				N/A						0					
10P. Dieldrin (60-57-1)				N/A						0					
11P. α-Enosulfan (115-29-7)				N/A						0					
12P. β-Endosulfan (115-29-7)				N/A						0					
13P. Endosulfan Sulfate (1031-07-8)				N/A						0					
14P. Endrin (72-20-8)				N/A						0					
15P. Endrin Aldehyde (7421-93-4)				N/A						0					
16P. Heptachlor (76-44-8)				N/A						0					

CONTINUE ON PAGE V-9

CONTINUED FROM PAGE V-8

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	002-Dewatering Photic

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)				N/A						0					
18P. PCB-1242 (53469-21-9)				N/A						0					
19P. PCB-1254 (11097-69-1)				N/A						0					
20P. PCB-1221 (11104-28-2)				N/A						0					
21P. PCB-1232 (11141-16-5)				N/A						0					
22P. PCB-1248 (12672-29-6)				N/A						0					
23P. PCB-1260 (11096-82-5)				N/A						0					
24P. PCB-1016 (12674-11-2)				N/A						0					
25P. Toxaphene (8001-35-2)				N/A						0					

Alabama Power
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' (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Upper Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10848

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/L
.loroform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

cc:

.lity Control ______________________ **Supervision**___________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
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Calera, AL 35040
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Χ (205) 257-1654

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Alabama Power

Lab Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Upper Pond Photic Zone Treated CCR Ash Pond 2C Survey

Laboratory ID Number: AX10848

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Ethylbenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichloropropylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Trichloroethylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
*	Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013	U	Not Detected	mg/L
*	Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
*	Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
*	Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.107	mg/L
*	Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
*	Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		0.816	mg/L
	admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		44.7	mg/L
*	Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000635	mg/L
*	Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000301	mg/L
*	Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.002	mg/L
	Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.332	mg/L
*	Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

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Lab & Field SERVICES

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Customer Account : BARUPPPT
Sample Date : 09-May-17
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Delivery Date : 10-May-17

Description: Barry Upper Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10848

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		4.83	mg/L
* Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.208	mg/L
* Mercury, Total by CVAF	JCC	5/17/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
* Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.00122	mg/L
* Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.00345	mg/L
* Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.0127	mg/L
* Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		85.4	mg/L
* Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.0028	mg/L
Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
* Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.010	mg/L
Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
Phenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
General Characteristics										
Field Temperature	JBM	5/9/2017	SM-2550		1				22.08	Deg. C.
FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
Field pH	JBM	5/9/2017	SM-4500H		1				6.62	SU
Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			1.2	mg/l
Field Conductivity	JBM	5/9/2017	SM-2510		1				735.2	umhos/cm

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Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

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Sample Date : 09-May-17
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Delivery Date : 10-May-17

Description: Barry Upper Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10848

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				94.6	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.27	mg/L
	pH	DLJ	5/12/2017	SM 4500H+ B		1	0.01			6.88	SU
	Alkalinity, Total as CaCO3	DLJ	5/12/2017	SM 2320 B		1	0.1			5.7	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/12/2017	SM 4500CO2 D		1	0.1			5.7	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				132	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		2.81	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		154	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.45	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		1	0.04	1		82.2	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		22.0	ADMI
*	Escherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0			1.0	MPN/100ml
	itrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.2		0.35	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/17/2017	SM 4500PE-TP		1	0.010	0.03	U	Not Detected	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				0.350	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.050	0.15	U	Not Detected	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

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ılity Control ______________________ **Supervision**____________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'?05) 664 - 6032 or 6171
((205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Upper Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10848

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
*	Nitrogen, Total Kjeldahl	GMW	5/17/2017	EPA 351.2		1	0.225	0.300	U	Not Detected	mg/L as N
*	Total Organic Carbon	KRC	5/12/2017	SM 5310 C		1	0.30	1		< 1	mg/L
	Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0		13.3	mg/L
	Acid Compounds										
	2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		29		< 29	ug/L
	2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		19		< 19	ug/L
	Phenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.6		< 9.6	ug/L
	Miscellaneous										
	Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1				05/16/2017	

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

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Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Mid Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10849

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/L
hloroform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Recovery is out of range for Total Organic Carbon. TBW 05/30/2017

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ality Control ____________________ **Supervision**____________________

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Version: 4.2

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General Test Laboratory
744 County Road 87, GSC #8
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((205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Mid Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10849

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Ethylbenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichloropropylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Trichloroethylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
*	Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013	U	Not Detected	mg/L
*	Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000289	mg/L
*	Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00136	mg/L
*	Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.181	mg/L
*	Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
*	Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		1.40	mg/L
	admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		56.1	mg/L
*	Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000277	mg/L
*	Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00031	mg/L
*	Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00175	mg/L
	Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.102	mg/L
*	Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

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Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Recovery is out of range for Total Organic Carbon. TBW 05/30/2017

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ality Control ____________________ **Supervision**____________________

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Version: 4.2

Alabama Power
General Test Laboratory
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Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Mid Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10849

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		8.21	mg/L
*	Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.105	mg/L
*	Mercury, Total by CVAF	JCC	5/17/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
*	Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.00588	mg/L
*	Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.00375	mg/L
*	Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.0132	mg/L
*	Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		78.9	mg/L
*	Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
	Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00743	mg/L
	Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
*	Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.0171	mg/L
	Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
	Phenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
	General Characteristics										
	Field Temperature	JBM	5/9/2017	SM-2550		1				22.23	Deg. C.
	FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
	Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
	Field pH	JBM	5/9/2017	SM-4500H		1				6.45	SU
	Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			1.6	mg/l
	Field Conductivity	JBM	5/9/2017	SM-2510		1				947.2	umhos/cm

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Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Recovery is out of range for Total Organic Carbon. TBW 05/30/2017

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Reported:8/28/2017
Version: 4.2

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General Test Laboratory
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CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Mid Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10849

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				120.1	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.01	mg/L
	pH	DLJ	5/12/2017	SM 4500H+ B		1	0.01			6.90	SU
	Alkalinity, Total as CaCO3	DLJ	5/12/2017	SM 2320 B		1	0.1			9.3	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/12/2017	SM 4500CO2 D		1	0.1			9.3	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				174	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		2.06	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		141	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.41	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		128	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		14.0	ADMI
*	Escherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0		U	Not Detected	MPN/100ml
*	Nitrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.20	U	Not Detected	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/17/2017	SM 4500PE-TP		1	0.010	0.03	U	Not Detected	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				Not Detected	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.050	0.15	U	Not Detected	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Recovery is out of range for Total Organic Carbon. TBW 05/30/2017

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Quality Control ______________________ **Supervision**__________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
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Calera, AL 35040
(?05) 664 - 6032 or 6171
((205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Mid Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10849

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
* Nitrogen, Total Kjeldahl	GMW	5/17/2017	EPA 351.2		1	0.225	0.300	U	Not Detected	mg/L as N
* Total Organic Carbon	KRC	5/12/2017	SM 5310 C		1	0.30	1		< 1	mg/L
Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0		16.2	mg/L
Acid Compounds										
2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		30		< 30	ug/L
2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		20		< 20	ug/L
Phenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
,4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.8		< 9.8	ug/L
Miscellaneous										
Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1				05/16/2017	

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Recovery is out of range for Total Organic Carbon. TBW 05/30/2017

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ality Control ______________________ **Supervision**______________________

Reported:8/28/2017
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General Test Laboratory
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Calera, AL 35040
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: (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Lower Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10850

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/11/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/L
nloroform, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/11/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/11/2017	EPA 624		1		0.010	< 0.010	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

cc:

ılity Control ______________________ **Supervision**____________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Lower Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10850

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Ethylbenzene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichloropropylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Trichloroethylene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	5/11/2017	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
*	Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013	U	Not Detected	mg/L
*	Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000288	mg/L
*	Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00107	mg/L
*	Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.159	mg/L
*	Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
*	Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		1.00	mg/L
	admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		48.5	mg/L
*	Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000385	mg/L
*	Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
*	Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00177	mg/L
	Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.156	mg/L
*	Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

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Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWPT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Lower Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10850

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		7.03	mg/L
*	Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.0728	mg/L
*	Mercury, Total by CVAF	JCC	5/17/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
*	Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.0169	mg/L
*	Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.00136	mg/L
*	Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.00933	mg/L
*	Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		80.1	mg/L
*	Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
	Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000284	mg/L
	Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
*	Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.0139	mg/L
	Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
	Phenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
	General Characteristics										
	Field Temperature	JBM	5/9/2017	SM-2550		1				22.15	Deg. C.
	FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
	Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
	Field pH	JBM	5/9/2017	SM-4500H		1				6.74	SU
	Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			2.0	mg/l
	Field Conductivity	JBM	5/9/2017	SM-2510		1				692.7	umhos/cm

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Customer ID: CCR2C2017
Delivery Date : 10-May-17

Description: Barry Lower Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10850

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				88.4	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.12	mg/L
	pH	DLJ	5/12/2017	SM 4500H+ B		1	0.01			7.52	SU
	Alkalinity, Total as CaCO3	DLJ	5/12/2017	SM 2320 B		1	0.1			16.2	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/12/2017	SM 4500CO2 D		1	0.1			16.1	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				150	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		2.04	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		136	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.40	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		1	0.04	1		93.2	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		18.0	ADMI
*	Escherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0		U	Not Detected	MPN/100ml
	itrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.20	U	Not Detected	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/17/2017	SM 4500PE-TP		1	0.010	0.03	U	Not Detected	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				< 0.3	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.050	0.15	U	Not Detected	mg/L as N

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Delivery Date : 10-May-17

Description: Barry Lower Pond Photic Zone Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10850

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
* Nitrogen, Total Kjeldahl	GMW	5/17/2017	EPA 351.2		1	0.225	0.3	< 0.3	mg/L as N
* Total Organic Carbon	KRC	5/15/2017	SM 5310 C		1	0.30	1	< 1	mg/L
Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0	16.2	mg/L
Acid Compounds									
2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		30	< 30	ug/L
2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		20	< 20	ug/L
Phenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		10	< 10	ug/L
Miscellaneous									
Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1			05/16/2017	

MDL's and RL's are adjusted for sample dilution, as applicable

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Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

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Definitions

Alabama Power
Lab & Field SERVICES

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range.
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
ALD082148800

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
002 Dewatering - Interstitial

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	<2.0				<2.0		3	mg/L				
b. Chemical Oxygen Demand (*COD*)	16.2				13.3		3	mg/L				
c. Total Organic Carbon (*TOC*)	<1				<1		3	mg/L				
d. Total Suspended Solids (*TSS*)	<2.5				<2.5		3	mg/L				
e. Ammonia (*as N*)	1.6				0.69		3	mg/L				
f. Flow	VALUE 5.76		VALUE		VALUE 5.76		System Design Flow	MGD		VALUE		
g. Temperature (*winter*)	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature (*summer*)	VALUE 21.6		VALUE		VALUE 21.4		3	°C		VALUE		
i. pH	MINIMUM 6.6	MAXIMUM 6.6	MINIMUM	MAXIMUM			3	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)			2.70				2.24		3	mg/L				
b. Chlorine, Total Residual		X												
c. Color			32.0				20.0		3	ADMI				
d. Fecal Coliform			0				0		3	MPN/100				
e. Fluoride (16984-48-8)			0.47				0.42		3	mg/L				
f. Nitrate-Nitrite (*as N*)			0.22				0.073		3	mg/L				

CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)			0.40				0.290		3	mg/L				
h. Oil and Grease			<5				<5		3	mg/L				
i. Phosphorus (as P), Total (7723-14-0)			<0.03				<0.03		3	mg/L				
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (*as* SO_4) (14808-79-8)			99.3				90.0		3	mg/L				
l. Sulfide (*as S*)			<0.01				<0.01		3	mg/L				
m. Sulfite (*as* SO_3) (14265-45-3)			2.4				1.5		3	mg/L				
n. Surfactants			<0.05				<0.05		3	mg/L				
o. Aluminum, Total (7429-90-5)			<0.013				<0.013		3	mg/L				
p. Barium, Total (7440-39-3)			0.594				0.333		3	mg/L				
q. Boron, Total (7440-42-8)			1.38				1.10		3	mg/L				
r. Cobalt, Total (7440-48-4)			0.000455				0.00015		3	mg/L				
s. Iron, Total (7439-89-6)			0.571				0.323		3	mg/L				
t. Magnesium, Total (7439-95-4)			8.33				7.61		3	mg/L				
u. Molybdenum, Total (7439-98-7)			0.036				0.0338		3	mg/L				
v. Manganese, Total (7439-96-5)			0.467				0.27		3	mg/L				
w. Tin, Total (7440-31-5)			0.00332				0.00184		3	mg/L				
x. Titanium, Total (7440-32-6)			<0.001				<0.001		3	mg/L				

CONTINUE ON PAGE V-3

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	002 Dewatering - Interstitial

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			0.00656				0.00333		3	mg/L				
2M. Arsenic, Total (7440-38-2)	X			0.0126				0.0052		3	mg/L				
3M. Beryllium, Total (7440-41-7)	X			<0.0002				<0.0002		3	mg/L				
4M. Cadmium, Total (7440-43-9)	X			<0.0002				<0.0002		3	mg/L				
5M. Chromium, Total (7440-47-3)	X			0.00108				0.000618		3	mg/L				
6M. Copper, Total (7440-50-8)	X			0.00206				0.00161		3	mg/L				
7M. Lead, Total (7439-92-1)	X			<0.0002				<0.0002		3	mg/L				
8M. Mercury, Total (7439-97-6)	X			<0.000005				<0.000005		3	mg/L				
9M. Nickel, Total (7440-02-0)	X			0.00448				0.0026		3	mg/L				
10M. Selenium, Total (7782-49-2)	X			0.0109				0.00835		3	mg/L				
11M. Silver, Total (7440-22-4)	X			<0.0002				<0.0002		3	mg/L				
12M. Thallium, Total (7440-28-0)	X			<0.0002				<0.0002		3	mg/L				
13M. Zinc, Total (7440-66-6)	X			0.0477				0.0272		3	mg/L				
14M. Cyanide, Total (57-12-5)	X			<0.010				<0.010		3	mg/L				
15M. Phenols, Total	X			<0.10				<0.10		3	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X			<0.100				<0.100		3	mg/L				
2V. Acrylonitrile (107-13-1)	X			<0.100				<0.100		3	mg/L				
3V. Benzene (71-43-2)	X			<0.005				<0.005		3	mg/L				
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				N/A						0					
5V. Bromoform (75-25-2)	X			<0.005				<0.005		3	mg/L				
6V. Carbon Tetrachloride (56-23-5)	X			<0.005				<0.005		3	mg/L				
7V. Chlorobenzene (108-90-7)	X			<0.005				<0.005		3	mg/L				
8V. Chlorodi-bromomethane (124-48-1)	X			<0.005				<0.005		3	mg/L				
9V. Chloroethane (75-00-3)			X												
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			<0.010				<0.010		3	mg/L				
11V. Chloroform (67-66-3)	X			<0.005				<0.005		3	mg/L				
12V. Dichloro-bromomethane (75-27-4)	X			<0.005				<0.005		3	mg/L				
13V. Dichloro-difluoromethane (75-71-8)				N/A						0					
14V. 1,1-Dichloro-ethane (75-34-3)	X			<0.005				<0.005		3	mg/L				
15V. 1,2-Dichloro-ethane (107-06-2)	X			<0.005				<0.005		3	mg/L				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			<0.005				<0.005		3	mg/L				
17V. 1,2-Dichloro-propane (78-87-5)	X			<0.005				<0.005		3	mg/L				
18V. 1,3-Dichloro-propylene (542-75-6)	X			<0.005				<0.005		3	mg/L				
19V. Ethylbenzene (100-41-4)	X			<0.005				<0.005		3	mg/L				
20V. Methyl Bromide (74-83-9)	X			<0.010				<0.010		3	mg/L				
21V. Methyl Chloride (74-87-3)			X												

CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X			<0.005				<0.005		3	mg/L				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			<0.005				<0.005		3	mg/L				
24V. Tetrachloro-ethylene (127-18-4)	X			<0.005				<0.005		3	mg/L				
25V. Toluene (108-88-3)	X			<0.005				<0.005		3	mg/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			<0.005				<0.005		3	mg/L				
27V. 1,1,1-Trichloro-ethane (71-55-6)	X			<0.005				<0.005		3	mg/L				
28V. 1,1,2-Trichloro-ethane (79-00-5)	X			<0.005				<0.005		3	mg/L				
29V Trichloro-ethylene (79-01-6)	X			<0.005				<0.005		3	mg/L				
30V. Trichloro-fluoromethane (75-69-4)				N/A						0					
31V. Vinyl Chloride (75-01-4)	X			<0.002				<0.002		3	mg/L				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			<0.0099				<0.0098		3	mg/L				
2A. 2,4-Dichloro-phenol (120-83-2)	X			<0.0099				<0.0098		3	mg/L				
3A. 2,4-Dimethyl-phenol (105-67-9)	X			<0.0099				<0.0098		3	mg/L				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			<0.0099				<0.0098		3	mg/L				
5A. 2,4-Dinitro-phenol (51-28-5)	X			<0.030				<0.029		3	mg/L				
6A. 2-Nitrophenol (88-75-5)	X			<0.0099				<0.0098		3	mg/L				
7A. 4-Nitrophenol (100-02-7)	X			<0.0099				<0.0098		3	mg/L				
8A. P-Chloro-M-Cresol (59-50-7)	X			<0.0099				<0.0098		3	mg/L				
9A. Pentachloro-phenol (87-86-5)	X			<0.020				<0.019		3	mg/L				
10A. Phenol (108-95-2)	X			<0.0099				<0.0098		3	mg/L				
11A. 2,4,6-Trichloro-phenol (88-05-2)	X			<0.0099				<0.0098		3	mg/L				

 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)				N/A						0					
2B. Acenaphtylene (208-96-8)				N/A						0					
3B. Anthracene (120-12-7)				N/A						0					
4B. Benzidine (92-87-5)				N/A						0					
5B. Benzo (*a*) Anthracene (56-55-3)				N/A						0					
6B. Benzo (*a*) Pyrene (50-32-8)				N/A						0					
7B. 3,4-Benzo-fluoranthene (205-99-2)				N/A						0					
8B. Benzo (*ghi*) Perylene (191-24-2)				N/A						0					
9B. Benzo (*k*) Fluoranthene (207-08-9)				N/A						0					
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)				N/A						0					
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)				N/A						0					
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)				N/A						0					
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)				N/A						0					
14B. 4-Bromophenyl Phenyl Ether (101-55-3)				N/A						0					
15B. Butyl Benzyl Phthalate (85-68-7)				N/A						0					
16B. 2-Chloro-naphthalene (91-58-7)				N/A						0					
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)				N/A						0					
18B. Chrysene (218-01-9)				N/A						0					
19B. Dibenzo (*a,h*) Anthracene (53-70-3)				N/A						0					
20B. 1,2-Dichloro-benzene (95-50-1)				N/A						0					
21B. 1,3-Di-chloro-benzene (541-73-1)				N/A						0					

CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)				N/A						0					
23B. 3,3-Dichloro-benzidine (91-94-1)				N/A						0					
24B. Diethyl Phthalate (84-66-2)				N/A						0					
25B. Dimethyl Phthalate (131 -11-3)				N/A						0					
26B. Di-N-Butyl Phthalate (84-74-2)				N/A						0					
27B. 2,4-Dinitro-toluene (121-14-2)				N/A						0					
28B. 2,6-Dinitro-toluene (606-20-2)				N/A						0					
29B. Di-N-Octyl Phthalate (117-84-0)				N/A						0					
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)				N/A						0					
31B. Fluoranthene (206-44-0)				N/A						0					
32B. Fluorene (86-73-7)				N/A						0					
33B. Hexachloro-benzene (118-74-1)				N/A						0					
34B. Hexachloro-butadiene (87-68-3)				N/A						0					
35B. Hexachloro-cyclopentadiene (77-47-4)				N/A						0					
36B Hexachloro-ethane (67-72-1)				N/A						0					
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)				N/A						0					
38B. Isophorone (78-59-1)				N/A						0					
39B. Naphthalene (91-20-3)				N/A						0					
40B. Nitrobenzene (98-95-3)				N/A						0					
41B. N-Nitro-sodimethylamine (62-75-9)				N/A						0					
42B. N-Nitrosodi-N-Propylamine (621-64-7)				N/A						0					

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)				N/A						0					
44B. Phenanthrene (85-01-8)				N/A						0					
45B. Pyrene (129-00-0)				N/A						0					
46B. 1,2,4-Tri-chlorobenzene (120-82-1)				N/A						0					
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				N/A						0					
2P. α-BHC (319-84-6)				N/A						0					
3P. β-BHC (319-85-7)				N/A						0					
4P. γ-BHC (58-89-9)				N/A						0					
5P. δ-BHC (319-86-8)				N/A						0					
6P. Chlordane (57-74-9)				N/A						0					
7P. 4,4'-DDT (50-29-3)				N/A						0					
8P. 4,4'-DDE (72-55-9)				N/A						0					
9P. 4,4'-DDD (72-54-8)				N/A						0					
10P. Dieldrin (60-57-1)				N/A						0					
11P. α-Enosulfan (115-29-7)				N/A						0					
12P. β-Endosulfan (115-29-7)				N/A						0					
13P. Endosulfan Sulfate (1031-07-8)				N/A						0					
14P. Endrin (72-20-8)				N/A						0					
15P. Endrin Aldehyde (7421-93-4)				N/A						0					
16P. Heptachlor (76-44-8)				N/A						0					

 CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
ALD082148800	002 Dewatering - Interstitial

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)				N/A						0					
18P. PCB-1242 (53469-21-9)				N/A						0					
19P. PCB-1254 (11097-69-1)				N/A						0					
20P. PCB-1221 (11104-28-2)				N/A						0					
21P. PCB-1232 (11141-16-5)				N/A						0					
22P. PCB-1248 (12672-29-6)				N/A						0					
23P. PCB-1260 (11096-82-5)				N/A						0					
24P. PCB-1016 (12674-11-2)				N/A						0					
25P. Toxaphene (8001-35-2)				N/A						0					

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'205) 664 - 6032 or 6171
(205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Upper Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10918

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/L
hloroform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

cc:

ality Control ____________________ **Supervision**____________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'²05) 664 - 6032 or 6171
: (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Upper Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10918

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Ethylbenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
1,3-Dichloropropylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
Trichloroethylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
Methylene Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/l
Toluene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
Metals, Cyanide, Total Phenols										
Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
* Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013		< 0.013	mg/L
* Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00142	mg/L
* Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00065	mg/L
* Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.260	mg/L
* Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
* Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		0.807	mg/L
admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		45.8	mg/L
* Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000299	mg/L
* Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
* Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00111	mg/L
Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.211	mg/L
* Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

cc:

ılity Control ______________________ **Supervision**______________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'"05) 664 - 6032 or 6171
: (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARUPPMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Upper Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10918

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		6.20	mg/L
*	Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.196	mg/L
*	Mercury, Total by CVAF	JCC	5/23/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
*	Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.0331	mg/L
*	Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.0012	mg/L
*	Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.00933	mg/L
*	Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		87.8	mg/L
*	Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00332	mg/L
	Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
*	Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.0217	mg/L
	Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
	ᵖhenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
	General Characteristics										
	Field Temperature	JBM	5/9/2017	SM-2550		1				21.01	Deg. C.
	FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
	Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
	Field pH	JBM	5/9/2017	SM-4500H		1				6.55	SU
	Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			2.4	mg/l
	Field Conductivity	JBM	5/9/2017	SM-2510		1				785.7	umhos/cm

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Description: Barry Upper Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10918

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				130.1	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.63	mg/L
	pH	DLJ	5/19/2017	SM 4500H+ B		1	0.01			7.74	SU
	Alkalinity, Total as CaCO3	DLJ	5/19/2017	SM 2320 B		1	0.1			27.3	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/19/2017	SM 4500CO2 D		1	0.1			27.1	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				140	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		2.70	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		151	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.42	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		1	0.04	1		81.8	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		16.0	ADMI
	¯scherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0		U	Not Detected	MPN/100ml
	ˌitrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.2		0.22	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/17/2017	SM 4500PE-TP		1	0.010	0.03	U	Not Detected	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				0.610	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.05	0.15		< 0.15	mg/L as N

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Lab & Field SERVICES

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Delivery Date : 11-May-17

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CCR Ash Pond 2C Survey

Laboratory ID Number: AX10918

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
*	Nitrogen, Total Kjeldahl	GMW	5/17/2017	EPA 351.2		1	0.225	0.3	0.390	mg/L as N
*	Total Organic Carbon	KRC	5/15/2017	SM 5310 C		1	0.30	1	< 1	mg/L
	Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0	13.3	mg/L
	Acid Compounds									
	2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		29	< 29	ug/L
	2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		19	< 19	ug/L
	`henol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	,4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
	Miscellaneous									
	Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1			05/16/2017	

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Expiration: June 30, 2018

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Alabama Power
Lab & Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Mid Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10919

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/L
hloroform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/l

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Lab & Field SERVICES

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CCR Ash Pond 2C Survey

Laboratory ID Number: AX10919

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Ethylbenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichloropropylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Trichloroethylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
*	Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013		< 0.013	mg/L
*	Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00656	mg/L
*	Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00235	mg/L
*	Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.594	mg/L
*	Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
*	Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		1.38	mg/L
	admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		54.7	mg/L
*	Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000476	mg/L
*	Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.000455	mg/L
*	Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00165	mg/L
	Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.188	mg/L
*	Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

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Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		8.30	mg/L
* Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.467	mg/L
* Mercury, Total by CVAF	JCC	5/23/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
* Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.036	mg/L
* Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.00448	mg/L
* Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.0109	mg/L
* Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		75.1	mg/L
* Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00219	mg/L
Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
* Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.0477	mg/L
Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
Phenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
General Characteristics										
Field Temperature	JBM	5/9/2017	SM-2550		1				21.56	Deg. C.
FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
Field pH	JBM	5/9/2017	SM-4500H		1				6.66	SU
Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			0.8	mg/l
Field Conductivity	JBM	5/9/2017	SM-2510		1				796.2	umhos/cm

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.TBW 05/30/2017

cc:

ality Control ______________________ **Supervision**__________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
05) 664 - 6032 or 6171
(205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

To: Jeremy Driver
Justin Mitchell

Customer Account : BARMIDMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Mid Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10919

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				107.7	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.40	mg/L
	pH	DLJ	5/19/2017	SM 4500H+ B		1	0.01			7.30	SU
	Alkalinity, Total as CaCO3	DLJ	5/19/2017	SM 2320 B		1	0.1			22.1	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/19/2017	SM 4500CO2 D		1	0.1			22.0	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				171	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		1.98	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		150	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.37	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		1	0.04	1		99.3	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		12.0	ADMI
	Escherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0		U	Not Detected	MPN/100ml
	Nitrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.20	U	Not Detected	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/17/2017	SM 4500PE-TP		1	0.010	0.03	U	Not Detected	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				1.68	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.05	0.15		1.6	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

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Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
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Customer ID: CCR2C2017
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Description: Barry Mid Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10919

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
* Nitrogen, Total Kjeldahl	GMW	5/17/2017	EPA 351.2		1	0.225	0.3	1.68	mg/L as N
* Total Organic Carbon	KRC	5/15/2017	SM 5310 C		1	0.30	1	< 1	mg/L
Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0	16.2	mg/L
Acid Compounds									
2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		29	< 29	ug/L
2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		19	< 19	ug/L
Phenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
,4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.7	< 9.7	ug/L
Miscellaneous									
Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1			05/16/2017	

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Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

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CERTIFICATE OF ANALYSIS

Alabama Power
Lab Field Services

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Lower Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10920

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	5/12/2017	EPA 624		1		0.100	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Trans-1,2-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/L
hloroform, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/l
1,2-Dichloropropane, by TTL	LAA	5/12/2017	EPA 624		1		0.005	< 0.005	mg/L
Bromomethane, by TTL	LAA	5/12/2017	EPA 624		1		0.010	< 0.010	mg/l

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Precision and Recovery are out of range for Total Organic Carbon. TBW 05/30/2017

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Alabama Power

Lab Field SERVICES

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Lower Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10920

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Ethylbenzene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichloropropylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Trichloroethylene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	5/12/2017	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	5/12/2017	EPA 1638		1				5/12/2017	DATE
*	Aluminum, Total	DLJ	5/15/2017	EPA 200.8		1	0.00432	0.013		< 0.013	mg/L
*	Antimony, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00202	mg/L
*	Arsenic, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.0126	mg/L
*	Barium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000086	0.000258		0.146	mg/L
*	Beryllium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
*	Boron, Total	HRG	5/23/2017	EPA 200.7		1	0.0333	0.1		1.12	mg/L
	admium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Calcium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		49.4	mg/L
*	Chromium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00108	mg/L
*	Cobalt, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		< 0.0002	mg/L
*	Copper, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.00206	mg/L
	Iron, Total	JHK	5/16/2017	EPA 200.8		1	0.000746	0.00224		0.571	mg/L
*	Lead, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L

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Precision and Recovery are out of range for Total Organic Carbon. TBW 05/30/2017

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CERTIFICATE OF ANALYSIS

Alabama Power

Lab Field Services

To: Jeremy Driver
Justin Mitchell

Customer Account : BARLOWMT
Sample Date : 09-May-17
Customer ID: CCR2C2017
Delivery Date : 11-May-17

Description: Barry Lower Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10920

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Magnesium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		8.33	mg/L
*	Manganese, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002		0.150	mg/L
*	Mercury, Total by CVAF	JCC	5/23/2017	EPA 245.7		1	0.9	5	U	Not Detected	ng/L
*	Molybdenum, Total	DLJ	5/15/2017	EPA 200.8		1	0.000081	0.000243		0.0322	mg/L
*	Nickel, Total	DLJ	5/15/2017	EPA 200.8		1	0.000385	0.00116		0.00197	mg/L
*	Selenium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000077	0.000231		0.00483	mg/L
*	Silver, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Sodium, Total	DLJ	5/15/2017	EPA 200.8		1	0.167	0.5		76.2	mg/L
*	Thallium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Tin, Total	DLJ	5/15/2017	EPA 200.8		1	0.000067	0.0002	U	Not Detected	mg/L
	Titanium, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001	U	Not Detected	mg/L
*	Zinc, Total	DLJ	5/15/2017	EPA 200.8		1	0.000333	0.001		0.0121	mg/L
	Cyanide, Total, by TTL	MTL	5/12/2017	SM 4500-CN CE		1		0.010		< 0.010	mg/L
	Phenol, Total, by TTL	KMC	5/17/2017	SM 5330		1		0.10		< 0.10	mg/L
	General Characteristics										
	Field Temperature	JBM	5/9/2017	SM-2550		1				21.48	Deg. C.
	FeCl3 Treated?	JBM	5/9/2017	Field Data		1				Yes	
	Pre-Settled?	JBM	5/9/2017	Field Data		1				Yes	
	Field pH	JBM	5/9/2017	SM-4500H		1				6.58	SU
	Field Sulfite	JBM	5/9/2017	HACH 8216		1	0.4			1.2	mg/l
	Field Conductivity	JBM	5/9/2017	SM-2510		1				769.2	umhos/cm

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Description: Barry Lower Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10920

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Field Oxidation Reduction Potential	JBM	5/9/2017	SM-2580		1				117.0	mV
	Field Dissolved Oxygen	JBM	5/9/2017	ASTM-888-05		1				8.46	mg/L
	pH	DLJ	5/19/2017	SM 4500H+ B		1	0.01			7.38	SU
	Alkalinity, Total as CaCO3	DLJ	5/19/2017	SM 2320 B		1	0.1			17.3	mg/L CaCO
	Bicarbonate Alkalinity, as CaCO3	DLJ	5/19/2017	SM 4500CO2 D		1	0.1			17.2	mg/l-CaCO
	Hardness, Total, (as CaCO3)	DLJ	5/15/2017	SM 2340 B		1				158	mg/L
*	Solids, Suspended	GAS	5/12/2017	SM 2540D		1		2.5		< 2.5	mg/L
*	Bromide, Total	SES	5/17/2017	EPA 300.0		1	0.04	0.08		2.04	mg/L
	Biochemical Oxygen Demand, 5 Day, b	CPP	5/11/2017	SM 5210 B-2001		1		2.0		< 2.0	mg/L
*	Chloride, Total	SES	5/17/2017	EPA 300.0		10	0.40	10		152	mg/L
*	Fluoride, Total	SES	5/17/2017	EPA 300.0		1	0.01	0.04		0.47	mg/L
*	Sulfate, Total	SES	5/17/2017	EPA 300.0		1	0.04	1		88.9	mg/L
	Color, by TTL	CRC	5/11/2017	SM 2120 E		1		10		32.0	ADMI
*	Escherichia Coli (E. Coli)	HRG	5/12/2017	SM 9223B		1	1.0		U	Not Detected	MPN/100ml
	itrogen, Nitrate/Nitrite	GMW	5/25/2017	EPA 353.2		1	0.05	0.20	U	Not Detected	mg/L as N
*	Oil and Grease	DLJ	5/16/2017	EPA 1664B		1	1.4	5		< 5	mg/L
	Sulfide, by TTL	CRC	5/11/2017	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	TRT	5/11/2017	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	SES	5/23/2017	SM 4500PE-TP		1	0.010	0.03		< 0.03	mg/L
	Nitrogen, Total, Calculation	GMW	5/25/2017	SM4500		1				0.880	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	5/26/2017	EPA 350.1		1	0.05	0.15		0.48	mg/L as N

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Description: Barry Lower Pond Muck Treated
CCR Ash Pond 2C Survey

Laboratory ID Number: AX10920

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
*	Nitrogen, Total Kjeldahl	GMW	6/1/2017	EPA 351.2		1	0.225	0.3	0.880	mg/L as N
*	Total Organic Carbon	KRC	5/15/2017	SM 5310 C		1	0.30	1	< 1	mg/L
	Chemical Oxygen Demand, by TTL	KMC	5/11/2017	SM 5220 D		1		5.0	10.4	mg/L
	Acid Compounds									
	2-Chlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	2,4-Dichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	2,4-Dimethylphenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	4,6-Dinitro-2-methylphenol, by TestAm	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	2,4-Dinitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		30	< 30	ug/L
	2-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	4-Nitrophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	4-chloro-3-methylphenol, by TestAmeri	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	Pentachlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		20	< 20	ug/L
	Phenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	4,6-Trichlorophenol, by TestAmerica	S1S	5/19/2017	EPA 625		1		9.9	< 9.9	ug/L
	Miscellaneous									
	Method 625 - Ext Date, by TestAmerica	NTH	5/16/2017			1			05/16/2017	

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: E. coli was received and analyzed out of holding time.
Biochemical Oxygen Demand, Color, Chemical Oxygen Demand, Surfactants, Sulfide, Total Phenol, Volatile Compounds, and Cyanide were analyzed by TTL.
Acid Compounds were analyzed by Test America.
Precision and Recovery are out of range for Total Organic Carbon. TBW 05/30/2017

cc:

ılity Control ______________________ **Supervision**______________________________

Reported:8/28/2017
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
'205) 664 - 6032 or 6171
' (205) 257-1654

Definitions

Alabama Power

Lab & Field SERVICES

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Sp	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range.
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information

EPA Form 2D

General Comments – Form 2D

Section I

002E – FGD Wastewater

This point currently does not exist but would be needed in the future as an internal sampling point to ensure the effluent from the FGD system meets the ELG limitations prior to mixing with other treated wastewater streams for discharge. See the Barry Proposed Flow Diagram included in this application.

002F – Closed Ash Pond Landfill Leachate

APC is requesting the inclusion of this point in the NPDES permit in the event leachate collection and treatment from the capped and closed ash pond is needed in the future.

This proposed discharge point does not currently exist and has not been located; therefore, the location and latitude/longitude are not shown in this application. Additionally, APC has not currently determined the type, size, treatment capabilities, or discharge configuration of the treatment system that will be needed to treat leachate. APC is uncertain if this point will be needed as a primary outfall or potentially as an internal monitoring point.

In accordance with Form 2D instructions, should effluent data from this point be needed to support the development of permit limits, the data presented in Form 2C from 002 – Dewatering Interstitial is currently the most representative until actual discharge data can be collected and analyzed. APC will submit a Form 2C analysis to characterize the effluent within 2 years of commencing discharge from this point, in accordance with the form 2D instructions.

Effluent from this proposed outfall should not be considered a new or increased discharge since this is an existing plant wastewater stream. See the Barry Proposed Flow Diagram included in this application.

003 – Proposed Wastewater Treatment Plant Outfall

As previously mentioned in the Form 2C General Comments, a new wastewater treatment plant (LVWW) was constructed and plant wastewater streams that were routed to the ash pond [i.e., low-volume wastewater, miscellaneous cooling water, treated sanitary wastewater, FGD wastewater, vehicle rinse water, and stormwater] have been re-routed to this new treatment plant.

As detailed in the General Comments – Form 2C, 002 – Ash Pond Discharge section, the treated effluent from the LVWW is currently routed to DSN002. However, APC is requesting a permitted discharge point for the effluent from the wastewater treatment plant at a location closer to the LVWW system (exact location yet to be determined; estimated location provided on enclosed figure), in the event that it is determined to be the more optimal discharge location during and/or after ash pond closure (the current ash pond discharge structure is planned to transition to a stormwater outfall for the closed and capped pond).

This proposed outfall should not be considered a new or increased discharge since only the location of the discharge point will change, and existing plant wastewater streams through the LVWW will remain the same (with the exception of removing coal pile runoff – see the comments on 004 below). See the Barry Proposed Flow Diagram included in this application.

004 – Proposed Coal Pile Runoff Pond Outfall

APC is requesting a permitted discharge point for the effluent from the coal pile runoff pond (Lagoon A) at a discharge point inside the barge canal (see enclosed figure). Lagoons A and B (existing coal pile runoff ponds) collect stormwater runoff from the Barry coal pile, which comprises the majority of the flow into these ponds. Lagoon A was recently expanded and redesigned to increase treatment capability, including chemical addition and solids settling areas. The proposed outfall will be a direct discharge from Lagoon A to the barge canal.

In addition to receiving stormwater runoff from the coal pile, Lagoon A will also receive incidental flows from a nearby concrete truck washout, as well as incidental flows from a carwash in the dry fly ash handling area. Effluent from the dry fly ash carwash area would be treated in the pond prior to discharge.

In addition to receiving stormwater runoff from the coal pile, Lagoon B also receives effluent from the Units 6 & 7 main sump (low volume wastewater) and a nearby carwash in the coal handling area. The effluent from Lagoon B has been routed to Lagoon A, which is currently routed to the LVWW system through the mother sump (previously these flows were all directed to the ash pond). Once this proposed outfall has been created, the coal pile runoff ponds would no longer be treated through the LVWW system.

This proposed outfall should not be considered a new or increased discharge since these wastewater streams will be redirected from the LVWW system. See the Barry Proposed Flow Diagram included in this application.

Fire Protection System Water

The source of water for the Fire Protection System Water (FPSW) at Plant Barry is raw river water which is filtered and chlorinated. The system is periodically tested in accordance with Federal and State regulations. As such, there is a potential for FPSW to be discharged from any of the permitted Plant Barry NPDES discharge points. Chlorine is maintained at a level adequate to prevent biological growth but would not be expected to exceed detectable levels at the point of discharge.

Section V.

Because these plant effluents are not currently discharging, sample analyses were not currently available. However, FGD wastewater (proposed outfall 002e) will be routed through the LVWW which will provide equivalent treatment to the ash pond; therefore, ash pond effluent sample results (from Form 2C – 002) are considered representative and are provided in Form 2D. In addition, limits for this outfall should be based on ELGs and/or water quality standards. Similarly, the results provided for the moved LVWW discharge point (proposed outfall 003) are also estimated using ash pond effluent sample results.

There is also currently no source of data for landfill leachate (proposed outfall 002f). However, APC expects the leachate to be of similar makeup to the interstitial ash pond water that was sampled to support dewatering and the landfill leachate will be routed through treatment similar to dewatering; therefore, estimates of the required Form 2D parameters are supplied from treated interstitial sample data (from Form 2C – 002 Dewatering - Interstitial).

Data provided for the proposed coal pile runoff pond discharge (proposed outfall 004) was estimated through a combination of lab testing and available data from a similar discharge at the Gorgas Steam Plant in Parrish, AL.

As previously mentioned, APC will submit a Form 2C analysis to re-characterize the effluent within 2 years of commencing discharges from each of these points, in accordance with the Form 2D instructions.

Plant Barry Form 2D Arrangement Map

1,000 500 0 1,000 2,000 Feet

Received 1-8-2020

Please print or type in the unshaded areas only

EPA I.D. NUMBER (*copy from Item 1 of Form 1*) ALD082148800

Form **2D** NPDES

New Sources and New Dischargers Application for Permit to Discharge Process Wastewater

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

Outfall Number (*list*)	Latitude Deg.	Latitude Min.	Latitude Sec.	Longitude Deg.	Longitude Min.	Longitude Sec.	Receiving Water (*name*)
002e	31	00	24	88	00	41	Mobile River
002f	31	00	24	88	00	41	Mobile River
003	31	00	24	88	00	41	Mobile River
004	31	00	24	88	00	41	Mobile River

II. Discharge Date (When do you expect to begin discharging?)

III. Flows, Sources of Pollution, and Treatment Technologies

A. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

Outfall Number	1. Operations Contributing Flow (*List*)	2. Average Flow (*Include Units*)	3. Treatment (*Description or List codes from Table 2D-1*)
002e	FGD Wastewater	0.72 MGD	1-U, 2-C, 2-K, 4-A
002f	Landfill Leachate	0.72 MGD	1-U, 2-C, 2-K, 4-A
003	Low volume wastewater treatment system	8.54 MGD	1-U 3-A
	Vehicle Rinse Water Misc. non-contact		1-G
	cooling waters		1-O
	FPSW		1-Q
	003A - Treated Sanitary wastewater		2-C
	003B - Pre-treated chemical metal cleaning wastes		2-K
	003C - Cooling tower		4-A
	blowdown-carbon capture process		5-L
	003D - FGD wastewater		5-R
004	Coal Pile Runoff	5.07 MGD	1-U
	004A - Low volume		3-A
	wastewater from U6 & 7 Sump		4-A
	FPSW		

B. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item III-A. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g., for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

C. Except for storm runoff, leaks, or spills, will any of the discharges described in Items III-A be intermittent or seasonal?

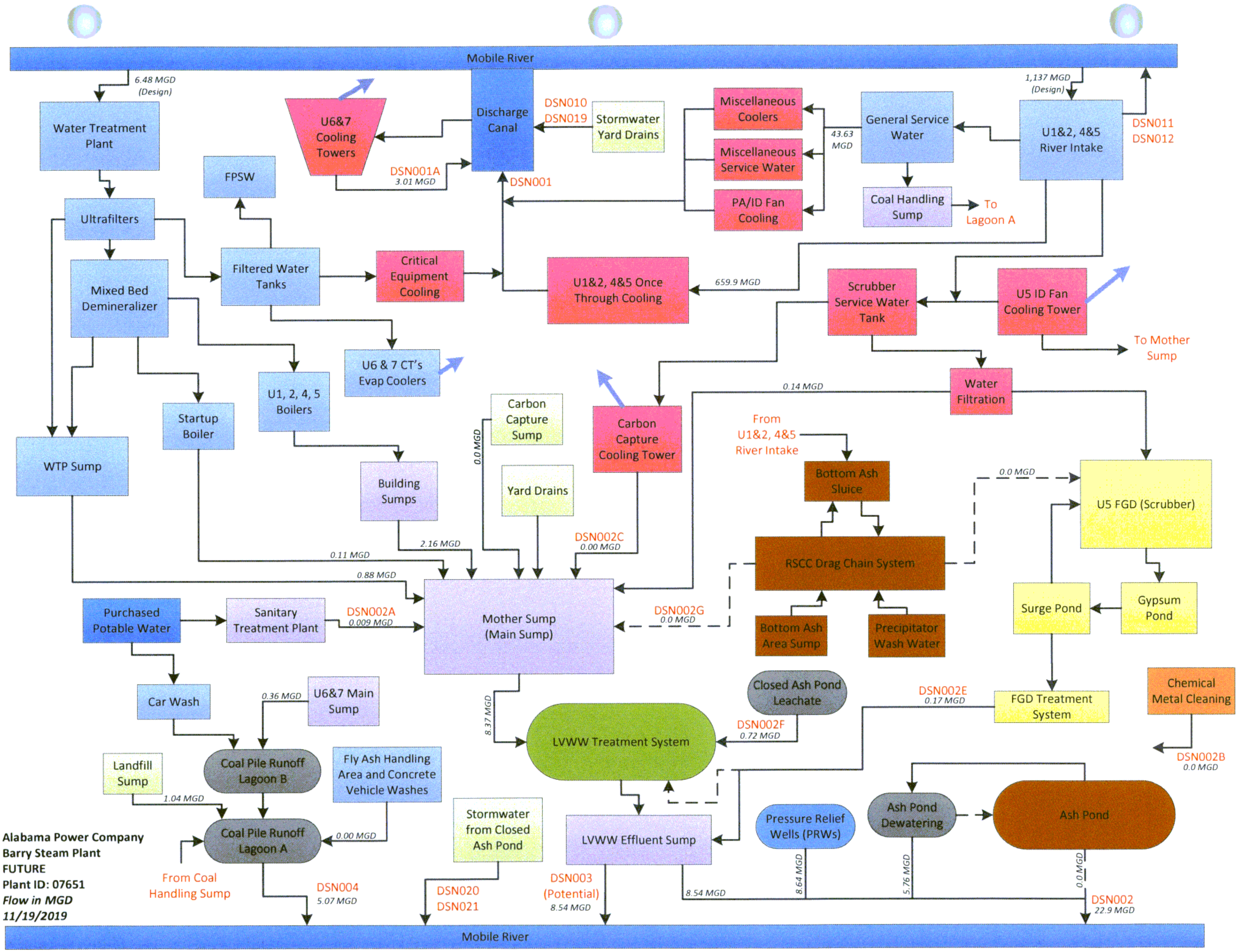
☐ YES (*complete the following table*) ☒ NO (*go to Section IV*)

Outfall Number	1. Frequency		2. Flow		
	a. Days Per Week (*specify average*)	b. Months Per Year (*specify average*)	a. Maximum Daily Flow Rate (*in mgd*)	b. Maximum Total Volume (*specify with units*)	c. Duration (*in days*)

IV. Production

If there is an applicable production-based effluent guideline or NSPS, for each outfall list the estimated level of production (projection of actual production level, not design), expressed in the terms and units used in the applicable effluent guideline or NSPS, for each of the first 3 years of operation. If production is likely to vary, you may also submit alternative estimates (attach a separate sheet).

Year	A. Quantity Per Day	B. Units Of Measure	c. Operation, Product, Material, etc. *(specify)*



Mobile River
6.48 MGD (Design)
Water Treatment Plant
U6&7 Cooling Towers
Discharge Canal
DSN010
DSN019
Stormwater Yard Drains
Miscellaneous Coolers
Miscellaneous Service Water
PA/ID Fan Cooling
43.63 MGD
General Service Water
1,137 MGD (Design)
U1&2, 4&5 River Intake
DSN011
DSN012
Coal Handling Sump
To Lagoon A
FPSW
DSN001A
3.01 MGD
DSN001
Ultrafilters
Filtered Water Tanks
Critical Equipment Cooling
U1&2, 4&5 Once Through Cooling
659.9 MGD
Scrubber Service Water Tank
U5 ID Fan Cooling Tower
To Mother Sump
Mixed Bed Demineralizer
U6 & 7 CT's Evap Coolers
Water Filtration
0.14 MGD
U1, 2, 4, 5 Boilers
Startup Boiler
Carbon Capture Sump
0.0 MGD
Carbon Capture Cooling Tower
From U1&2, 4&5 River Intake
Bottom Ash Sluice
WTP Sump
Building Sumps
Yard Drains
0.0 MGD
U5 FGD (Scrubber)
RSCC Drag Chain System
DSN002C
0.00 MGD
2.16 MGD
0.11 MGD
0.88 MGD
Purchased Potable Water
Sanitary Treatment Plant
DSN002A
0.009 MGD
Mother Sump (Main Sump)
DSN002G
0.0 MGD
Bottom Ash Area Sump
Precipitator Wash Water
Surge Pond
Gypsum Pond
Car Wash
0.36 MGD
U6&7 Main Sump
8.37 MGD
LVWW Treatment System
Closed Ash Pond Leachate
DSN002F
0.72 MGD
DSN002E
0.17 MGD
FGD Treatment System
Chemical Metal Cleaning
DSN002B
0.0 MGD
Landfill Sump
1.04 MGD
Coal Pile Runoff Lagoon B
Fly Ash Handling Area and Concrete Vehicle Washes
Coal Pile Runoff Lagoon A
0.00 MGD
Stormwater from Closed Ash Pond
LVWW Effluent Sump
Pressure Relief Wells (PRWs)
Ash Pond Dewatering
Ash Pond
8.64 MGD
5.76 MGD
0.0 MGD
From Coal Handling Sump
DSN004
5.07 MGD
DSN020
DSN021
DSN003 (Potential)
8.54 MGD
8.54 MGD
DSN002
22.9 MGD
Alabama Power Company
Barry Steam Plant
FUTURE
Plant ID: 07651
Flow in MGD
11/19/2019

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	Outfall Number
	ALD082148800	002e-FGD Wastewater

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Biochemical Oxygen Demand (BOD)	0.9 mg/L	0.09 mg/L	3 - Data from other similar plants
Chemical Oxygen Demand (COD)	11.0 mg/L	11.0 mg/L	3
Total Organic Carbon (TOC)	3.18 mg/L	3.18 mg/L	3
Total Suspended Solids (TSS)	<2.5 mg/L	<2.3 mg/L	3
Flow	0.72 MGD	0.36 MGD	4 - Best professional judgement
Ammonia (as N)	<0.3 mg/L	<0.125 mg/L	3
Temperature (winter)	74°F	57°F	4
Temperature (summer)	96°F	81°F	4
pH	8.8 S.U.	7.0 S.U.	3
Bromide	0.54 mg/L	0.54 mg/L	3
Total Residual Chlorine (TRC)	<0.05 mg/L	<0.05 mg/L	3
Color	<10 ADMI	<10 ADMI	3
E. coli	93.3 MPN/100mL	93.3 MPN/100mL	3
Fluoride	0.41 mg/L	0.41 mg/L	3
Nitrate-Nitrite (as N)	0.40 mg/L	0.40 mg/L	3
Oil & Grease	<5 mg/L	<3.8 mg/L	3
Phosphorous (as P), Total	<0.03 mg/L	<0.03 mg/L	3
Sulfate	55.0 mg/L	55.0 mg/L	3
Sulfide (as S)	<0.01 mg/L	<0.01 mg/L	3
Sulfite (as SO_3)	<4 mg/L	<4 mg/L	3
Surfactants	0.07 mg/L	0.07 mg/L	3
Aluminum, Total	0.153 mg/L	0.153 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	Outfall Number
	ALD082148800	002e cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Barium, Total	0.211 mg/L	0.211 mg/L	3 - Data from other similar plants
Boron, Total	0.989 mg/L	0.989 mg/L	3
Cobalt, Total	<0.000203 mg/L	<0.000203 mg/L	3
Iron, Total	0.155 mg/L	<0.066 mg/L	3
Magnesium, Total	7.79 mg/L	7.79 mg/L	3
Molybdenum, Total	0.0873 mg/L	0.0873 mg/L	3
Manganese, Total	0.0250 mg/L	0.0250 mg/L	3
Tin, Total	<0.000203 mg/L	<0.000203 mg/L	3
Titanium, Total	0.00586 mg/L	<0.00586 mg/L	3
Antimony, Total	0.00466 mg/L	0.00466 mg/L	3
Arsenic, Total	<5.73 ppd	<0.584 ppd	3
Beryllium, Total	<0.000203 mg/L	<0.000203 mg/L	3
Cadmium, Total	<0.000203 mg/L	<0.000203 mg/L	3
Chromium, Total	0.00165 mg/L	0.00165 mg/L	3
Copper, Total	<0.013 mg/L	<0.009 mg/L	3
Lead, Total	<0.000203 mg/L	<0.000203 mg/L	3
Mercury, Total	0.0119 ug/L	<0.00614 ug/L	3
Nickel, Total	0.00207 mg/L	0.00207 mg/L	3
Selenium, Total	0.0228 mg/L	0.0228 mg/L	3
Silver, Total	<0.000203 mg/L	<0.000203 mg/L	3
Thallium, Total	0.000208 mg/L	0.000208 mg/L	3
Zinc, Total	0.00167 mg/L	0.00167 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)* ALD082148800	Outfall Number 002e cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Cyanide, Total	<0.010 mg/L	<0.010 mg/L	3 - Data from other similar plants
Phenols, Total	<0.10 mg/L	<0.10 mg/L	3
Accrolein	<0.100 mg/L	<0.100 mg/L	3
Acrylonitrile	<0.100 mg/L	<0.100 mg/L	3
Benzene	<0.005 mg/L	<0.005 mg/L	3
Bromoform	<0.005 mg/L	<0.005 mg/L	3
Carbon Tetrachloride	<0.005 mg/L	<0.005 mg/L	3
Chlorobenzene	<0.005 mg/L	<0.005 mg/L	3
Chlorodibromomethane	<0.005 mg/L	<0.005 mg/L	3
Chloroethane	<0.010 mg/L	<0.010 mg/L	3
2-Chloro-ethylvinyl Ether	<0.010 mg/L	<0.010 mg/L	3
Chloroform	<0.005 mg/L	<0.005 mg/L	3
Dichlorobromomethane	<0.005 mg/L	<0.005 mg/L	3
1,1-Dichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,2-Dichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,1-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	3
1,2-Dichloropropane	<0.005 mg/L	<0.005 mg/L	3
1,3-Dichloropropylene	<0.005 mg/L	<0.005 mg/L	3
Ethylbenzene	<0.005 mg/L	<0.005 mg/L	3
Methyl Bromide	<0.010 mg/L	<0.010 mg/L	3
Methyl Chloride	<0.005 mg/L	<0.005 mg/L	3
Methylene Chloride	<0.005 mg/L	<0.005 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	Outfall Number
	ALD082148800	002e cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
1,1,2,2-Tetrachloroethane	<0.005 mg/L	<0.005 mg/L	3 - Data from other similar plants
Tetrachloroethylene	<0.005 mg/L	<0.005 mg/L	3
Toluene	<0.005 mg/L	<0.005 mg/L	3
1,2-Trans-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	3
1,1,1-Trichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,1,2-Trichloroethane	<0.005 mg/L	<0.005 mg/L	3
Trichloroethylene	<0.005 mg/L	<0.005 mg/L	3
Vinyl Chloride	<0.002 mg/L	<0.002 mg/L	3
2-Chlorophenol	<0.009 mg/L	<0.009 mg/L	3
2,4-Dichlorophenol	<0.009 mg/L	<0.009 mg/L	3
2,4-Dimethylphenol	<0.009 mg/L	<0.009 mg/L	3
4,6-Dinitro-O-Cresol	<0.047 mg/L	<0.047 mg/L	3
2,4-Dinitrophenol	<0.047 mg/L	<0.047 mg/L	3
2-Nitrophenol	<0.009 mg/L	<0.009 mg/L	3
4-Nitrophenol	<0.047 mg/L	<0.047 mg/L	3
P-Chloro-M-Cresol	<0.009 mg/L	<0.009 mg/L	3
Pentachlorophenol	<0.023 mg/L	<0.023 mg/L	3
Phenol	<0.009 mg/L	<0.009 mg/L	3
2,4,6-Trichlorophenol	<0.009 mg/L	<0.009 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)* ALD082148800	Outfall Number 002f-Landfill Leachate

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Biochemical Oxygen Demand (BOD)	<2.0 mg/L	<2.0 mg/L	4 - Best professional estimates
Chemical Oxygen Demand (COD)	16.2 mg/L	13.3 mg/L	4
Total Organic Carbon (TOC)	<1 mg/L	<1 mg/L	4
Total Suspended Solids (TSS)	<2.5 mg/L	<2.5 mg/L	4
Flow	0.72 MGD	0.36 MGD	4
Ammonia (as N)	<0.74 mg/L	1.6 mg/L	4
Temperature (winter)	Not available		
Temperature (summer)	21.4°C	21.6°C	4
pH	6.6 S.U.	6.6 S.U.	4
Bromide	0.54 mg/L	0.54 mg/L	4
Total Residual Chlorine (TRC)	Not available		
Color	32.0 ADMI	20.0 ADMI	4
E. coli	0 MPN/100mL	0 MPN/100mL	4
Fluoride	0.47 mg/L	0.42 mg/L	4
Nitrate-Nitrite (as N)	0.22 mg/L	0.073 mg/L	4
Oil & Grease	<5 mg/L	<5 mg/L	4
Phosphorous (as P), Total	<0.03 mg/L	<0.03 mg/L	4
Sulfate	99.3 mg/L	90.0 mg/L	4
Sulfide (as S)	<0.01 mg/L	<0.01 mg/L	4
Sulfite (as SO_3)	2.4 mg/L	1.5 mg/L	4
Surfactants	<0.05 mg/L	<0.05 mg/L	4
Aluminum, Total	<0.013 mg/L	<0.013 mg/L	4

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	Outfall Number
	ALD082148800	002f cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Barium, Total	0.594 mg/L	0.333 mg/L	4
Boron, Total	1.38 mg/L	1.10 mg/L	4
Cobalt, Total	0.000455 mg/L	0.00015 mg/L	4
Iron, Total	0.571 mg/L	0.323 mg/L	4
Magnesium, Total	8.33 mg/L	7.61 mg/L	4
Molybdenum, Total	0.036 mg/L	0.0338 mg/L	4
Manganese, Total	0.467 mg/L	0.27 mg/L	4
Tin, Total	0.00332 mg/L	0.00184 mg/L	4
Titanium, Total	<0.001 mg/L	<0.001 mg/L	4
Antimony, Total	0.00656 mg/L	0.00333 mg/L	4
Arsenic, Total	0.0126 mg/L	0.0052 mg/L	4
Beryllium, Total	<0.0002 mg/L	<0.0002 mg/L	4
Cadmium, Total	<0.0002 mg/L	<0.0002 mg/L	4
Chromium, Total	0.00108 mg/L	0.00068 mg/L	4
Copper, Total	0.00206 mg/L	0.00161 mg/L	4
Lead, Total	<0.0002 mg/L	<0.0002 mg/L	4
Mercury, Total	<0.005 ug/L	<0.005 ug/L	4
Nickel, Total	0.00448 mg/L	0.0026 mg/L	4
Selenium, Total	0.0109 mg/L	0.00835 mg/L	4
Silver, Total	<0.0002 mg/L	<0.0002 mg/L	3
Thallium, Total	<0.0002 mg/L	<0.0002 mg/L	3
Zinc, Total	0.0477 mg/L	0.0272 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	Outfall Number
	ALD082148800	002f cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Cyanide, Total	<0.010 mg/L	<0.010 mg/L	4
Phenols, Total	<0.10 mg/L	<0.10 mg/L	4
Accrolein	<0.100 mg/L	<0.100 mg/L	4
Acrylonitrile	<0.100 mg/L	<0.100 mg/L	4
Benzene	<0.005 mg/L	<0.005 mg/L	4
Bromoform	<0.005 mg/L	<0.005 mg/L	4
Carbon Tetrachloride	<0.005 mg/L	<0.005 mg/L	4
Chlorobenzene	<0.005 mg/L	<0.005 mg/L	4
Chlorodibromomethane	<0.005 mg/L	<0.005 mg/L	4
Chloroethane	Not available		
2-Chloro-ethylvinyl Ether	<0.010 mg/L	<0.010 mg/L	4
Chloroform	<0.005 mg/L	<0.005 mg/L	4
Dichlorobromomethane	<0.005 mg/L	<0.005 mg/L	4
1,1-Dichloroethane	<0.005 mg/L	<0.005 mg/L	4
1,2-Dichloroethane	<0.005 mg/L	<0.005 mg/L	4
1,1-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	4
1,2-Dichloropropane	<0.005 mg/L	<0.005 mg/L	4
1,3-Dichloropropylene	<0.005 mg/L	<0.005 mg/L	4
Ethylbenzene	<0.005 mg/L	<0.005 mg/L	4
Methyl Bromide	<0.010 mg/L	<0.010 mg/L	4
Methyl Chloride	Not Available		
Methylene Chloride	<0.005 mg/L	<0.005 mg/L	4

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	Outfall Number
	ALD082148800	002f cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
1,1,2,2-Tetrachloroethane	<0.005 mg/L	<0.005 mg/L	4
Tetrachloroethylene	<0.005 mg/L	<0.005 mg/L	4
Toluene	<0.005 mg/L	<0.005 mg/L	4
1,2-Trans-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	4
1,1,1-Trichloroethane	<0.005 mg/L	<0.005 mg/L	4
1,1,2-Trichloroethane	<0.005 mg/L	<0.005 mg/L	4
Trichloroethylene	Not available		
Vinyl Chloride	<0.002 mg/L	<0.002 mg/L	4
2-Chlorophenol	<0.0099 mg/L	<0.0098 mg/L	4
2,4-Dichlorophenol	<0.0099 mg/L	<0.0098 mg/L	4
2,4-Dimethylphenol	<0.0099 mg/L	<0.0098 mg/L	4
4,6-Dinitro-O-Cresol	<0.0099 mg/L	<0.0098 mg/L	4
2,4-Dinitrophenol	<0.030 mg/L	<0.029 mg/L	4
2-Nitrophenol	<0.0099 mg/L	<0.0098 mg/L	4
4-Nitrophenol	<0.0099 mg/L	<0.0098 mg/L	4
P-Chloro-M-Cresol	<0.0099 mg/L	<0.0098 mg/L	4
Pentachlorophenol	<0.02 mg/L	<0.019 mg/L	4
Phenol	<0.0099 mg/L	<0.0098 mg/L	4
2,4,6-Trichlorophenol	<0.0099 mg/L	<0.0098 mg/L	4

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*) ALD082148800	Outfall Number 003

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Biochemical Oxygen Demand (BOD)	0.9 mg/L	0.09 mg/L	3 - Data from other similar plants
Chemical Oxygen Demand (COD)	11.0 mg/L	11.0 mg/L	3
Total Organic Carbon (TOC)	3.18 mg/L	3.18 mg/L	3
Total Suspended Solids (TSS)	<2.5 mg/L	<2.3 mg/L	3
Flow	11.232 MGD	8.54 MGD	3
Ammonia (as N)	<0.3 mg/L	<0.125 mg/L	3
Temperature (winter)	74^{0}F	57^{0}F	4
Temperature (summer)	96^{0}F	81^{0}F	4
pH	8.8 S.U.	7.0 S.U.	3
Bromide	0.54 mg/L	0.54 mg/L	3
Total Residual Chlorine (TRC)	<0.05 mg/L	<0.05 mg/L	3
Color	<10 ADMI	<10 ADMI	3
E. coli	93.3 MPN/100mL	93.3 MPN/100mL	3
Fluoride	0.41 mg/L	0.41 mg/L	3
Nitrate-Nitrite (as N)	0.40 mg/L	0.40 mg/L	3
Oil & Grease	<5 mg/L	<3.8 mg/L	3
Phosphorous (as P), Total	<0.03 mg/L	<0.03 mg/L	3
Sulfate	55.0 mg/L	55.0 mg/L	3
Sulfide (as S)	<0.01 mg/L	<0.01 mg/L	3
Sulfite (as SO_3)	<4 mg/L	<4 mg/L	3
Surfactants	0.07 mg/L	0.07 mg/L	3
Aluminum, Total	0.153 mg/L	0.153 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	Outfall Number
	ALD082148800	003 cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Barium, Total	0.211 mg/L	0.211 mg/L	3 - Data from other similar plants
Boron, Total	0.989 mg/L	0.989 mg/L	3
Cobalt, Total	<0.000203 mg/L	<0.000203 mg/L	3
Iron, Total	0.155 mg/L	<0.066 mg/L	3
Magnesium, Total	7.79 mg/L	7.79 mg/L	3
Molybdenum, Total	0.0873 mg/L	0.0873 mg/L	3
Manganese, Total	0.0250 mg/L	0.0250 mg/L	3
Tin, Total	<0.000203 mg/L	<0.000203 mg/L	3
Titanium, Total	0.00586 mg/L	<0.00586 mg/L	3
Antimony, Total	0.00466 mg/L	0.00466 mg/L	3
Arsenic, Total	<5.73 ppd	<0.584 ppd	3
Beryllium, Total	<0.000203 mg/L	<0.000203 mg/L	3
Cadmium, Total	<0.000203 mg/L	<0.000203 mg/L	3
Chromium, Total	0.00165 mg/L	0.00165 mg/L	3
Copper, Total	<0.013 mg/L	<0.009 mg/L	3
Lead, Total	<0.000203 mg/L	<0.000203 mg/L	3
Mercury, Total	0.0119 ug/L	<0.00614 ug/L	3
Nickel, Total	0.00207 mg/L	0.00207 mg/L	3
Selenium, Total	0.0228 mg/L	0.0228 mg/L	3
Silver, Total	<0.000203 mg/L	<0.000203 mg/L	3
Thallium, Total	0.000208 mg/L	0.000208 mg/L	3
Zinc, Total	0.00167 mg/L	0.00167 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*) ALD082148800	Outfall Number 003 cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Cyanide, Total	<0.010 mg/L	<0.010 mg/L	3 - Data from other similar plants
Phenols, Total	<0.10 mg/L	<0.10 mg/L	3
Accrolein	<0.100 mg/L	<0.100 mg/L	3
Acrylonitrile	<0.100 mg/L	<0.100 mg/L	3
Benzene	<0.005 mg/L	<0.005 mg/L	3
Bromoform	<0.005 mg/L	<0.005 mg/L	3
Carbon Tetrachloride	<0.005 mg/L	<0.005 mg/L	3
Chlorobenzene	<0.005 mg/L	<0.005 mg/L	3
Chlorodibromomethane	<0.005 mg/L	<0.005 mg/L	3
Chloroethane	<0.010 mg/L	<0.010 mg/L	3
2-Chloro-ethylvinyl Ether	<0.010 mg/L	<0.010 mg/L	3
Chloroform	<0.005 mg/L	<0.005 mg/L	3
Dichlorobromomethane	<0.005 mg/L	<0.005 mg/L	3
1,1-Dichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,2-Dichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,1-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	3
1,2-Dichloropropane	<0.005 mg/L	<0.005 mg/L	3
1,3-Dichloropropylene	<0.005 mg/L	<0.005 mg/L	3
Ethylbenzene	<0.005 mg/L	<0.005 mg/L	3
Methyl Bromide	<0.010 mg/L	<0.010 mg/L	3
Methyl Chloride	<0.005 mg/L	<0.005 mg/L	3
Methylene Chloride	<0.005 mg/L	<0.005 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	Outfall Number
	ALD082148800	003 cont'd

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
1,1,2,2-Tetrachloroethane	<0.005 mg/L	<0.005 mg/L	3 - Data from other similar plants
Tetrachloroethylene	<0.005 mg/L	<0.005 mg/L	3
Toluene	<0.005 mg/L	<0.005 mg/L	3
1,2-Trans-Dichloroethylene	<0.005 mg/L	<0.005 mg/L	3
1,1,1-Trichloroethane	<0.005 mg/L	<0.005 mg/L	3
1,1,2-Trichloroethane	<0.005 mg/L	<0.005 mg/L	3
Trichloroethylene	<0.005 mg/L	<0.005 mg/L	3
Vinyl Chloride	<0.002 mg/L	<0.002 mg/L	3
2-Chlorophenol	<0.009 mg/L	<0.009 mg/L	3
2,4-Dichlorophenol	<0.009 mg/L	<0.009 mg/L	3
2,4-Dimethylphenol	<0.009 mg/L	<0.009 mg/L	3
4,6-Dinitro-O-Cresol	<0.047 mg/L	<0.047 mg/L	3
2,4-Dinitrophenol	<0.047 mg/L	<0.047 mg/L	3
2-Nitrophenol	<0.009 mg/L	<0.009 mg/L	3
4-Nitrophenol	<0.047 mg/L	<0.047 mg/L	3
P-Chloro-M-Cresol	<0.009 mg/L	<0.009 mg/L	3
Pentachlorophenol	<0.023 mg/L	<0.023 mg/L	3
Phenol	<0.009 mg/L	<0.009 mg/L	3
2,4,6-Trichlorophenol	<0.009 mg/L	<0.009 mg/L	3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	Outfall Number
	ALD082148800	004

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Biochemical Oxygen Demand (BOD)	<2 mg/L		3
Chemical Oxygen Demand (COD)	<5 mg/L		3
Total Organic Carbon (TOC)	1.30 mg/L	1.30 mg/L	3
Total Suspended Solids (TSS)	14.00 mg/L	14.00 mg/L	3
Flow	5.07 MGD		pump design capacity
Ammonia (As N)	0.14 mg/L	0.10 mg/L	3
Temperature (winter)	12.4 °C		4
Temperature (summer)	29.1 °C		3
pH	7.3 s.u.		3
Bromide	0.00 mg/L		3
Total Residual Chlorine (TRC)	<5.0 mg/L		4
Color	17 admi		3
E. Coli	1 mpn/100mL		3
Fluoride	0.00 mg/L		3
Nitrate-Nitrite (as N)	0.22 mg/L		3
Oil & Grease (O&G)	<5 mg/L		3
Phosphorous (as P)	0.00 mg/L		3
Sulfate (as SO_4)	78.90 mg/L		3
Sulfide (as S)	<0.01 mg/L		3
Sulfite (as SO_3)	<4 mg/L		3
Surfactants	<0.05 mg/L		3
Aluminum, Total	0.01 mg/L		3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)* ALD082148800	Outfall Number 004

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Barium, Total	0.17 mg/L		1
Boron, Total	1.03 mg/L		3
Cobalt, Total	0.003 mg/L		1
Iron, Total	0.52 mg/L		3
Magnesium, Total	6.17 mg/L		3
Molybdenum, Total	0.002 mg/L		3
Manganese, Total	0.43 mg/L		3
Tin, Total	0.003 mg/L		3
Titanium, Total	0.000 mg/L		3
Antimony, Total	0.000 mg/L		3
Beryllium, Total	0.000 mg/L		3
Chromium, Total	0.001 mg/L		3
Lead, Total	0.000 mg/L		3
Nickel, Total	0.037 mg/L		3
Silver, Total	0.000 mg/L		3
Zinc, Total	0.027 mg/L		3
Phenols, Total	<0.01 mg/L		3
Arsenic, Total	0.000 mg/L		3
Cadmium, Total	0.000 mg/L		3
Copper, Total	0.018 mg/L		3
Mercury, Total	0.00000147 mg/L		3
Selenium, Total	0.00031 mg/L		3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER *(copy from Item 1 of Form 1)* ALD082148800	Outfall Number 004

V. Effluent Characteristics

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

General Instructions *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

1. Pollutant	2. Maximum Daily Value *(include units)*	3. Average Daily Value *(include units)*	4. Source *(see instructions)*
Thallium, Total	0.000 mg/L		3
Cyanide, Total	<0.010 mg/L		3

CONTINUED FROM THE FRONT	EPA I.D. NUMBER (*copy from Item 1 of Form 1*) ALD082148800	

C. Use the space below to list any of the pollutants listed in Table 2D-3 of the instructions which you know or have reason to believe will be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it will be present.

1. Pollutant	2. Reason for Discharge
Vanadium	Present in trace amounts in coal.

VI. Engineering Report on Wastewater Treatment

A. If there is any technical evaluation concerning your wastewater treatment, including engineering reports or pilot plant studies, check the appropriate box below.

☐ Report Available ☒ No Report

B. Provide the name and location of any existing plant(s) which, to the best of your knowledge resembles this production facility with respect to production processes, wastewater constituents, or wastewater treatments.

Name	Location
Barry Steam Plant (proposed outfall 003)	15300 Highway 43 North, Bucks, AL 36512 The wastewater constituents from the wastewater management pond will resemble the effluent produced from the ash pond and/or the LVWW system.
Gorgas Steam Plant (proposed outfall 004)	460 Gorgas Road, Parrish, Alabama 35580 The wastewater constituents from the coal pile runoff pond will resemble the coal pile runoff pond effluent at Plant Gorgas.

CONTINUE ON NEXT PAGE

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
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VII. Other Information *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations for the proposed facility. Attach additional sheets if necessary.

Please see the additional information provided in the General Comments - Form 2D section.

VIII. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name and Official Title (*type or print*)	B. Phone No.
Susan B. Comensky, V.P. - Environmental Affairs	(205) 257-0298
C. Signature	D. Date Signed
Susan Comensky	1/8/2020

General Comments – Form 2E

Section 1.

002A – Sanitary Wastewater Treatment Plant

This is an internal monitoring point for the Sanitary Wastewater Treatment Plant which previously discharged to the ash pond and now discharges to the LVWW system. An Ash Pond Equivalency Demonstration for treatment of sewage plant wastes has been submitted to ADEM which demonstrated that ash ponds provide adequate treatment of sewage plant wastes required for the NPDES permit. This demonstration was the basis for the existing limitations and monitoring requirements in the current NPDES permit for this discharge point. The performance of the LVWW system is expected to meet or exceed that of the ash pond; therefore, APC requests continuation of this discharge point and associated discharge limitations and monitoring requirements.

Pressure Relief Well Effluent

PRWs are being evaluated as part of the ash pond closure process. If utilized, the PRWs will be installed around the edge of the ash pond dike (outside the ash footprint) at varying screen depths and pumped at varying rates/frequencies while ash excavation and consolidation are occurring. The purpose of the PRWs is to reduce the fluctuation of groundwater elevations that result from changes in river elevation throughout the year. This will provide more consistent subsurface pressures and favorable working conditions during ash pond closure. This discharge will consist of only groundwater and will be routed through a separate treatment system, the effluent of which will be routed to the ash pond discharge structure at 002. Following ash pond closure, this construction measure will no longer be needed, and discharges will cease.

Because this effluent is not a process water, an EPA Form 2E has been prepared for this proposed discharge point. During a pilot study conducted prior to ash pond closure, treated groundwater samples were obtained from two wells; the results of the analyses performed are representative of the expected effluent from the proposed discharge (provided in Section IV of Form 2E). See the Barry Proposed Flow Diagram included in this application.

Fire Protection System Water

The source of water for the Fire Protection System Water (FPSW) at Plant Barry is raw river water which is filtered and chlorinated. The system is periodically tested in accordance with Federal and State regulations. As such, there is a potential for FPSW to be discharged from any of the permitted Plant Barry NPDES discharge points. Chlorine is maintained at a level adequate to prevent biological growth but would not be expected to exceed detectable levels at the point of discharge.

Please print or type in the unshaded areas only.	EPA ID Number (copy from Item 1 of Form 1) ALD082148800	Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM 2E NPDES

EPA Facilities Which Do Not Discharge Process Wastewater

I. RECEIVING WATERS

For this outfall, list the latitude and longitude, and name of the receiving water(s).

Outfall Number *(list)*	Latitude			Longitude			Receiving Water *(name)*
	Deg	Min	Sec	Deg	Min	Sec	
002A	31	00	24	88	00	41	Mobile River via 002

II. DISCHARGE DATE *(If a new discharger, the date you expect to begin discharging)*

N/A

III. TYPE OF WASTE

A. Check the box(es) indicating the general type(s) of wastes discharged.

☒ Sanitary Wastes ☐ Restaurant or Cafeteria Wastes ☐ Noncontact Cooling Water ☐ Other Nonprocess Wastewater *(Identify)*

B. If any cooling water additives are used, list them here. Briefly describe their composition if this information is available.

N/A

IV. EFFLUENT CHARACTERISTICS

A. Existing Sources — Provide measurements for the parameters listed in the left-hand column below, unless waived by the permitting authority *(see instructions)*.

B. New Dischargers — Provide estimates for the parameters listed in the left-hand column below, unless waived by the permitting authority. Instead of the number of measurements taken, provide the source of estimated values *(see instructions)*.

Pollutant or Parameter	(1) Maximum Daily Value *(include units)*		(2) Average Daily Value *(last year)* *(include units)*		(3) Number of Measurements Taken *(last year)*	*(or)* (4) Source of Estimate *(if new discharger)*
	Mass	Concentration	Mass	Concentration		
Biochemical Oxygen Demand (BOD)		1.6 mg/L			1	
Total Suspended Solids (TSS)		6.5 mg/L			1	
Fecal Coliform *(if believed present or if sanitary waste is discharged)*		<1.0 MPN/100mL			1	
Total Residual Chlorine *(if chlorine is used)*		1.0 mg/L			1	
Oil and Grease		<5 mg/L			1	
*Chemical oxygen demand (COD)						
*Total organic carbon (TOC)						
Ammonia *(as N)*		13 mg/L			1	
Discharge Flow	Value 0.00864 MGD				1	
pH *(give range)*	Value 5.5				1	
Temperature *(Winter)*	17.4 °C		°C		1	
Temperature *(Summer)*	°C		°C			

*If noncontact cooling water is discharged

V. Except for leaks or spills, will the discharge described in this form be intermittent or seasonal? If yes, briefly describe the frequency of flow and duration.	☐ Yes ☒ No

VI. TREATMENT SYSTEM *(Describe briefly any treatment system(s) used or to be used)*

The sanitary wastewater treatment plant at Plant Barry is a 9,000 gallon per day (GPD) FAST^{R} (Fixed Activated Sludge Treatment) system that uses naturally occurring bacteria (biomass) to treat sewage for dispersal into the environment. This is a continuous process that provides the biomass with waste (food) and air in a suitable environment. Dead bacteria and non-biodegradable waste settle and accumulate in the bottom of the tank for periodic removal.

The FAST^{R} process consists of the treatment module and blower. The blower provides air to the system via the air supply pipe. The air supply pipe and draft tube create an air lift. The air lift mixes oxygen and waste throughout the media inside the tank. Bacteria grows on the media and digests the waste. A vent pipe expels harmless vapors created by the process.

VII. OTHER INFORMATION *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations. Attach additional sheets, if necessary.

VIII. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title	B. Phone No. *(area code & no.)*
Susan B. Comensky, Vice President of Environmental Affairs	(205)257-0298
C. Signature	D. Date Signed
Susan Comensky	1/8/2020

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera AL 35040
'205) 664 - 6032 or 6171
((205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR02AR
Sample Date/Time : 14-Feb-18 8:20 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Treated Sanitary WW
DSN002A Form 2E

Laboratory ID Number: AY03862

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
	General Characteristics									
*	Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5	6.5	mg/L
*	Biochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	2		1.6	mg/L
	BOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1			0805	
	Biochemical Oxygen Demand, Carbona	CPP	2/15/2018	SM 5210B		1		2	< 2.0	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		10	1	3	13	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at 6 deg C from time of collection until sample analysis began.
Carbonaceous BOD analysis performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control [signature] Supervision [signature]

Reported:3/5/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR02AR
Sample Date/Time : 13-Feb-18 10:40 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Treated Sanitary WW
DSN002A 2E

Laboratory ID Number: AY03741

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	General Characteristics										
	Flow (MGD)	JBH/L	2/13/2018	Field Data		1				0 00864	MGD
	Field Temperature	GFH/	2/13/2018	SM-2550		1				17.4	Deg C
	Field pH	GFH/	2/13/2018	SM-4500H		1				5 52	SU
	Chlorine, Total Residual	GFH/	2/13/2018	Field Test		1	0 05			1 0	mg/L
*	Escherichia Coli (E Coli)	CES	2/14/2018	SM 9223B		1	1			<1 0	MPN/100ml
*	Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1 4	5		< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control Keith Kornegay Supervision [signature]

Reported 2/23/2018
Version: 4 2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

Definitions

Alabama Power

Lab & Field SERVICES

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit, minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification, regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information.
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

Please print or type in the unshaded areas only.	EPA ID Number (copy from Item 1 of Form 1)	Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM 2E NPDES

EPA Facilities Which Do Not Discharge Process Wastewater

I. RECEIVING WATERS

For this outfall, list the latitude and longitude, and name of the receiving water(s).

Outfall Number *(list)*	Latitude			Longitude			Receiving Water *(name)*
	Deg	Min	Sec	Deg	Min	Sec	
Pressure Relief Well Effluent (via 002)	31	00	24	88	00	41	Mobile River via 002

II. DISCHARGE DATE *(If a new discharger, the date you expect to begin discharging)*

III. TYPE OF WASTE

A. Check the box(es) indicating the general type(s) of wastes discharged.

☐ Sanitary Wastes ☐ Restaurant or Cafeteria Wastes ☐ Noncontact Cooling Water ☒ Other Nonprocess Wastewater *(Identify)*

B. If any cooling water additives are used, list them here. Briefly describe their composition if this information is available.

IV. EFFLUENT CHARACTERISTICS

A. Existing Sources — Provide measurements for the parameters listed in the left-hand column below, unless waived by the permitting authority *(see instructions)*.

B. New Dischargers — Provide estimates for the parameters listed in the left-hand column below, unless waived by the permitting authority. Instead of the number of measurements taken, provide the source of estimated values *(see instructions)*.

Pollutant or Parameter	(1) Maximum Daily Value *(include units)*		(2) Average Daily Value *(last year)* *(include units)*		(3) Number of Measurements Taken *(last year)*	*(or)* (4) Source of Estimate *(if new discharger)*
	Mass	Concentration	Mass	Concentration		
Biochemical Oxygen Demand (BOD)		0 mg/L			2	
Total Suspended Solids (TSS)		<2.5 mg/L			4	
Fecal Coliform *(if believed present or if sanitary waste is discharged)*		<1.0 MPN/100mL			2	
Total Residual Chlorine *(if chlorine is used)*		N/A			0	
Oil and Grease		1.3 mg/L			4	
*Chemical oxygen demand (COD)						
*Total organic carbon (TOC)						
Ammonia *(as N)*		0.21 mg/L			4	
Discharge Flow	Value 8.64 MGD (max)					Estimated
pH *(give range)*	Value 6.8 - 7.5 SU				4	
Temperature *(Winter)*	°C		°C			
Temperature *(Summer)*	°C		°C			

*If noncontact cooling water is discharged

V. Except for leaks or spills, will the discharge described in this form be intermittent or seasonal? ☒ Yes ☐ No

If yes, briefly describe the frequency of flow and duration.

Pressure Relief Wells (PRWs) will be installed at various locations surrounding the ash pond and will pump groundwater as necessary to maintain safe conditions during ash pond closure activities. The effluent from these wells will be treated and discharged at outfall 002. Typical discharge rates are anticipated to be between 3,000 and 6,000 gallons per minute, depending on the number of wells and pump rates needed at any given point during closure.

VI. TREATMENT SYSTEM *(Describe briefly any treatment system(s) used or to be used)*

A physical/chemical treatment system is being designed to treat the groundwater at the proposed flow rates.

VII. OTHER INFORMATION *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations. Attach additional sheets, if necessary.

VIII. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title	B. Phone No. *(area code & no.)*
Susan B. Comensky, Vice President of Environmental Affairs	(205)257-0298
C. Signature	D. Date Signed
Susan Comensky	1/8/2020

Please print or type in the unshaded areas only.	EPA ID Number (copy from Item 1 of Form 1)	Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM 2E NPDES

EPA Facilities Which Do Not Discharge Process Wastewater

I. RECEIVING WATERS

For this outfall, list the latitude and longitude, and name of the receiving water(s).

Outfall Number *(list)*	Latitude			Longitude			Receiving Water *(name)*
	Deg	Min	Sec	Deg	Min	Sec	
All NPDES Permitted Outfalls at Plant Barry	31	00	24	88	00	41	Mobile River

II. DISCHARGE DATE *(If a new discharger, the date you expect to begin discharging)*

III. TYPE OF WASTE

A. Check the box(es) indicating the general type(s) of wastes discharged.

☐ Sanitary Wastes ☐ Restaurant or Cafeteria Wastes ☐ Noncontact Cooling Water ☒ Other Nonprocess Wastewater *(Identify)*

B. If any cooling water additives are used, list them here. Briefly describe their composition if this information is available.

IV. EFFLUENT CHARACTERISTICS

A. **Existing Sources** — Provide measurements for the parameters listed in the left-hand column below, unless waived by the permitting authority *(see instructions)*.

B. **New Dischargers** — Provide estimates for the parameters listed in the left-hand column below, unless waived by the permitting authority. Instead of the number of measurements taken, provide the source of estimated values *(see instructions)*.

Pollutant or Parameter	(1) Maximum Daily Value *(include units)*		(2) Average Daily Value *(last year)* *(include units)*		(3) Number of Measurements Taken *(last year)*	*(or)* (4) Source of Estimate *(if new discharger)*
	Mass	Concentration	Mass	Concentration		
Biochemical Oxygen Demand (BOD)		0.3 mg/L			1	
Total Suspended Solids (TSS)		<2.5 mg/L			1	
Fecal Coliform *(if believed present or if sanitary waste is discharged)*		<1.0 MPN/100mL			1	
Total Residual Chlorine *(if chlorine is used)*		<0.05 mg/L			1	
Oil and Grease		<5 mg/L			1	
*Chemical oxygen demand (COD)						
*Total organic carbon (TOC)						
Ammonia *(as N)*		<0.3 mg/L			1	
Discharge Flow	Value 0.00432 MGD				1	
pH *(give range)*	Value 7.55 SU				1	
Temperature *(Winter)*	18.5 °C		°C		1	
Temperature *(Summer)*	°C		°C			

*If noncontact cooling water is discharged

V. Except for leaks or spills, will the discharge described in this form be intermittent or seasonal? ☒ Yes ☐ No

If yes, briefly describe the frequency of flow and duration.

This water is used as necessary in the Fire Protection System.

Testing of the system occurs periodically in accordance with applicable Federal and State Regulations.

VI. TREATMENT SYSTEM *(Describe briefly any treatment system(s) used or to be used)*

VII. OTHER INFORMATION *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations. Attach additional sheets, if necessary.

The fire water system at Plant Barry is tested periodically in accordance with applicable Federal and State regulations.

VIII. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title	B. Phone No. *(area code & no.)*
Susan B. Comensky, Vice President of Environmental Affairs	(205)257-0298
C. Signature	D. Date Signed
Susan Comensky	1/8/2020

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARFWS2E
Sample Date/Time : 14-Feb-18 8:30 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Fire Water System
Fire Water System 2E

Laboratory ID Number: AY03863

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
General Characteristics										
* Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5	U	Not Detected	mg/L
* Biochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	0			0.3	mg/L
BOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1				0805	
* Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		1	0.1	0.3	U	Not Detected	mg/L as N

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

uality Control Keith Kornegay Supervision________________

Reported:2/28/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

To: TV Davis
Barry Steam Plant

Customer Account : NBARFWS2E
Sample Date/Time : 13-Feb-18 10:05 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Fire Water System
Fire Water System 2E

Laboratory ID Number: AY03742

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
General Characteristics									
Flow (MGD)	GFH/	2/13/2018	Field Data		1			0.00432	MGD
Field Temperature	GFH/	2/13/2018	SM-2550		1			18.5	Deg C
Field pH	GFH/	2/13/2018	SM-4500H		1			7.55	SU
Chlorine, Total Residual	GFH/	2/13/2018	Field Test		1	0.05		Not Detected	mg/L
* Escherichia Coli (E. Coli)	CES	2/14/2018	SM 9223B		1	1		<1.0	MPN/100ml
* Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1.4	5	< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control Keith Kornegay Supervision [signature]

Reported:2/23/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
Fax (205) 257-1654

Alabama Power

Lab & Field SERVICES

Definitions

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range.
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information.
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

General Comments – Form 2F

010 – Stormwater associated with electric power generation – Stormwater samples collected from this outfall are representative of stormwater that is discharged from the other stormwater outfalls at Plant Barry. This includes outfalls 010, 013, and 019, but does not include outfalls 020 and 021, which are described below.

013 – Stormwater runoff from administrative building and parking lot

019 – Stormwater associated with electric power generation

020 – Stormwater associated with electric power generation – This is a new stormwater outfall that will be constructed during the ash pond closure process (See the proposed location shown on the site map enclosed with Form 2F of this application). This outfall will consist of the stormwater from a portion (approximately 29 acres) of the capped and closed ash pond and will contain no other process wastewater. See the Barry Proposed Flow Diagram included in this application.

021 – Stormwater associated with electric power generation – This is a new stormwater outfall that will be constructed during the ash pond closure process (See the proposed location shown on the site map enclosed with Form 2F of this application). This outfall will consist of the stormwater from the majority of the capped and closed ash pond and will contain no other process wastewater. This outfall will utilize the existing ash pond discharge outfall point. See the Barry Proposed Flow Diagram included in this application.

Please print or type in the unshaded areas only.

EPA ID Number (*copy from Item 1 of Form 1*) ALD082148800

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

FORM **2F** NPDES

EPA

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number (*list*)	B. Latitude			C. Longitude			D. Receiving Water (*name*)
DSN 010	31	00	24	88	00	41	Mobile River
DSN 013	31	00	24	88	00	41	Mobile River
DSN 019	31	00	24	88	00	41	Mobile River
DSN 020	31	00	24	88	00	41	Mobile River
DSN 021	31	00	24	88	00	41	Mobile River

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B: You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall; paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied; each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

 Continue on Page 2

EPA ID Number (*copy from Item 1 of Form 1*)
ALD082148800

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

VII. Discharge information *(Continued from page 3 of Form 2F)*

Part A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number (*if available*)	Maximum Values (*include units*)		Average Values (*include units*)		Number of Storm Events Sampled	DSN010
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		Sources of Pollutants
Oil and Grease	<5mg/L	N/A			1	Runoff from Switchyard
Biological Oxygen Demand (BOD5)	3.2mg/L	3.0mg/L			1	Runoff from Switchyard
Chemical Oxygen Demand (COD)	39.1mg/L	27.4mg/L			1	Runoff from Switchyard
Total Suspended Solids (TSS)	65.1mg/L	75.4mg/L			1	Runoff from Switchyard
Total Nitrogen	0.877mg/L	0.821 mg/L			1	Runoff from Switchyard
Total Phosphorus	0.065mg/L	0.552 mg/L			1	Runoff from Switchyard
pH	Minimum 8.7	Maximum 8.7	Minimum	Maximum	1	Runoff from Switchyard

Part B – List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number (*if available*)	Maximum Values (*include units*)		Average Values (*include units*)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
Total Arsenic	0.00419 mg/L	0.00541 mg/L			1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater
Total Chromium	0.00360 mg/L	0.00448 mg/L			1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater
Total Copper	0.0108 mg/L	0.0135 mg/L			1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater
Total Iron	0.712 mg/L	0.967 mg/L			1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater
Total Mercury	0.00000897 mg/L				1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater
Total Zinc	0.163 mg/L	0.198 mg/L			1	Pollutant listed in the Barry NPDES
						Permit for its Process Wastewater

Continue on Reverse

Continued from the Front

Part C - List each pollutant shown in Table 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
N/A						

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event *(in minutes)*	3. Total rainfall during storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event *(gallons/minute or specify units)*	6. Total flow from rain event *(gallons or specify units)*
11/1/2018	300 min.	0.91 inches	150 hours	1,183 gal/min	102,564 gallons

7. Provide a description of the method of flow measurement or estimate.

The rational method was used to determine the flow. The impervious area of the drainage area was multiplied by a runoff coefficient of 1.0. The pervious area of the drainage area was multiplied by a runoff coefficient of 0.8. The sum of these two calculations was then multiplied by the depth of the rainfall to determine the flow.

Continued from the Front

IV. Narrative Description of Pollutant Sources

A. For each outfall, provide an estimate of the area (include units) of impervious surfaces (including paved areas and building roofs) drained to the outfall, and an estimate of the total surface area drained by the outfall.

Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*	Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*
010	1.3 acres	7.06 acres	021	0 acres	570 acres
013	3.2 acres	3.23 acres			
019	0.9 acres	6.04 acres			
020	0 acres	29 acres			

B. Provide a narrative description of significant materials that are currently or in the past three years have been treated, stored or disposed in a manner to allow exposure to storm water; method of treatment, storage, or disposal; past and present materials management practices employed to minimize contact by these materials with storm water runoff; materials loading and access areas, and the location, manner, and frequency in which pesticides, herbicides, soil conditioners, and fertilizers are applied.

Upon ash pond closure, outfalls 020 and 021 will discharge stormwater runoff from the closed and capped pond. Closure activities are currently underway. During closure, any stormwater that commingles with ash pond water will be treated to compliance standards by a dedicated treatment system prior to discharge to the Mobile River.

C. For each outfall, provide the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of the treatment the storm water receives, including the schedule and type of maintenance for control and treatment measures and the ultimate disposal of any solid or fluid wastes other than by discharge.

Outfall Number	Treatment	List Codes from Table 2F-1
010 013 019 020 021	Monthly, weekly, and/or spot checks are used to eliminate or minimize the release of pollutants at all outfalls. All employees are trained to report all types of spills immediately.	4-A

V. Nonstormwater Discharges

A. I certify under penalty of law hat the outfall(s) covered by this application have been tested or evaluated for the presence of nonstormwater discharges, and that all nonstormwater discharged from these outfall(s) are identified in either an accompanying Form 2C or From 2E application for the outfall.

Name and Official Title (*type or print*)	Signature	Date Signed
Susan B. Comensky, V.P. - Environmental Affairs	Susan Comensky	1/8/2020

B. Provide a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.

VI. Significant Leaks or Spills

Provide existing information regarding the history of significant leaks or spills of toxic or hazardous pollutants at the facility in the last three years, including the approximate date and location of the spill or leak, and the type and amount of material released.

There were no significant oil spills during the last three years.

 Continue on Page 3

Continued from Page 2

EPA ID Number *(copy from Item 1 of Form 1)*
ALD082148800

VII. Discharge Information

A, B, C, & D: See instructions before proceeding. Complete one set of tables for each outfall. Annotate the outfall number in the space provided.
Table VII-A, VII-B, VII-C are included on separate sheets numbers VII-1 and VII-2.

E. Potential discharges not covered by analysis – is any toxic pollutant listed in table 2F-2, 2F-3, or 2F-4, a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ Yes *(list all such pollutants below)* ☒ No *(go to Section IX)*

VIII. Biological Toxicity Testing Data

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ Yes *(list all such pollutants below)* ☒ No *(go to Section IX)*

IX. Contract Analysis Information

Were any of the analyses reported in Item VII performed by a contract laboratory or consulting firm?

☒ Yes *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ No *(go to Section X)*

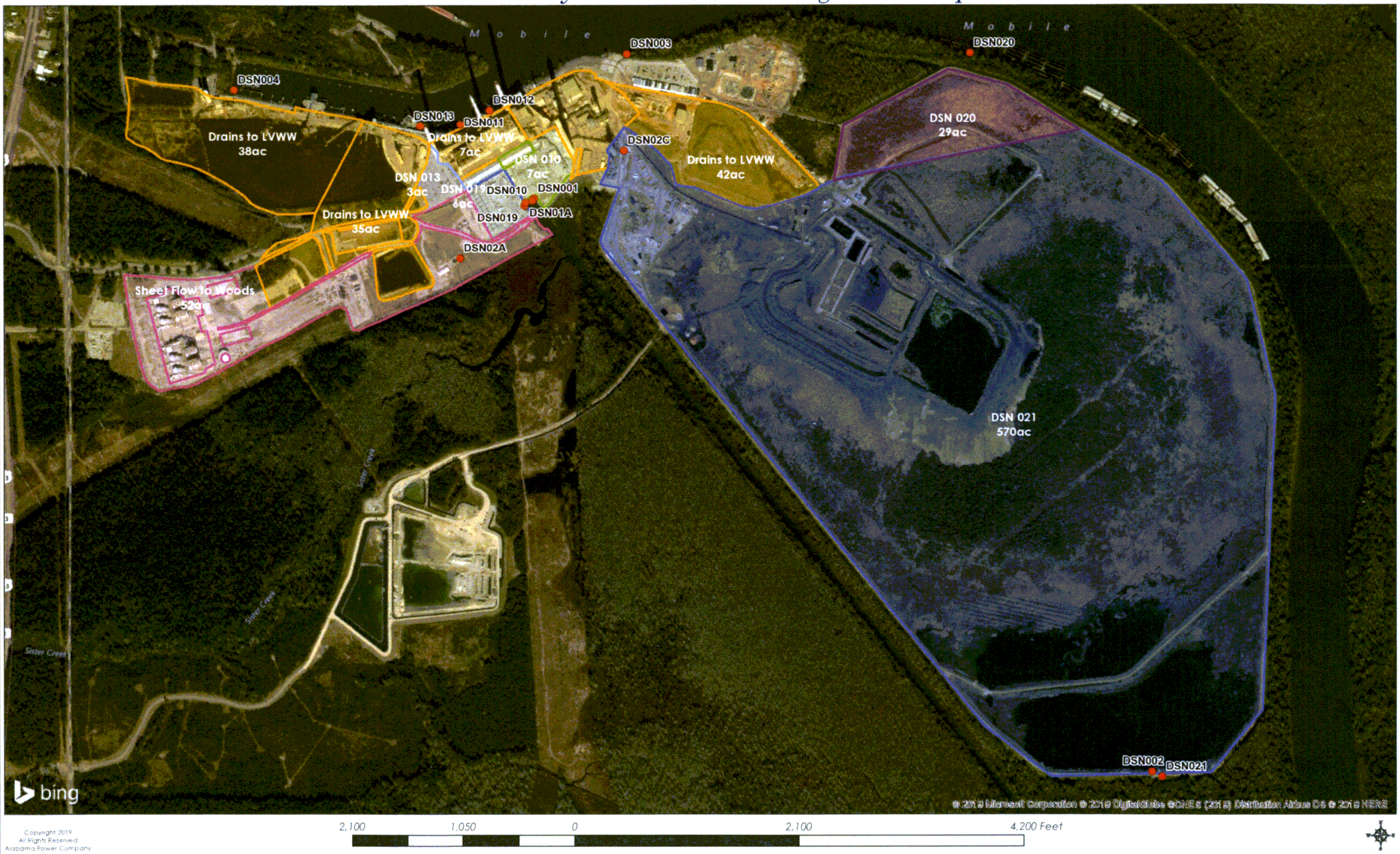
A. Name	B. Address	C. Area Code & Phone No.	D. Pollutants Analyzed
Pace Analytical Services (previously TTL)	3516 Greensboro Avenue Tuscaloosa, AL 35401	(205)614-6630	Refer to enclosed Certificates of Analyses

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title *(Type Or Print)*	B. Area Code and Phone No.
Susan B. Comensky, V.P. - Environmental Affairs	(205)257-0298
C. Signature	D. Date Signed
Susan Comensky	1/8/2020

Plant Barry Stormwater Drainage Area Map



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Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR0102F
Sample Date/Time : 01-Nov-18 8:45 AM
Customer ID: AL-0002879
Delivery Date : 01-Nov-18

Description: Barry SW Runoff Form 2F - Grab

Laboratory ID Number: AY26107

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Metals, Cyanide, Total Phenols									
Total, Low Level Prep Date	DLJ	11/5/2018	EPA 1638		1			11/5/18	DATE
* Arsenic, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000068	0.000203	0.00419	mg/L
* Chromium, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000101	0.000203	0.00360	mg/L
* Copper, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000152	0.000203	0.0108	mg/L
Iron, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000812	0.001634	0.712	mg/L
* Mercury, Total by CVAF	GAS	11/9/2018	EPA 245.7		1	0.9	5	8.97	ng/L
* Zinc, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000337	0.001015	0.163	mg/L
General Characteristics									
Field Temperature	TVD/	11/1/2018	SM-2550		1			21.4	Deg C
Chlorine, Free	TVD/	11/1/2018	Field Test		1	0.01		Not Detected	mg/l
Field pH	TVD/	11/1/2018	SM-4500H		1			8.71	SU
Precipitation	TVD/	11/1/2018			1	0		0.91	inches
Filter Completion Date	KRC	11/6/2018	SM 2540D		1			11/06/2018	Date
Solids, Suspended	CRB	11/8/2018	SM 2540D		1		2.5	65.1	mg/L
Biochemical Oxygen Demand, 5 Day, b	CPP	11/2/2018	SM 5210 B-2001		1		2	3.2	mg/L
Chlorine, Total Residual	TVD/	11/1/2018	Field Test		1	0.05		Not Detected	mg/L
* Nitrogen, Nitrate/Nitrite	KRC	11/13/2018	EPA 353.2		1	0.1	0.3	0.47	mg/L as N
* Oil and Grease	HRG	11/15/2018	EPA 1664B		1	1.4	5	< 5	mg/L
* Phosphorus, Total	EMG	11/9/2018	SM 4500PE-TP		1	0.021	0.03	0.065	mg/L
Nitrogen, Total, Calculation	KRC	11/13/2018	SM4500		1			0.877	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2019

Comments: Biochemical Oxygen Demand, 5 Day and Chemical Oxygen Demand analyses performed by Tuscaloosa Testing Laboratory._fkk 11/15/18

cc: Cotton/Sikes/Ward
Coker/Dutton

uality Control ______________________ **Supervision**____________________________

Reported:11/27/2018
Version: 4.2

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General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
`X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab& Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBAR0102F
Sample Date/Time : 01-Nov-18 8:45 AM
Customer ID: AL-0002879
Delivery Date : 01-Nov-18

Description: Barry SW Runoff Form 2F - Grab

Laboratory ID Number: AY26107

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Nitrogen, Ammonia by Gas Diffusion	JCC	11/5/2018	EPA 350.1		1	0.03	0.1	< 0.1	mg/L as N
* Nitrogen, Total Kjeldahl	JCC	11/6/2018	EPA 351.2		1	0.1	0.1	0.406	mg/L as N
Chemical Oxygen Demand, by TTL	TLM	11/7/2018	SM 5220 D		1		5	39.1	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2019

Comments: Biochemical Oxygen Demand, 5 Day and Chemical Oxygen Demand analyses performed by Tuscaloosa Testing Laboratory._fkk 11/15/18

cc: Cotton/Sikes/Ward
Coker/Dutton

'ality Control [signature] Supervision [signature]

Reported:11/27/2018
Version: 4.2

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CERTIFICATE OF ANALYSIS

Alabama Power
Lab& Field SERVICES

ɪo: TV Davis
Barry Steam Plant

Customer Account : NBAR0102F
Sample Date/Time : 01-Nov-18 11:45 AM
Customer ID: AL-0002879
Delivery Date : 01-Nov-18

Description: Barry SW Runoff Form 2F - Composite

Laboratory ID Number: AY26110

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Metals, Cyanide, Total Phenols									
Total, Low Level Prep Date	DLJ	11/5/2018	EPA 1638		1			11/5/18	DATE
* Arsenic, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000068	0.000203	0.00541	mg/L
* Chromium, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000101	0.000203	0.00448	mg/L
* Copper, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000152	0.000203	0.0135	mg/L
Iron, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000812	0.001634	0.967	mg/L
* Zinc, Total	ABB	11/6/2018	EPA 200.8		1.015	0.000337	0.001015	0.198	mg/L
General Characteristics									
Filter Completion Date	KRC	11/6/2018	SM 2540D		1			11/06/2018	Date
* Solids, Suspended	CRB	11/8/2018	SM 2540D		1		2.5	75.4	mg/L
Biochemical Oxygen Demand, 5 Day, b	CPP	11/2/2018	SM 5210 B-2001		1		2	3.0	mg/L
* Nitrogen, Nitrate/Nitrite	KRC	11/13/2018	EPA 353.2		1	0.1	0.3	0.37	mg/L as N
* Phosphorus, Total	EMG	11/9/2018	SM 4500PE-TP		1	0.021	0.03	0.552	mg/L
Nitrogen, Total, Calculation	KRC	11/13/2018	SM4500		1			0.821	mg/L
litrogen, Ammonia by Gas Diffusion	JCC	11/5/2018	EPA 350.1		1	0.03	0.1	< 0.1	mg/L as N
Nitrogen, Total Kjeldahl	JCC	11/6/2018	EPA 351.2		1	0.1	0.1	0.451	mg/L as N
Chemical Oxygen Demand, by TTL	TLM	11/5/2018	SM 5220 D		1		5	27.4	mg/L

This Certificate states the physical and/or chemical characteristics of the sample as submitted. This document shall not be reproduced, except in full, without written consent from Alabama Power's General Test Laboratory.

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2019

Comments: Biochemical Oxygen Demand, 5 Day and Chemical Oxygen Demand analyses performed by Tuscaloosa Testing Laboratory._fkk 11/15/18

cc: Cotton/Sikes/Ward
Coker/Dutton

ɪality Control [signature] Supervision [signature]

Reported:11/27/2018
Version: 4.2

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`X (205) 257-1654

Definitions

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Lab & Field SERVICES

Abbreviation	Description
DF	Dilution Factor
LFB	Lab Fortified Blank
MB	Method Blank
MDL	Method Detection Limit; minimum concentration of an analyte that can be determined with 99% confidence that the concentration is greater than zero.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
Prec	Precision (% RPD)
Q	Qualifier; comment used to note deviations or additional information associated with analytical results.
QC	Quality Control
Rec	Recovery of Matrix Spike
RL	Reporting Limit; lowest concentration at which an analyte can be quantitatively measured.
Vio Spe	Violation Specification; regulatory limit which has been exceeded by the sample analyzed.

Qualifier	Description
B	Analyte found in reagent blank. Indicates possible reagent or background contamination.
E	Estimated reported value exceeded calibration range
J	Reported value is an estimate because concentration is less than reporting limit.
N	Organic constituents tentatively identified. Confirmation is needed.
R	Matrix spike recovery is out of range.
U	Compound was analyzed, but not detected.
P	Precision is out of range.
C	Analyte was verified by re-analysis.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
L	Check standard is outside of the required specification limit.
D	All samples were stored at less than or equal to 6 °C and for no longer than 48 hours from time of sampling, unless otherwise noted.
F	Water Field Group (WFG) qualifier; see comments for more information
I	Improper sample preservation.
T	Sample temperature outside acceptable limits.

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‹ (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 13-Feb-18 10:00 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Intake Water Repermitting

Laboratory ID Number: AY03737

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Metals, Cyanide, Total Phenols									
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245.7		1	0.9	5	9.11	ng/L
Cyanide, Total, by TTL	MTL	2/19/2018	SM 4500-CN CE		1		0.01	< 0.010	mg/L
Phenol, Total, by TTL	KMC	3/2/2018	SM 5330		1		0.1	< 0.10	mg/L
General Characteristics									
Flow (MGD)	JBH/L	2/13/2018	Field Data		1			617.93	MGD
Field Temperature	JBH/L	2/13/2018	SM-2550		1			11.4	Deg. C
Field pH	JBH/L	2/13/2018	SM-4500H		1			7.39	SU
Field Sulfite	JBH/L	2/13/2018	HACH 8216		1	4		Not Detected	mg/l
Chlorine, Total Residual	JBH/L	2/13/2018	Field Test		1	0.05		Not Detected	mg/L
* Escherichia Coli (E. Coli)	CES	2/14/2018	SM 9223B		1	1		167.0	MPN/100ml
* Oil and Grease	RDA	2/22/2018	EPA 1664B		1	1.4	5	< 5	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: Cyanide, Total and Phenol, Total analyses performed by Tuscaloosa Testing Laboratory._fkk 2/14/18

cc: Bo Cotton
Paula Coker
Brad Dutton

uality Control [signature] Supervision [signature]

Reported 3/5/2018
Version: 4.2

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CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

o: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
.-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

~uality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

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FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	1,2-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,3-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01		< 0.010	mg/l
	Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,4-Dichlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/l
	Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005		< 0.005	mg/L
	Metals, Cyanide, Total Phenols										
	Total, Low Level Prep Date	JHK	2/15/2018	EPA 1638		1				2/15/2018	DATE
	Aluminum, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.033799	0.1015		1.35	mg/L
	Antimony, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
*	Arsenic, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00107	mg/L
*	Barium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.0426	mg/L
*	Beryllium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		< 0.000203	mg/L
*	Boron, Total	HRG	2/15/2018	EPA 200.7		1.015	0.033799	0.1015	U	Not Detected	mg/L
*	Cadmium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments: BOD was collected as a 24 hour composite and was iced during compositing. Sample was held at or below 6 deg C from time of collection until sample analysis began.
Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision**______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
	Calcium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.169505	0.5075		16.5	mg/L
*	Chromium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00238	mg/L
*	Cobalt, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000960	mg/L
*	Copper, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00199	mg/L
	Iron, Total	DLJ	2/19/2018	EPA 200.8		10.15	0.00545	0.016341		2.35	mg/L
*	Lead, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.00160	mg/L
	Magnesium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.169505	0.5075		3.27	mg/L
*	Manganese, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.120	mg/L
*	Molybdenum, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000315	mg/L
*	Nickel, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00244	mg/L
*	Selenium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203		0.000469	mg/L
*	Silver, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
*	Thallium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
	Tin, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000068	0.000203	U	Not Detected	mg/L
	Titanium, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.0195	mg/L
	Zinc, Total	DLJ	2/19/2018	EPA 200.8		1.015	0.000337	0.001015		0.00798	mg/L
	General Characteristics										
	Hardness, Total, (as CaCO3)	DLJ	2/19/2018	SM 2340 B		1				54.6	mg/L
*	Solids, Suspended	KRC	2/15/2018	SM 2540D		1		2.5		62.4	mg/L
*	Biochemical Oxygen Demand, 5 Day	CES	2/20/2018	SM 5210B		1	0			0.8	mg/L
	BOD Analysis Start Date/Time	CES	2/15/2018	SM 5210B		1				0805	

This Certificate states the physical and/or chemical characteristics of the sample as submitted. This document shall not be reproduced, except in full, without written consent from Alabama Power's General Test Laboratory.

MDL's and RL's are adjusted for sample dilution, as applicable

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Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

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Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision**______________________

Reported:3/13/2018
Version: 4.2

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FAX (205) 257-1654

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Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

	Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
*	Bromide	CES	2/19/2018	EPA 300.0		1	0.04	0.08		< 0.08	mg/L
*	Fluoride	CES	2/19/2018	EPA 300.0		1	0.01	0.04		0.06	mg/L
*	Sulfate	CES	2/19/2018	EPA 300.0		1	0.04	1		17.0	mg/L
	Color, by TTL	TRT	2/15/2018	SM 2120 E		1		10		12.0	ADMI
*	Nitrogen, Nitrate/Nitrite	ABB	2/20/2018	EPA 353.2		1	0.1	0.3		0.33	mg/L as N
	Nitrogen, Total Organic	GMW	3/9/2018	EPA 351.3		1	0.1			Not Detected	mg/l as N
	Sulfide, by TTL	TRT	2/20/2018	SM4500 S2 D		1		0.01		< 0.01	mg/l
	Surfactants (Foaming Agents), by TTL	KJG	2/15/2018	SM 5540C		1		0.05		< 0.05	mg/l
*	Phosphorus, Total	CNJ	2/22/2018	SM 4500PE-TP		1	0.01	0.03		0.085	mg/L
*	Nitrogen, Ammonia, Distilled	GMW	2/26/2018	EPA 350.1		1	0.1	0.3	U	Not Detected	mg/L as N
*	Nitrogen, Total Kjeldahl	GMW	3/7/2018	EPA 351.2		1	0.156	1	U	Not Detected	mg/L as N
	Total Organic Carbon	DLJ	2/19/2018	SM 5310 B		1	0.5	2		5.72	mg/L
	Chemical Oxygen Demand, by TTL	TLM	2/20/2018	SM 5220 D		1		5		13.9	mg/L
	Base/Neutral Compounds										
	Acenaphthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
	Acenaphthylene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
	Anthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/l
	Benzidine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047		< 0.047	mg/l
	Benz(a)anthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
	Benzo(a)pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L
	Benzo(b)fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009		< 0.009	mg/L

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Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

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Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Benzo(g,h,i)perylene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Benzo(k)fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Bis(2-chloroethoxy)methane, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Bis(2-chloroethyl)ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Bis(2-chloroisopropyl)ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Bis(2-ethylhexyl)phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
4-Bromophenyl phenyl ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Butyl benzyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
2-Chloronaphthalene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
4-Chlorophenyl phenyl ether, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
Chrysene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Dibenzo(a,h)anthracene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
3,3-Dichlorobenzidine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.019	< 0.019	mg/L
Diethyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Dimethyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Di-n-butyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
2,4-Dinitrotoluene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
2,6-Dinitrotoluene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Di-n-octyl phthalate, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
1,2-Diphenylhydrazine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047	< 0.047	mg/L
Fluoranthene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

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Paula Coker
Brad Dutton

Quality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

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Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Fluorene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Hexachlorobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Hexachlorobutadiene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Hexachlorocyclopentadiene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Hexachloroethane, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Indeno(1,2,3-cd)pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Isophorone, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Naphthalene, TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Nitrobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
N-Nitrosodimethylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
N-Nitrosodi-n-propylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
N-Nitrosodiphenylamine, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Phenanthrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Pyrene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
1,2,4-Trichlorobenzene, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Acid Compounds									
2-Chlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/l
2,4-Dichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
2,4-Dimethylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
4,6-Dinitro-2-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047	< 0.047	mg/L
2,4-Dinitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047	< 0.047	mg/L

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Chemical Oxygen Demand, Color, Sulfide, Surfactants, EPA 624 and EPA 625 analyses performed by Tuscaloosa Testing Laboratory._fkk 2/15/18

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Quality Control ______________ **Supervision** ______________

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CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARINTR
Sample Date/Time : 14-Feb-18 9:16 AM
Customer ID: AL-0002879
Delivery Date : 14-Feb-18

Description: Barry Intake Water
Repermitting 2C

Laboratory ID Number: AY03854

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
2-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
4-Nitrophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.047	< 0.047	mg/L
4-chloro-3-methylphenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
Pentachlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.024	< 0.024	mg/L
Phenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L
2,4,6-Trichlorophenol, by TTL	LAA	3/1/2018	EPA 625.1		1		0.009	< 0.009	mg/L

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Quality Control ____ Supervision ____

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CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

ɔ: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03861

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
.-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

ʼʼuality Control ______________________ **Supervision** ______________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field Services

o: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03861

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control Keith Kona... **Supervision** [signature]

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

o: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03859

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
.-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

~uality Control ______________ **Supervision** ______________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field Services

ɔ: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03859

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____ Supervision ____

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
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FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

To: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03857

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____________________ **Supervision**____________________

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field Services

o: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03857

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control _______ **Supervision** _______

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03855

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
Volatile Compounds									
Acrolein, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Acrylonitrile, by TTL	LAA	2/23/2018	EPA 624		1		0.1	< 0.100	mg/L
Carbon Tetrachloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Benzene, TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Trichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,1-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromoform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Vinyl Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.002	< 0.002	mg/L
Chlorobenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Dibromochloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Tetrachloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Trans-1,2-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
2-Chloroethyl vinyl ether, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/L
Chloroform, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2-Trichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Bromodichloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,2-Dichloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
1,1-Dichloroethene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____________ **Supervision** ____________

Reported:3/13/2018
Version: 4.2

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FAX (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

o: TV Davis
Barry Steam Plant

Customer Account : NBARBBLK
Sample Date/Time : 14-Feb-18 12:00 AM
Customer ID:
Delivery Date : 14-Feb-18

Description: Plant Barry
Trip Blank

Laboratory ID Number: AY03855

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q Results	Units
1,2-Dichloropropane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
cis-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
trans-1,3-Dichloropropene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Bromomethane, by TTL	LAA	2/23/2018	EPA 624		1		0.01	< 0.010	mg/l
Ethylbenzene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Chloromethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
Methylene Chloride, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L
1,1,2,2-Tetrachloroethane, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/l
Toluene, by TTL	LAA	2/23/2018	EPA 624		1		0.005	< 0.005	mg/L

MDL's and RL's are adjusted for sample dilution, as applicable

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control Keith Kornegay **Supervision** [signature]

Reported:3/13/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARLBLK
Sample Date/Time : 13-Feb-18 12:00 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Repermitting - Lab Blank

Laboratory ID Number: AY03747

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Metals, Cyanide, Total Phenols										
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245 7		1	0 9	5	U	Not Detected	ng/L

This Certificate states the physical and/or chemical characteristics of the sample as submitted. This document shall not be reproduced, except in full, without written consent from Alabama Power's General Test Laboratory.

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control [signature] Supervision [signature]

Reported 3/5/2018
Version 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARFBLK
Sample Date/Time : 13-Feb-18 8:50 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Ash Pond Discharge - Field Blank

Laboratory ID Number: AY03746

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Metals, Cyanide, Total Phenols										
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245.7		1	0.9	5	U	Not Detected	ng/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

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Reported:3/5/2018
Version: 4.2

Alabama Power
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(205) 664 - 6032 or 6171
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CERTIFICATE OF ANALYSIS

Alabama Power
Lab& Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARFBLK
Sample Date/Time : 13-Feb-18 10 00 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Intake - Field Blank

Laboratory ID Number: AY03743

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Metals, Cyanide, Total Phenols										
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245 7		1	0.9	5	U	Not Detected	ng/L

This Certificate states the physical and/or chemical characteristics of the sample as submitted. This document shall not be reproduced, except in full, without written consent from Alabama Power's General Test Laboratory.

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ____________ **Supervision** ____________

Reported:3/5/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power
Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARFBLK
Sample Date/Time : 13-Feb-18 9:10 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry OTCW - Field Blank

Laboratory ID Number: AY03744

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Metals, Cyanide, Total Phenols										
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245.7		1	0.9	5	U	Not Detected	ng/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

Quality Control ______ Supervision ______

Reported:3/5/2018
Version: 4.2

Alabama Power
General Test Laboratory
744 County Road 87, GSC #8
Calera, AL 35040
(205) 664 - 6032 or 6171
X (205) 257-1654

CERTIFICATE OF ANALYSIS

Alabama Power

Lab & Field SERVICES

To: TV Davis
Barry Steam Plant

Customer Account : NBARFBLK
Sample Date/Time : 13-Feb-18 8:50 AM
Customer ID: AL-0002879
Delivery Date : 13-Feb-18

Description: Barry Cooling Tower BD - Field Blank

Laboratory ID Number: AY03745

Name	Analyst	Test Date	Reference	Vio Spec	DF	MDL	RL	Q	Results	Units
Metals, Cyanide, Total Phenols										
* Mercury, Total by CVAF	ABB	2/20/2018	EPA 245 7		1	0.9	5	U	Not Detected	ng/L

MDL's and RL's are adjusted for sample dilution, as applicable

*** Test results for these accredited parameters meet all 2003 NELAC and 2009 TNI requirements, with exceptions noted on this report**
Laboratory certification ID: E571114
Issued By: State of Florida, Department of Health
Expiration: June 30, 2018

Comments:

cc: Bo Cotton
Paula Coker
Brad Dutton

ality Control [signature] Supervision [signature]

Reported:3/5/2018
Version: 4.2

JAMES M. BARRY ELECTRIC GENERATING PLANT
316(a) THERMAL VARIANCE STUDY

April 2013

Alabama Power Company, GSC #8
Environmental Affairs Department
P.O. Box 2641
Birmingham, Alabama, 35291

EXECUTIVE SUMMARY

Section 316(a) of the Clean Water Act (CWA) authorizes state regulatory agencies, upon application from a point source discharger, to establish an alternative thermal limit or variance in lieu of the technology or water quality based limits that otherwise would apply. The permittee requesting the thermal variance must demonstrate that the proposed limit will assure the protection and propagation of the balanced, indigenous population (BIP) of shellfish, fish, and wildlife in and around the receiving water body. The purpose of this report is to demonstrate that the thermal variance, which was first granted by the Environmental Protection Agency (EPA) in 1977 for Alabama Power Company's (APC's) J.M. Barry Electric Generating Plant (Plant Barry), continues to assure the protection and propagation of the BIP of the Mobile River, supporting the renewal of alternative thermal limits.

This report details a two-year study of the macroinvertebrate and a one-year study of the adult fish communities in the receiving waterbody for the purposes of demonstrating that the alternative thermal limits assure the protection and propagation of the BIP of shellfish, fish, and wildlife. Data collected from study areas upstream from, adjacent to, and downstream from the discharge point were used to assess the effects of Plant Barry's thermal effluent. A unique challenge of this study is to provide enough biotic and abiotic data to discriminate the effects of temperature from other environmental variables. Although the macroinvertebrate community is not part of the 316(a) BIP standard to be considered, and is only a subset of the entire aquatic organism population, it is the only community that had the potential to be evaluated with the necessary level of statistical certainty. Because the macroinvertebrate community is more sensitive to the thermal

changes than the adult fish community and is important to sustain a BIP of adult fish, the response in the macroinvertebrates should be considered a conservative reflection of effects to the adult fish community. Traditional statistical methods such as an analysis of variance and an analysis of covariance were used to relate changes in various macroinvertebrate metrics to different sections of the Mobile River. However, the generalized additive model statistical method was used to discern any "true" temperature effects on these metrics. Confounding factors identified from the body of statistical analyses include saltwater encroachment and sedimentation, which were significant factors affecting the macroinvertebrate community. APC also performed water quality monitoring and thermal modeling in order to evaluate possible relationships between abiotic factors, such as in-stream levels of dissolved oxygen (DO) and various pollutants, as well as various biological indices. This study is a follow-up to and verification of prior 316(a) studies submitted to the EPA Region IV on June 30, 1977, and to the Alabama Department of Environmental Management (ADEM) on May 29, 2003, demonstrating that there has been no appreciable harm to the BIP in the Mobile River as a result of prior thermal discharges from Plant Barry.

ADEM formally approved the current 316(a) study plan for Plant Barry (Alabama Power Company 2009), which included the analytical framework to address the specific BIP criteria from 40 CFR 125.71(c). Using EPA's Section 316(a) regulations and guidance, the study addressed the following seven factors:

(1) whether the populations form a community typically characterized by diversity at all trophic levels,
(2) whether the community has the capacity to sustain itself through cyclic seasonal changes,
(3) whether necessary food chain species are present,

(4) whether the community is dominated by pollution-tolerant species,
(5) whether indigenous species are present,
(6) identification of representative important species ("ris"; i.e., recreationally and commercially important, threatened, and endangered species), and
(7) water quality and temperature monitoring.

The first six criteria were derived from EPA's definition of "balanced indigenous community", which they define as synonymous with "balanced indigenous population". These criteria are examined in order to evaluate whether the thermal variance previously approved under Section 316(a) has assured the protection and propagation of a BIP of shellfish, fish, and wildlife, specifically reviewing adult fish. Additionally, this study evaluated the macroinvertebrate community, which is the best indicator for determining the thermal tolerance of the localized adult fish community. Under Section 125.73(c) of EPA's rules, existing dischargers may base their 316(a) demonstrations on the historical absence of prior appreciable harm in lieu of predictive studies. As EPA Guidance states, such studies "must provide reasonable assurance (emphasis added) of protection and propagation of the indigenous community. Mathematical certainty regarding a dynamic biological situation is impossible to achieve…." (EPA 316(a) Thermal Guidance – Thermal Discharges, September 30, 1974 at p. 8).

The overall weight of evidence from all of the macroinvertebrate and adult fish metrics indicates that the thermal discharge from Plant Barry has caused no appreciable harm to the BIP of shellfish, fish, and wildlife in and around the Mobile River, as outlined in this report. All adult fish and macroinvertebrate organisms from the heat-affected areas of the river were diverse, were sustained through cyclic seasonal changes, were sufficiently present to support the food chain, and were not dominated by pollution-tolerant species, when compared to areas of the river unaffected by heat. There was no evidence of diminishing indigenous fish populations. Any changes in the macroinvertebrate and adult fish communities as a result of thermal discharge and in the heat-affected areas were not biologically meaningful and showed recovery at the downstream heat-affected areas. The water quality of the Mobile River in the vicinity of Plant Barry for these studies was typical for operations under the present thermal variance.

The evaluation of the macroinvertebrate and adult fish communities in both the heat-affected and unaffected areas of the Mobile River in the vicinity of Plant Barry clearly indicates the existence of a BIP of shellfish, fish, and wildlife. Through this study and many previous studies, APC has demonstrated with sufficient scientific data and certainty, that the thermal discharge from Plant Barry has caused no appreciable harm to the shellfish, fish, and wildlife communities. Based on this evidence, ADEM should continue APC's 316(a) variance for its thermal discharges from Plant Barry.

GLOSSARY OF ACRONYMS AND DEFINITIONS

§316(a)	Section 316(a) of the Clean Water Act, 33 U.S.C. § 1326(a), provides that the EPA and delegated state agencies may authorize alternate thermal conditions in NPDES permits where the effluent limitation is more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the thermal discharge is made. (State regulations, in turn, provide for the granting of thermal variances and have the requisite authority to issue such variances. The variances are reviewed with each NPDES permit renewal.)
ADCP	Acoustic Doppler Current Profiler
ADEM	Alabama Department of Environmental Management
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
APC	Alabama Power Company
BIC	balanced indigenous community, equivalent to BIP
BIP	balanced indigenous population
C	Celsius
cfs	cubic feet per second
CI	confidence interval
cm	centimeter
CPUE	Catch Per Unit Effort
CWA	Clean Water Act
DC	direct current
df	degrees of freedom
DO	dissolved oxygen
EFDC	Environmental Fluid Dynamics Code
EPA	United States Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera and Trichoptera; three taxonomic orders whose presence is often used as a water quality indicator for macroinvertebrates
Evenness	a measure of diversity of a biological community
F	Fahrenheit
ft	feet
g	gram
GAM	generalized additive model

HBI	Hilsenhoff Biotic Index
Hester-Dendy	a macroinvertebrate multi-plate sampling device
HOBO	a product line of continuous water temperature loggers made by Onset Corporation
L	liter
LDO®	Luminescent dissolved oxygen
log	logarithm
LOI	loss on ignition
m	meter
MLR	multiple linear regression
μ	micro (10^{-6}, as a prefix)
mg	milligrams
mm	millimeter
MW	megawatt
NCDENR	North Carolina Department of Environment and Natural Resources
ng	nanogram
NPDES	National Pollutant Discharge Elimination System - Program was established by the federal government and administered by the EPA to control point source discharges of water pollution.
NS	not significant
QA	quality assurance
QC	quality control
ris	representative important species, namely recreationally and commercially important, threatened or endangered species
RMSE	root-mean-square error
S	siemens, a unit of electrical conductance
SWDI	Shannon-Weaver diversity index
USGS	United States Geological Survey
V	volt

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1. INTRODUCTION

James M. Barry Electric Generating Plant (Plant Barry), owned and operated by Alabama Power Company (APC), is a coal-fired and natural gas-fired facility located on the Mobile River in northern Mobile County, Alabama. Plant Barry has five coal-fired units (1–5) that use once-through cooling water from the Mobile River, with a total nameplate capacity of 1,525 MW. APC added two 566-MW combined-cycle units (6–7) in 2000–2001. These two additional generating units are closed-cycle and have little net effect on the volume and temperature of the cooling water intake and discharge. Two intake structures withdraw river water from a man-made barge canal located at river mile 30.5; one supplies units 1–3 and makeup water for units 6–7 cooling towers, while the other supplies units 4–5. All five coal-fired units discharge at a common point at the head of a man-made 1.4 mile–long discharge canal before re-entering the Mobile River at river mile 27.25, approximately 3 miles downstream of the intake.

Since the 1970s, numerous studies have been conducted on the thermal, biological, and water quality properties of the Mobile River in the vicinity of Plant Barry. Studies conducted from 1974 through 1976 included analyses of the plankton, macroinvertebrate, larval fish and adult fish communities near Plant Barry (Alabama Power Company, 1977). The results of this 316(a) Demonstration Study were reviewed by ADEM and EPA, and the subsequent National Pollutant Discharge Elimination System (NPDES) permits from 1976 through 1999 did not include thermal limits. In 1999, ADEM again granted a 316(a) variance when it reissued the NPDES permit for Plant Barry that for the first time imposed a numerical thermal limit on the discharged effluent. This permit was modified in 2003 when ADEM granted a thermal variance extending the interim limits specified in the 1999 permit. ADEM also requested additional information to support the continuation of the thermal variance at the next permit issuance. APC has prepared and provided reports, site-specific data, studies, and documentation in response to EPA's repeated requests for information supporting a thermal variance for Plant Barry (APC 1977, APC 1985, APC 1998, APC 1999, APC 2001, APC 2004, Bayne 1997, Bayne *et al.* 2003, Lawrence and Bayne 1977, Webber *et al.* 1999).

According to CWA Section 316(a), to qualify for a variance in thermal discharge limits APC must demonstrate that the proposed limits for Plant Barry will assure the continued protection and propagation of the BIP in and around the Mobile River.

The following study demonstrates, with scientific data, that the thermal variance, which has been granted since the 1970s, will continue to assure the protection and propagation of the BIP in the Mobile River near Plant Barry, justifying the renewal of that thermal variance.

The criteria used to gauge the BIP are derived from 40 CFR 125.71(c), which defines a balanced indigenous community (BIC) as:

> "synonymous with the term balanced, indigenous population in the Act and means a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species and by a lack of domination of pollution-tolerant species. Such a community may include historically non-native species introduced in connection with a program of wildlife management and species whose presence or abundance results from substantial, irreversible environmental modifications. Normally, however, such a community will not include species whose presence or abundance is attributable to the introduction of pollutants that will be eliminated by compliance by all sources with §301(b)(2) of the Act; and may not include species whose presence or abundance is attributable to alternative effluent limitation imposed pursuant to §316(a)."

The seven criteria examined in this study are:

(1) "a population typically characterized by diversity,"
(2) "the capacity to sustain itself through cyclic seasonal changes,"
(3) "presence of necessary food chain species,"
(4) "lack of domination of pollution-tolerant species,"
(5) "indigenous,"
(6) representative important species identification, and
(7) water quality and temperature monitoring.

APC designed this study to address each of these BIP criteria for adult fish and evaluated macroinvertebrates, which are the best indicator for determining the thermal tolerance of the localized adult fish community. APC performed various quantitative and qualitative measures for both of these communities to assess each of the seven criteria. This report presents the methods used and the conclusions reached for both the macroinvertebrates and adult fish. The macroinvertebrate community is the only biotic community with the potential to be evaluated with this added level of statistical power. In contrast, the adult fish community could only be evaluated directly using a qualitative approach with the responses of the more sensitive macroinvertebrates to indicate thermal effects on the adult fish community. Abiotic factors, in addition to water temperature, were studied as potential confounding factors affecting the macroinvertebrate and adult fish communities. These abiotic factors include conductivity (saltwater wedge), sedimentation (e.g., deposition from barge traffic), and dissolved oxygen (natural seasonal variation).

Three types of statistical analyses are used to assess potential thermal effects on the macroinvertebrate community. Graphical analyses of means and error bars are used to assess comparisons among three zones of temperature influence: upstream control, mixing zone, and downstream. Comparison among these zones of temperature influence are also assessed through analysis of variance (ANOVA) and analysis of covariance

(ANCOVA). The ANOVA compares the zones based on data as measured, and the ANCOVA compares the zones based on data adjusted for confounding abiotic factors. An additional analysis using a generalized additive model (GAM) is focused on assessing the effect of temperature on macroinvertebrates independently of other abiotic factors. For a qualitative comparison using graphical analysis, the adult fish zones were grouped into heat-unaffected and heat-affected areas. Thereafter, the report presents a detailed discussion, by biological community, of the specific metrics used to evaluate each of the seven criteria. Based on the collective weight of evidence across all communities, those results demonstrate that the thermal variance has not resulted in prior appreciable harm, and will continue to assure the ongoing protection and propagation of a BIP of fish, shellfish, and wildlife in the Mobile River near Plant Barry.

2. METHODS

APC met with ADEM to discuss an appropriate study plan for verifying whether the current NPDES-permitted thermal limits at Plant Barry continue to assure the protection and propagation of a BIP of shellfish, fish, and wildlife in the Mobile River. ADEM and APC agreed on the final study plan at an August 26, 2009 meeting. APC provided ADEM with a written copy of the final approved study plan on November 18, 2009, and began field sampling in the spring of 2010. The second year of the adult fish studies will be completed prior to October 31, 2013. APC will submit the results of the second year of this study.

APC personnel collected samples for macroinvertebrates and adult fish to assess the effects of the thermal discharge from Plant Barry on the BIP in the Mobile River. Macroinvertebrates were sampled during 2010 and 2011. Figure 1 presents the location of the sampling sites for each of the biological studies. Eighteen study sites were selected at varying distances from the thermal discharge point: the farthest upstream control station (Station 1) was located 8.2 miles upstream of the thermal discharge, and the farthest downstream station (Station 18) was located 6.2 miles downstream of the thermal discharge. The macroinvertebrate study area included four stations located upstream of the intake canal, five stations between the intake canal and the thermal discharge, and nine stations downstream of the thermal discharge. This study area, with a total of 18 stations, covered approximately 15 miles of the Mobile River. The geographic locations of the 18 macroinvertebrate stations were derived in part from a 2008 pilot study as well as from biological studies conducted in the 1970s.

The adult fish portion of this study included two areas, encompassing three study zones selected according to their location relative to the thermal discharge: (1) heat-unaffected area or upstream control zone, (2) heat-affected area including the thermal mixing zone and downstream zone. These three zones are located 5.6–6.0 miles above the thermal discharge (upstream control), 0.3–0.6 miles below the thermal discharge (thermal mixing zone), and 3.1–3.4 miles below the thermal discharge (downstream). The geographic locations for the fish zones were derived in part from the biological studies conducted by APC in the 1970s (Alabama Power, 1977).

APC collected water quality data along with the biological data. Additionally, APC monitored hydrological and plant operational data to develop an environmental fluid dynamics code (EFDC) thermal model. APC completed all studies within a two-year period: from May 2010 through October 2011 (macroinvertebrate and adult fish). APC performed all graphical and statistical analyses using SPSS (IBM 2010) and the R-package (R Core Team 2012), statistical analysis software programs. APC evaluated changes in the macroinvertebrate metrics using 95% confidence interval graphs. Biothermal modeling, through the use of multivariate statistical methods, was necessary to differentiate water temperature effects from other environmental variables on the macroinvertebrate community. This set of advanced statistical analyses, including GAM and the traditional ANOVA and ANCOVA, was performed using the R-package (R Core Team 2012). Qualitative differences in the adult fish metrics were graphically evaluated based on the range of values (minimum to maximum).

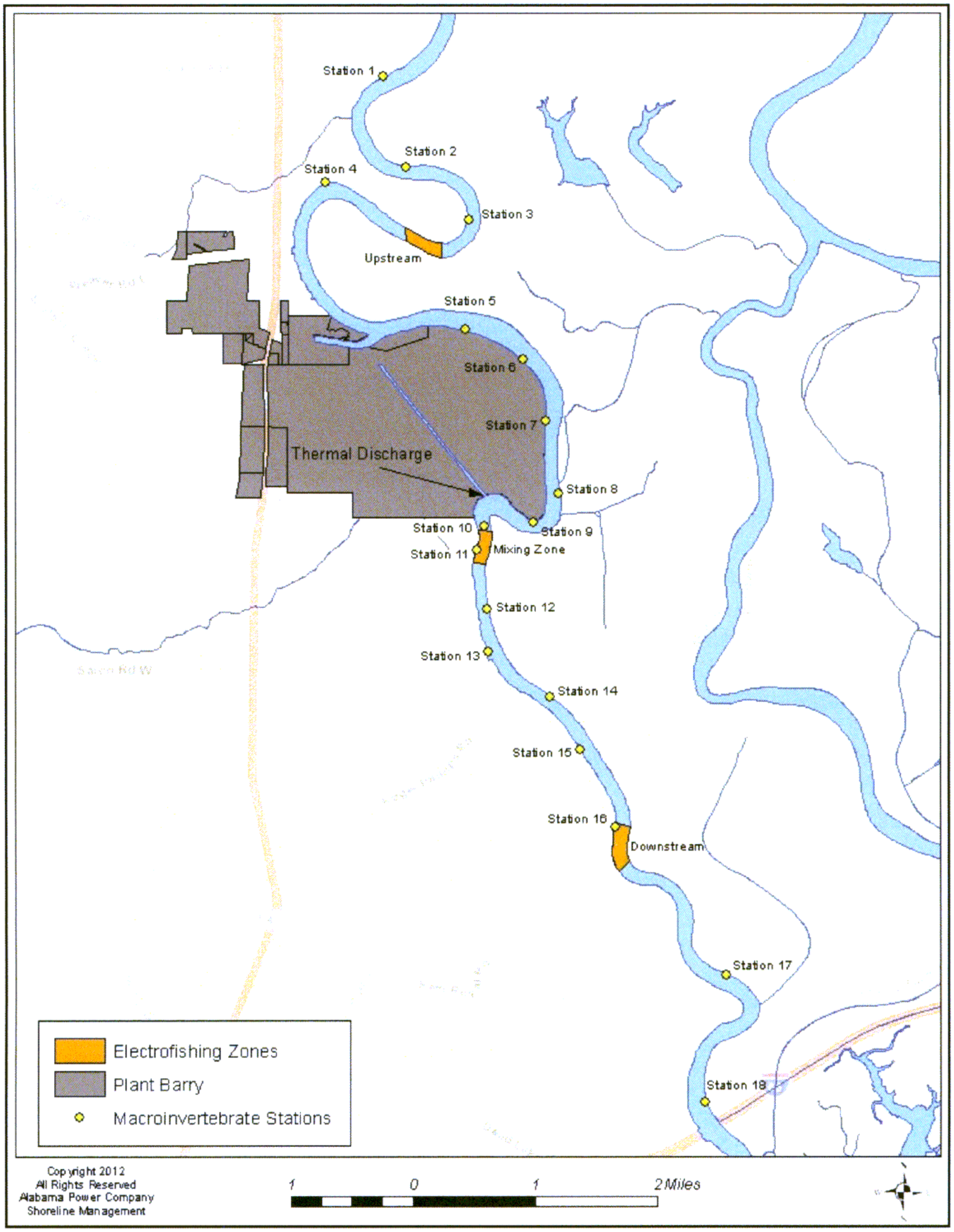

Figure 1. Locations of the sampling zones and stations for the biological studies conducted in the Mobile River near Plant Barry in 2010 and 2011.

2.1. Macroinvertebrate Study Methods

APC collected macroinvertebrates at 18 locations or stations during spring, summer, and fall of 2010 and 2011. Ten Hester-Dendy plate samplers were deployed at approximately 6.5 feet below mean sea level at each of the 18 stations. The chosen deployment depth was targeted for 5 feet below the historical minimum stage for the Mobile River. An aluminum housing was built to hold 10 artificial plate samplers (photos included in Appendix D). This aluminum plate holder was fabricated to withstand hydrologic pressures (e.g., changing tides and proximity to barge traffic) and protect the plates. Divers deployed the aluminum plate holders with plate samplers, which were anchored on the river bottom with rebar. Thermistors (Onset HOBO®) were deployed with each set of plate samplers to continuously record water temperature. Sediment loading, dissolved oxygen, and conductivity measurements were also taken in an effort to account for these factors when assessing the effects of water temperature on the various macroinvertebrate indices.

The most upstream station was located 8.2 miles upstream of the thermal discharge, while the most downstream station was located 6.2 miles downstream of the thermal discharge (Figure 1). The APC experimental design including 18 stations covered a river distance of approximately 15 miles. This design incorporated additional downstream monitoring stations so that downstream recovery, if necessary, could be demonstrated. For purposes of comparison analysis, three zones were established. The upstream zone included stations 1–7, the mixing zone included stations 8–13, and the downstream zone included stations 14–18. The plates were deployed for 4-week periods in the spring, summer and fall of 2010 and 2011. Plate deployment and retrieval events with diver assistance typically took two days to complete. The plate deployment dates were May 3–4, July 12–14, and September 6–7 for 2010, and May 9–10, July 11–12, and September 19–20 for 2011. The respective retrieval dates were May 31–June 2, August 9–10, and October 3–4 for 2010, and June 6–7, August 8–9 and October 17–18 for 2011.

Upon retrieval, the divers placed the plate samplers and a data label in a plastic container and placed them on ice. Three samplers from each station were randomly selected for sediment analysis. The remaining seven samplers were taken to the lab where the material on each plate was scraped and rinsed through a 500-µm brass sieve. All retained material was placed into a collection jar and preserved with 70 percent isopropanol; Rose Bengal dye was added to stain the organisms for greater visibility. APC biologists sorted the macroinvertebrates under a dissecting microscope and identified them to the lowest practical taxon, usually genus. Chironomids were mounted on slides and identified to genus using a compound microscope. A random subsample of 50 chironomids was identified and used to extrapolate the remainder of the sample when large samples sizes were collected.

To ensure Quality Assurance/Quality Control (QA/QC) in macroinvertebrate sorting, APC biologists randomly selected approximately 10 percent of the samples and re-sorted them. From that 10 percent, samples that had less than 85 percent recovery in the number of macroinvertebrates counted were reprocessed.

Differences in the macroinvertebrate community between sample zones and seasons were evaluated using the following metrics (Barbour *et al.* 1996; Hilsenhoff 1987; Morin 1999; Harris *et al.* 1987):

(1) Total number of macroinvertebrate individuals

(2) Total number of taxa or species richness

(3) Total number of EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa

(4) Shannon-Weaver diversity index (SWDI)

(5) Evenness

(6) Total number of pollution-tolerant macroinvertebrate individuals by taxa, Hilsenhoff Biotic Index with tolerance values (NCDENR 2006)

2.2. Adult Fish Study Methods

APC collected adult fish within two areas, heat unaffected and heat affected, including three locations or zones during spring, summer, and fall, by nighttime electrofishing. The heat-unaffected area encompassed the upstream control zone (8.2 miles upstream of the thermal discharge), and the heat-affected area included both the mixing zone and the downstream zone (approximately 0.3 and 3.1 miles downstream of the thermal discharge, respectively) (Figure 1).

Sampling occurred in June, August, and October 2010. The variety in seasons was to account for any temporal variability or seasonal cyclic changes associated with qualitative assessment of this community. APC field technicians used a Smith-Root® bow-mounted electrofishing system. The system was operated in pulse DC mode with outputs of 250 to 840 V and 4.5 to 6.5 amps for fish collection. For each sampling zone, similar shoreline habitat for fish collection was targeted. The electrical current and voltage were the same at each of the three sampling zones. A minimum of 1,200 seconds of collection or effort was required at every station, with 600 seconds on the right bank and 600 seconds on the left bank. All fish collected from the sample sites were identified to species, weighed (g), measured (total length in mm), and released. Large catches of individual species were processed by using subsamples of 50 individuals. The remainder of the catch was batched by taking a total count and weight. To ensure correct field identification, select specimens were retained as vouchers and preserved in 10 percent formalin for follow-up laboratory confirmation.

Differences in the adult fish community between the heat-unaffected area and the heat-affected area were evaluated based on the following parameters:

(1) Catch-per-unit effort (CPUE)

(2) Total number of species

(3) Relative abundance

(4) Abundance of exotic or non-indigenous species

(5) Presence of major trophic levels

If there were differences between the heat-affected area and the heat-unaffected area, APC then compared the upstream zone with the downstream zone to determine whether the fish metrics indicated recovery.

2.3. Water Quality Methods

APC collected water quality data at each zone or station of the Mobile River being studied during each of the previously described macroinvertebrate and adult fish studies. Water quality profiles were measured with each of the biological sampling events. Thermistors or continuous water temperature loggers were deployed during each of the biological sampling events. Macroinvertebrate plate sediment sampling and water quality sampling were performed while collecting macroinvertebrates.

For the macroinvertebrate study, water quality profile measurements (water temperature, dissolved oxygen and specific conductivity) were taken during the deployment and retrieval events. The water quality profiles were performed at the deepest point along the river channel segment cross-section, with measurements taken at 0, 1, 3, 5, 10, 15, 20, 25, and 30 ft depths, continuing in 10-foot intervals if needed. Water samples were collected concurrently with each profile from a depth of 5 feet. The samples were analyzed for total cations including total mercury and selenium; nitrites and nitrates; total phosphorus and ortho-phosphate; and chlorophyll. Thermistors were attached to the Hester-Dendy plate sampler holders to continuously record temperature during the deployment periods.

As discussed in Section 2.1, three Hester-Dendy plates from each macroinvertebrate station were used to make an estimate of sedimentation. These plate samplers were scraped of all material. The material was then rinsed into a tare weighed 1-liter jar. The sample jar was then placed in an oven at 103 °F for drying. After 24 hours, the sample jars with sediment were weighed. Subsequent drying and weighing cycles continued until the change in the sediment weight was less than 5 percent. Each dried sediment sample was analyzed for loss on ignition (LOI) to determine the relative percentage of organic and inorganic sediments.

Water quality datasondes (Hach LDO®) were deployed in close proximity to all the plate samplers, at the same elevation as the samplers. The datasondes continuously measured conductivity and dissolved oxygen for the duration of the macroinvertebrate deployment periods.

Water quality profiles were also obtained from each zone during sampling for adult fish. A total of nine water quality profiles (three zones for three events) were obtained during adult fish sampling. Also, thermistors were deployed along the side of the electrofishing boat at approximately a 2-ft depth to record water temperature in the sampling strata where the fish were collected.

2.4. Thermal Modeling Methods

The Environmental Fluid Dynamics Code (EFDC) thermal model was developed using a wide variety of hydrologic, operational, and meteorological input data. EFDC is a widely used public domain software package (Craig 2010). The goal of the model development is to understand the primary factors affecting the thermal loading to the receiving stream and to assist in interpretation of biological results.

APC collected continuous temperature and water level data during 2010 and 2011 in support of model development and calibration. Flow and water surface elevation data from the United States Geological Survey (USGS) stream gaging station at Bucks (USGS 02470629) and water surface elevation data from APC monitoring stations throughout the study area were used as model inputs. Plant operational data, such as once-through cooling water flows and discharge temperatures, were also used as model inputs. Acoustic Doppler Current Profiler (ADCP) discharge and temperature data collection events throughout the study area were used for model calibration. Bathymetry data collected in 2009 were provided by APC, and included the discharge canal. A survey of the intake canal was performed by Southern Company Civil Field Services in 2008. Meteorological data were collected from the Mobile Regional Airport, the Fairhope

Mesonet station, and Plant Barry's weather station. Auburn University prepared a full report on the thermal modeling methods and data collection. The report is presented in Appendix E of this report.

2.5. Biothermal Modeling Methods

The primary goal of the biothermal modeling analysis is to assess if water temperature appears to have a significant effect on the biological metrics after adjusting for the environmental variables. The macroinvertebrate community was the only biological community that could be evaluated with the necessary level of statistical power. The biological metrics are the same ones used to evaluate the macroinvertebrate community (Section 3.2) and include:

- Total number of macroinvertebrate individuals or abundance,
- Total number of taxa, an indicator of diversity,
- Total number of EPT (Ephemeroptera (mayfly), Plecoptera (stonefly), Trichoptera (caddisfly)) taxa,
- Shannon-Weaver diversity index,
- Evenness, and
- HBI (Hilsenhoff Biotic Index), a measure of pollution-tolerant taxa.

In cases where the distributional properties of these variables indicated a skewed distribution more similar to a log-normal, a logarithm transformation was employed in order to obtain a more powerful analysis. The suite of environmental variables to be adjusted for in the model in addition to water temperature includes:

- Conductivity, a measure a dissolved solids and an indicator of salinity intrusion,

- Sediment weight, taken from plate samplers,
- LOI, as a measure of organic matter, portion of sediment on plate samplers as organic matter,
- River mile, the locations of the 18 stations,
- Season, as spring, summer and fall, and
- Year, study conducted in 2010 and 2011.

One environmental variable, dissolved oxygen, was measured in the study but not included in this analysis. Dissolved oxygen was excluded because it was clear that in many cases the datasondes deployed to monitor DO did not yield reliable results from station to station. Furthermore, profile measurements of DO taken during the same periods and the remaining reliable portion of the datasondes show that DO levels were typically greater than 5 mg/L, indicating no stress on the macroinvertebrate individuals (Nebeker, 1972).

If the primary assessment indicates that there is an effect of water temperature, then secondary hypotheses concern whether this effect extends spatially beyond the mixing zone and whether or not it is seasonally ephemeral. If an effect is observed, but this effect does not extend beyond the mixing zone, then the spatial extent of the effect is not sufficient to be disruptive to the riverine ecosystem. If an effect does extend beyond the mixing zone, but only exists for a short period in the year such that it is clear that the macroinvertebrate community quickly recovers, then the effect is ephemeral and not likely to be disruptive of the ecosystem.

Several statistical tools were used to assess the nature and extent of water temperature effects. The independent effect of water temperature on the biological metric responses was modeled using a generalized additive model (GAM) (Wood, 2006). To test hypotheses concerning spatial (or zone) and seasonal effects, more traditional ANOVA and ANCOVA methods were used.

The GAM approach has been used by EPA to classify macroinvertebrate genera into different tolerance classifications (Yuan 2004). The GAM is a modeling tool that extends multiple linear regression (MLR) in two important ways. First, the GAM is capable of constructing a multiple variable prediction equation that combines both categorical (season, zone, year) and continuous (temperature, conductivity, sedimentation, LOI) variables. Second, the continuous variables can be represented in terms of a cubic spline basis so that curvilinear relationships between the dependent and independent variables are quantified. As with the MLR approach, the GAM enables testing of statistical significance for each term in the predictive equation. However, because the continuous variables may be represented by complex curvilinear functions, the nature of the relationship is best assessed through graphics that display the observed and predicted data.

Another graphical tool employed to assess the specific relationship of each dependent variable to temperature is the added variable plot (Chambers and Hastie 1992). This plot shows the relationship of the dependent macroinvertebrate variable to temperature after adjusting both for independent variables other than water temperature. That is, both the biological response and temperature are adjusted for season, river mile, conductivity, sediment weight, and LOI using a linear model (i.e., analysis of covariance model) and then the adjusted biological response variable residuals are plotted against the adjusted temperature variable (residuals). The scatterplot of residuals was enhanced by adding a loess regression line (Chambers and Hastie, 1992) to help identify the association of the adjusted macroinvertebrate variable to the adjusted temperature variable. Loess, an acronym for "local regression", is a nonparametric curve fitting tool and can easily be applied to multivariate data (Jacoby 2000). These added variable plots show the effect of water temperature on the biological endpoints independent of the other environmental variables, such as conductivity and sedimentation.

In addition to the GAM analysis, more basic comparisons on a spatial scale were implemented by comparing zones using ANOVA and ANCOVA. The ANOVA uses a two factor model of station groups and season to test for significant ($p<0.05$) effects. This is a definitive look at the metrics without adjusting for the environmental variables listed above. The stations are grouped by zones, Upstream (1–7), Mixing Zone (8–13), and Downstream (14–18). The ANCOVA will then adjust for the variability of the environmental variables, called covariates, and evaluate the difference between the means as if the covariates were being held constant across the zones of temperature influence.

The results of the two-way ANOVA are further processed to address very specific zone by season comparisons. Using a linear function of the parameter estimates from this two-factor model, the mean response for each season and zone is estimated. Comparisons between zones within season are computed using linear contrasts of the parameter vector and presented with t-tests and p-values. It is a common practice when conducting multiple comparisons such as this, to adjust the p-value to larger values to reduce the risk of inflating the false positive error rate (Westfall and Young 1993). However, in this analysis a conservative approach was taken and no adjustment was made to ensure that significant differences were not overlooked. Final summary tables comparing the mixing zone and the downstream zone to the upstream control were extracted from these comparisons and the effect size is presented as a percentage of the upstream control zone. For endpoints that are not log-transformed, an example percent difference is computed as:

$$percent\ difference = \frac{mz - us}{us} \times 100$$

Where *us* is upstream mean and *mz* is the mixing zone mean (or downstream mean). For endpoints that are log-transformed, the percent difference is computed as:

$$percent\ difference = \left(1 - 10^{(mz-us)}\right) \times 100$$

To make these comparisons while adjusting for the effects of environmental variables, the model was expanded to include conductivity, sediment weight, and LOI as covariates along with station group and season to form an analysis of covariance model (ANCOVA). By comparing ANCOVA and ANOVA, it can be determined whether these covariates help to explain differences observed among station groups.

The ANCOVA results are ultimately used to assess whether water temperature has a significant effect on the biological endpoints and the magnitude of the difference between the heat-affected and heat-unaffected areas after adjusting for the environmental variables. If a significant difference was determined for a biological endpoint, an assessment was made to determine whether this difference was biologically meaningful. For example, a statistically significant decrease ($p<0.05$) in metrics for macroinvertebrate organisms does not necessarily mean that there is appreciable harm to the BIP of shellfish, fish, and wildlife.

3. RESULTS

The 316(a) study for Plant Barry evaluated the macroinvertebrate and adult fish communities in both the heat-affected (mixing zone and downstream) and the heat-unaffected (upstream) areas of the Mobile River. The 18 macroinvertebrate stations were grouped into three zones for analysis purposes, with stations 1–7 representing the upstream zone, stations 8–13 representing the mixing zone, and stations 14–18 representing the downstream zone. The Hester-Dendy plates were deployed for macroinvertebrate sampling from May 3 through June 2, July 12 through August 10, and September 6 through October 4 in 2010, and in 2011 from May 9 through June 7, July 11 through August 9, and September 19 through October 18. The adult fish zones were grouped into two areas for qualitative comparison purposes, with the upstream control zone representing the heat-unaffected area and the mixing zone and downstream zone representing the heat-affected area. The adult fish sampling by electrofishing was performed on June 7, August 23, and October 19 in 2010. A review of river temperatures and plant operations during the study was performed to ensure a proper evaluation based on historical conditions for the Mobile River. Water quality monitoring indicated the presence of a saltwater wedge during the fall season in both 2010 and 2011. As described in the methods, several statistical approaches including graphical analysis, ANOVA and ANCOVA, and a GAM assist in assessing the effect of thermal influence after adjusting for the effect that the other environmental variables, specifically conductivity and sedimentation, have on the macroinvertebrate community.

3.1. River Temperatures and Plant Operations

The water temperature of the Mobile River in the vicinity of Plant Barry during the study was consistent with historical temperatures during the summer. The electric generating units at Plant Barry were operated so that the discharge canal NPDES water temperature limits (monthly average of 108 °F, and daily maximum of 112 °F, April through November, as required by the NPDES permit) were not exceeded. The study period for the macroinvertebrates and adult fish included summer sampling events when the water temperatures were near the upper temperature limit for NPDES compliance.

A comparison of the operation of Plant Barry during this study for 2010 and 2011, as compared to historical generation averages, is included in Figure 2. For the months of September and October 2010, APC reduced plant generation to correspond with load demand. Plant Barry's operation in summer 2011 showed a similar generation pattern to summer 2010 with load reductions in spring and fall.

The river temperatures during this study at the NPDES monitor located in the discharge canal were near typical historical water temperatures except for the latter part of September 2010 and late August through November 2011 (Figure 3). This is a reflection of lower plant generation during this same time period. The daily maximum water temperatures at the NPDES monitor were within NPDES-permitted temperature limits for daily maximum and monthly averages. The highest water temperatures for the study periods occurred from June to mid-August each year. These months encompassed the macroinvertebrate sampling in summer 2010 and 2011, and the adult fish sampling in summer 2010 (Figures 4 and 5).

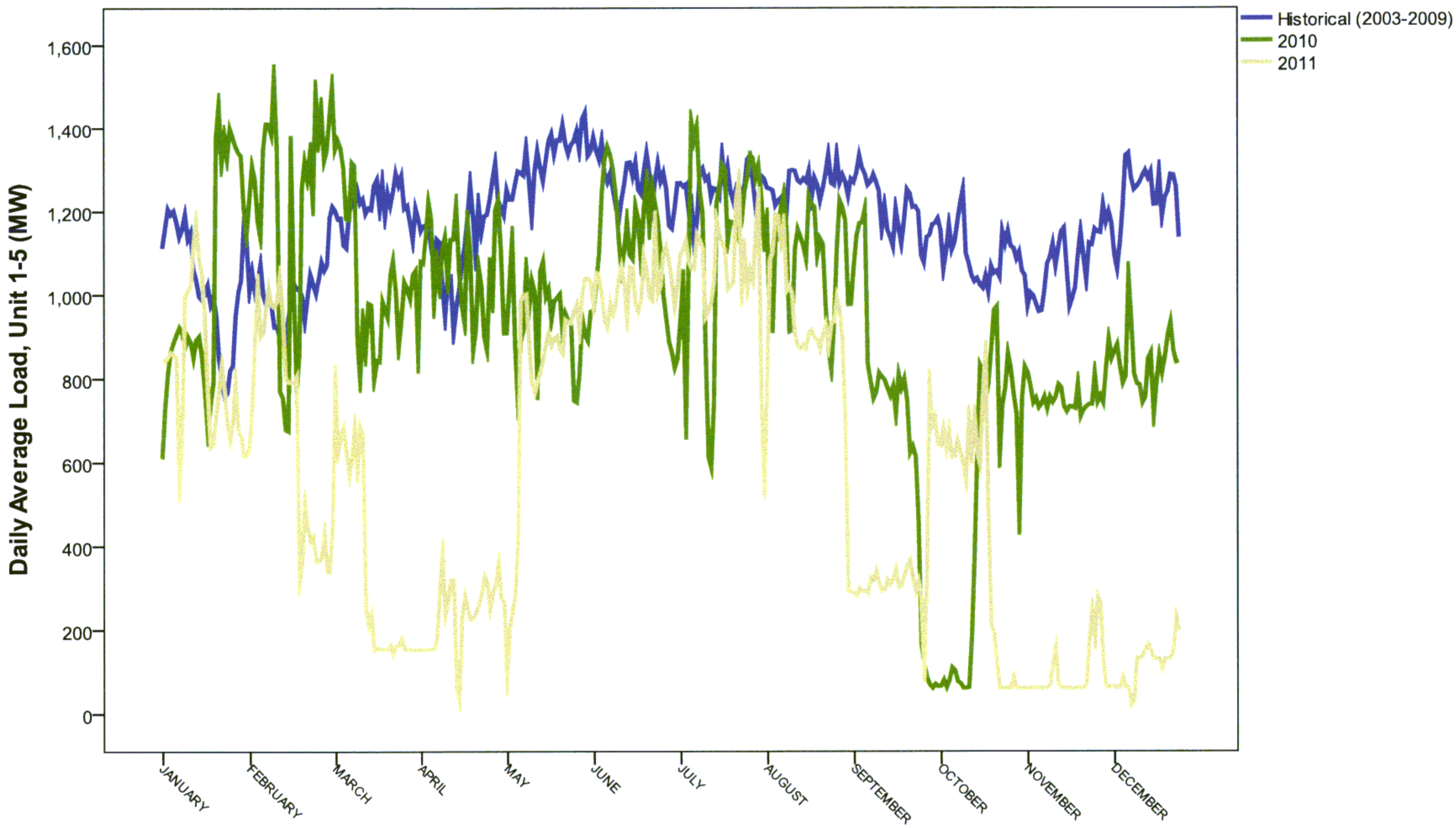

Figure 2. Historic daily average generation (MW) for Plant Barry, Units 1–5. Time periods include 2003–2009, 2010, and 2011.

The Mobile River flow near Plant Barry is typically highly variable (Figure 6). In the winter, spring, and late fall, the flow is dominated by runoff from rain events and can exceed a 50,000-cfs daily average. In the summer and early fall, the river flow is much reduced and greatly influenced by tidal fluctuation and can have negative daily average measurements, indicating reverse-flow conditions.

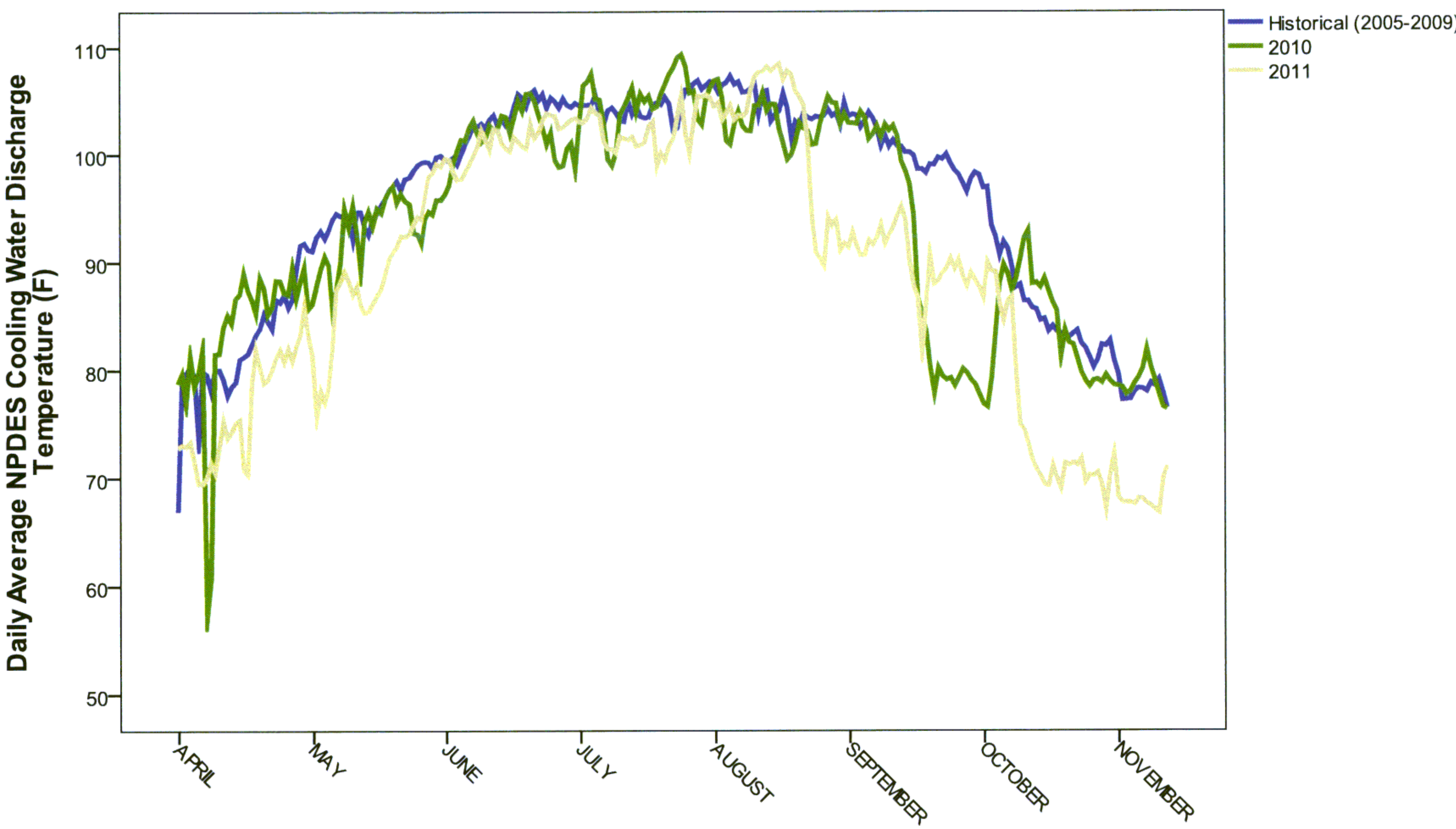

Figure 3. Daily average NPDES cooling water discharge temperatures in the discharge canal. Time periods include 2005–2009, 2010, and 2011

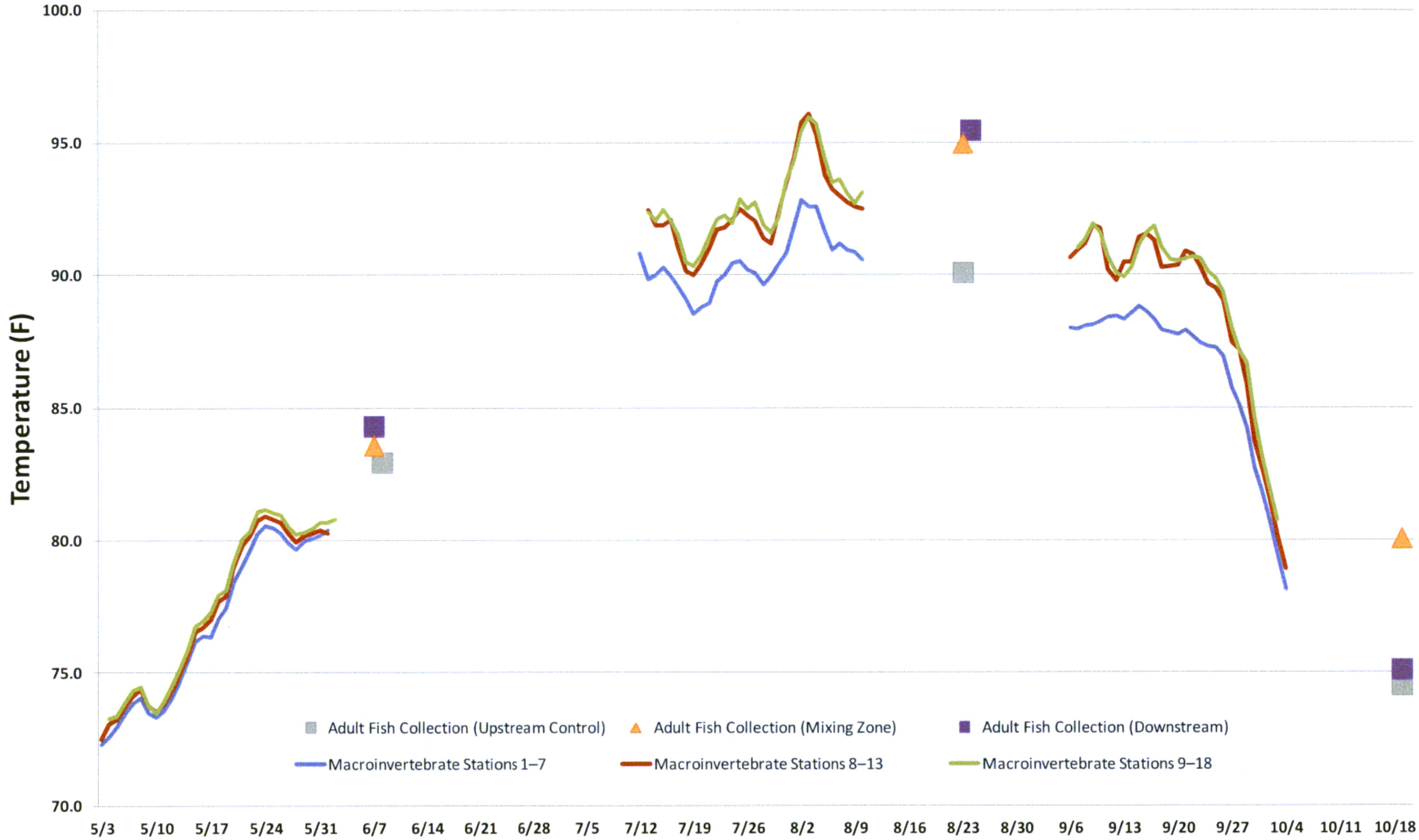

Figure 4. Water temperature data for the 2010 biological sampling zones.

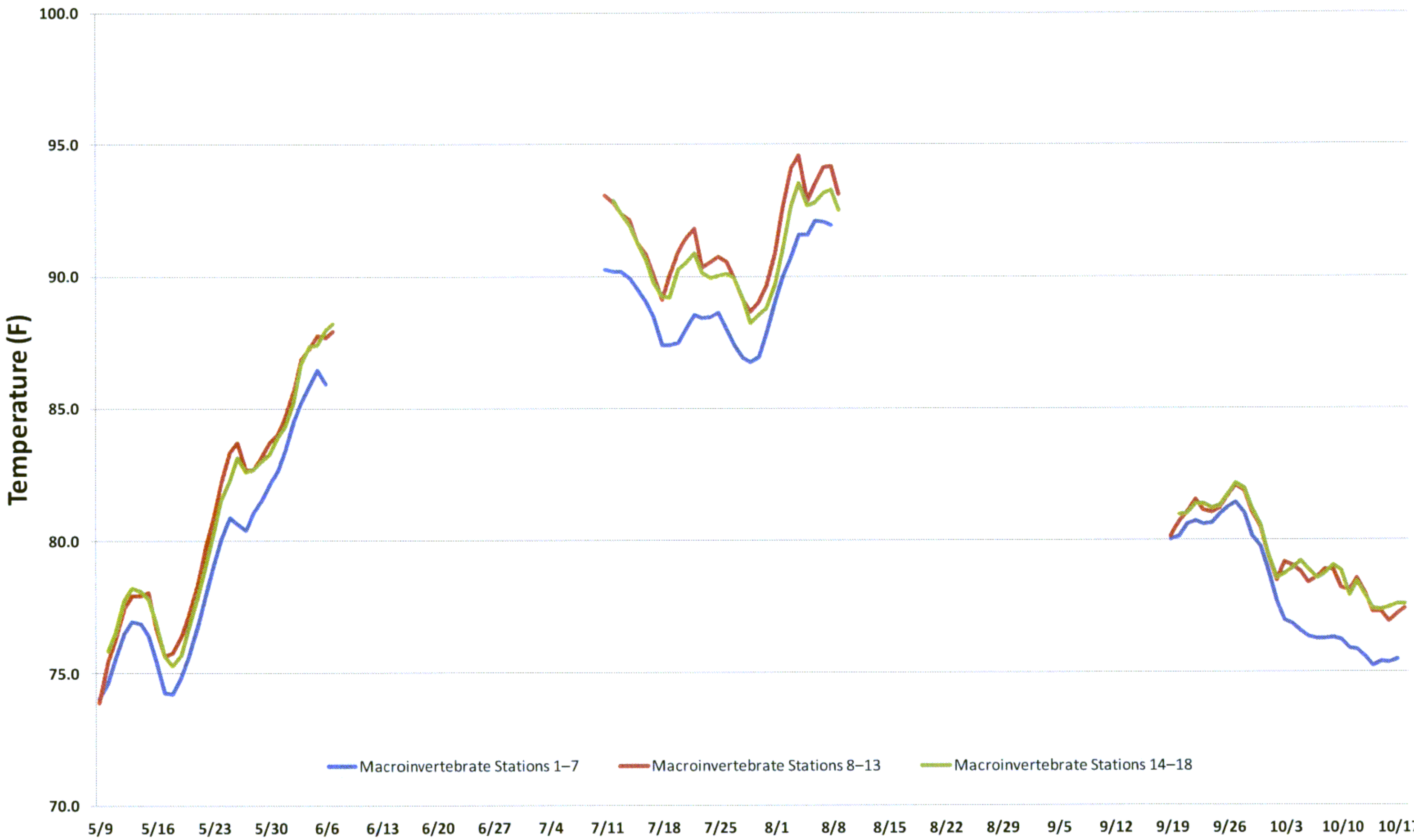

Figure 5. Continuous water temperature data recorded during macroinvertebrate plate deployment periods in 2011.

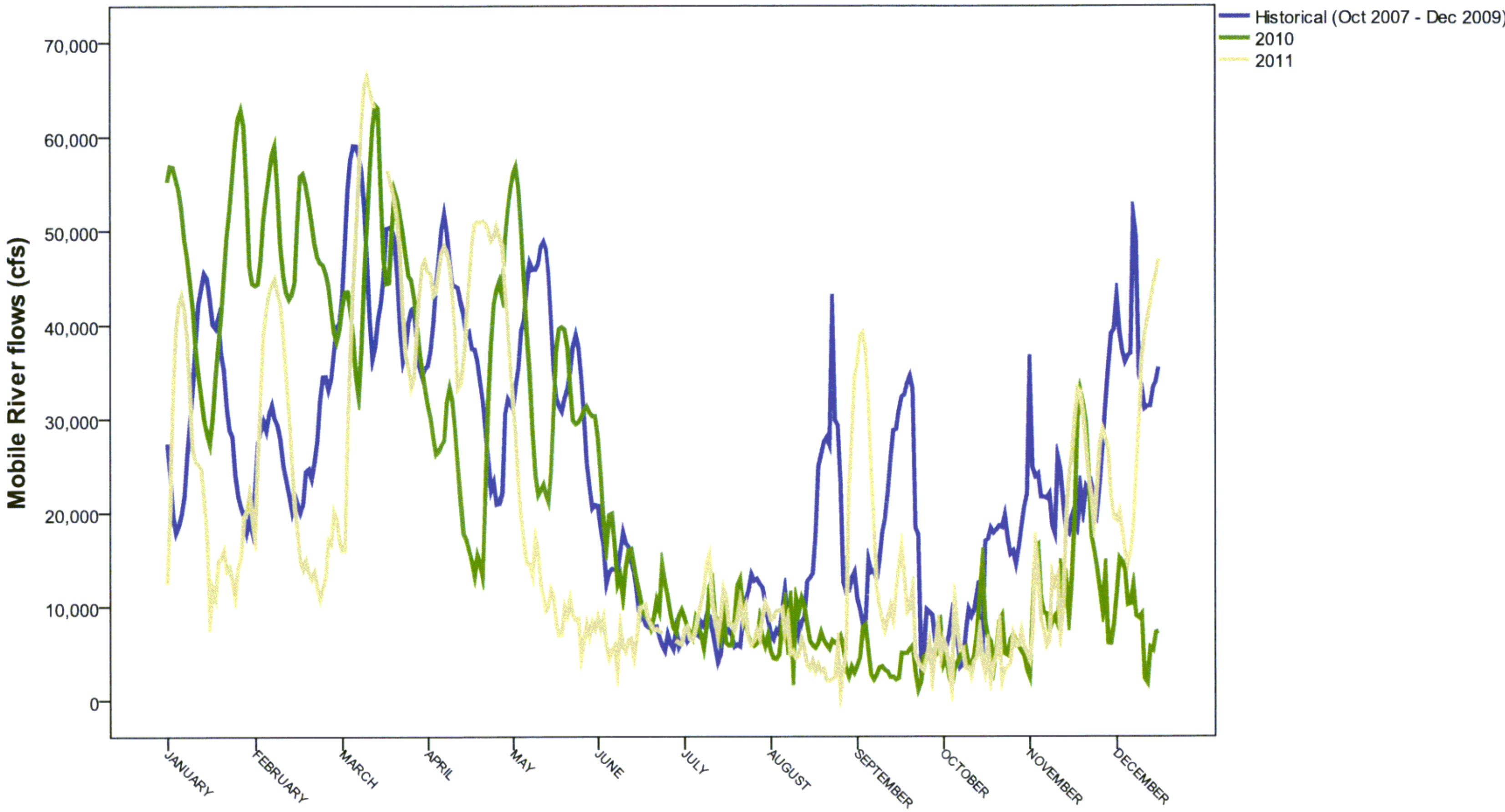

Figure 6. Historical daily average flow of the Mobile River at the Bucks gaging station (USGS 02470629). Time periods include 2007–2009, 2010, and 2011.

Both sampling studies (macroinvertebrates and adult fish) occurred during conditions representative of an average year with respect to summer water temperatures, summer plant loads, and river flows, reflecting Plant Barry's current operations under alternative thermal limits established pursuant to 316(a).

3.2. Macroinvertebrates

Seven of the ten Hester-Dendy plates deployed at each station were used for the macroinvertebrate sampling. However, due to damage or loss of the samplers, only two of the seven were recovered from Station 3 during the 2010 spring sampling, six of the seven were recovered from stations 12 and 17 during the 2011 spring sampling, and no plates were recovered from stations 9 and 18 during the 2011 spring sampling. All plates were lost for all seasons at Station 16 in 2011. All QA/QC procedures were successfully performed. All unique taxonomic identifications were confirmed by APC biologists and all sample specimens were stored and archived. The metrics used to evaluate the macroinvertebrate community were the number of macroinvertebrate individuals collected, number of taxa, and the number of EPT taxa. Additional indices were calculated including the Shannon-Weaver diversity index, evenness, and the Hilsenhoff Biotic Index.

For the analysis, the 18 macroinvertebrate stations were grouped into three zones, with stations 1–7 representing the upstream zone, stations 8–13 representing the mixing zone, and stations 14–18 representing the downstream zone. The heat-unaffected stations (upstream) are differentiated from the heat-affected stations (mixing zone and downstream) based on a marked increase in average water temperatures for the summer seasons.

Three additional Hester-Dendy plates from each station were used to make an estimation of sedimentation and evaluate its potential effects on the macroinvertebrate community. Sediment weights and loss on ignition (LOI) analyses show the magnitude of sedimentation and type of sediments, respectively, for each plate.

Sediment weights are a measure of sedimentation on each plate. LOI is representative of the fraction or percent of the organic material in the sediment. The remaining fraction is inorganic or inert material such as silt or sand. The mixing zone and downstream stations showed a statistically significant decrease in dry sediment weight when compared with the upstream stations in spring of 2010. A statistically significant decrease from upstream dry sediment weight also occurred in the mixing zone in the summer of 2010 and at the downstream stations in spring of 2011 (Figures 7 and 8). The LOI data show an increase for both 2010 and 2011 in spring only at the downstream stations (Figures 9 and 10). Both sets of data show differences between station groups for some seasons, as indicated by the lack of overlap of the 95% confidence plots. These results indicate that sedimentation may affect the macroinvertebrate metrics between seasons or station groups. Therefore, the amount or type of sedimentation is considered as a possible confounding factor when evaluating the macroinvertebrate metrics or indices. The sediment weights and LOI will be evaluated as a factor in the biothermal modeling analysis.

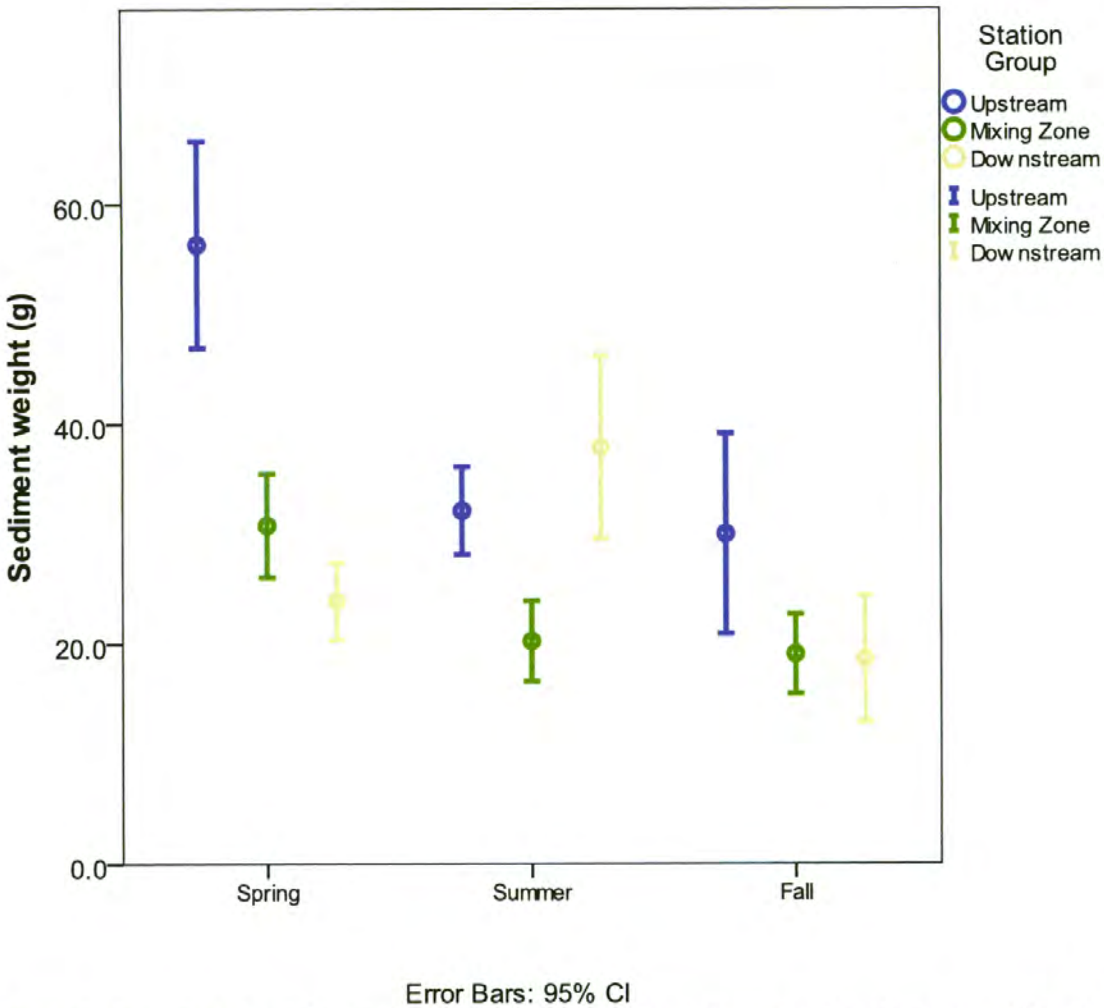

Figure 7. Error bar plot (95% CI) of the Hester-Dendy plate sediment weights (dry) seasonally and by zone for 2010. Each bar represents the individual plate samplers retrieved from each station group (N=21 at the upstream station group; N=18 at the mixing zone station group; N=15 at the downstream station group). Slightly fewer plates were retrieved from the upstream station group during the spring season (N=19) due to lost samplers at one of the stations.

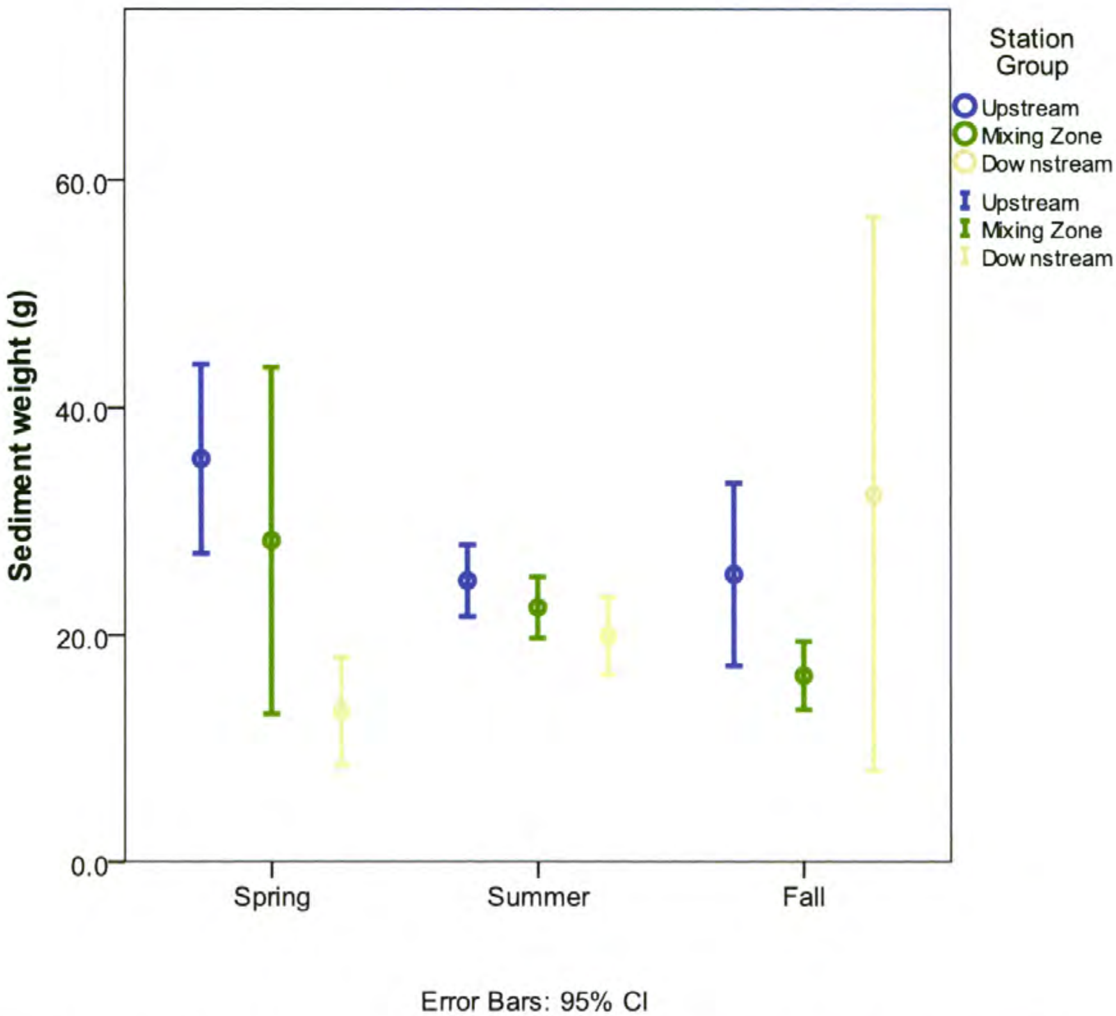

Figure 8. Error bar plot (95% CI) of the Hester-Dendy plate sediment weights (dry) seasonally and by zone for 2011. Each bar represents the individual plate samplers retrieved from each station group (N=21 at the upstream station group; N=18 at the mixing zone station group; N=12 at the downstream station group). Slightly fewer plates were retrieved from the mixing zone station group (N=15) and the downstream station group (N=9) due to lost samplers.

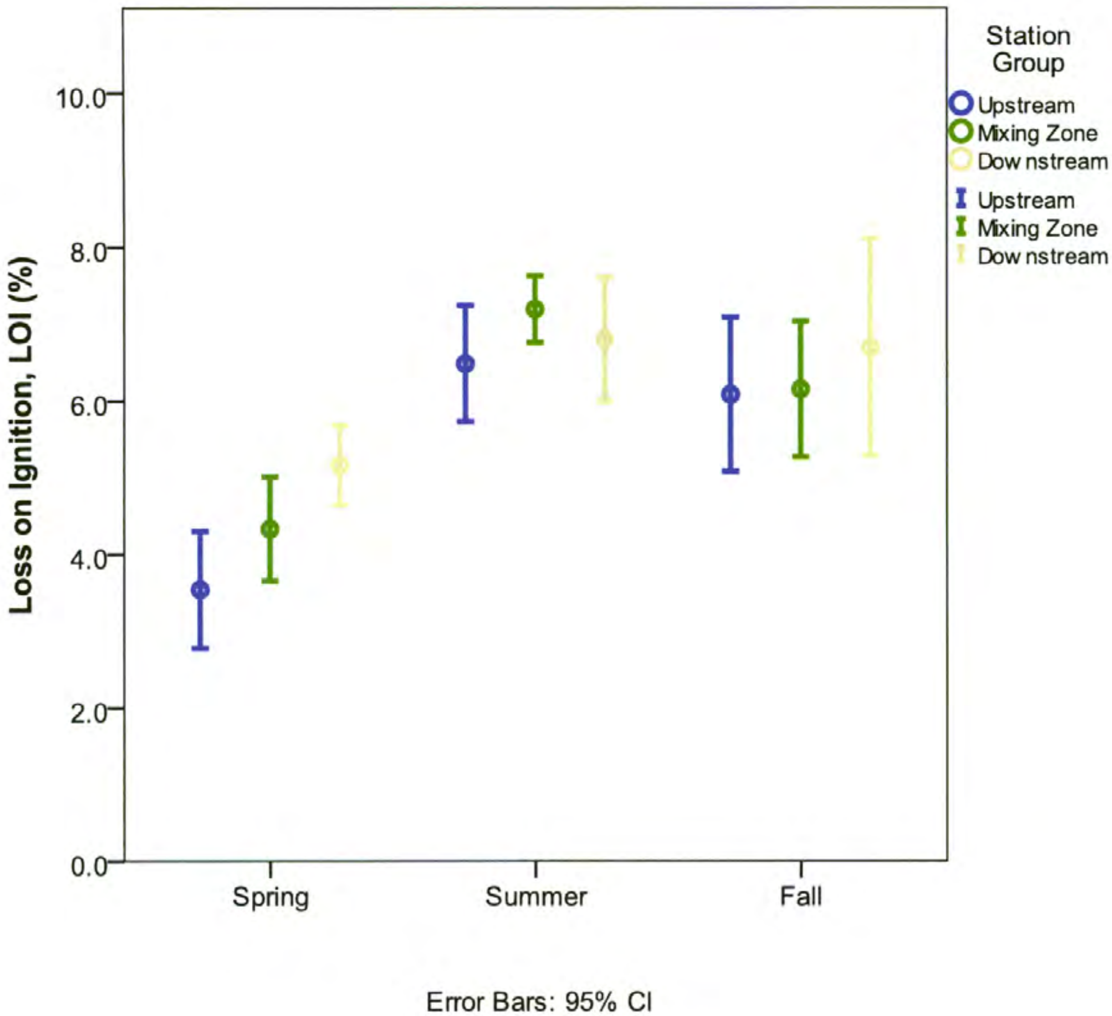

Figure 9. Error bar plot (95% CI) of the Hester-Dendy plate sediment loss on ignition (LOI) seasonally and by station for 2010. Each bar represents the individual plate samplers retrieved from each station group (N=21 at the upstream station group; N=18 at the mixing zone station group; N=15 at the downstream station group). Slightly fewer plates were retrieved from the upstream station group during the spring season (N=19) due to lost samplers at one of the stations.

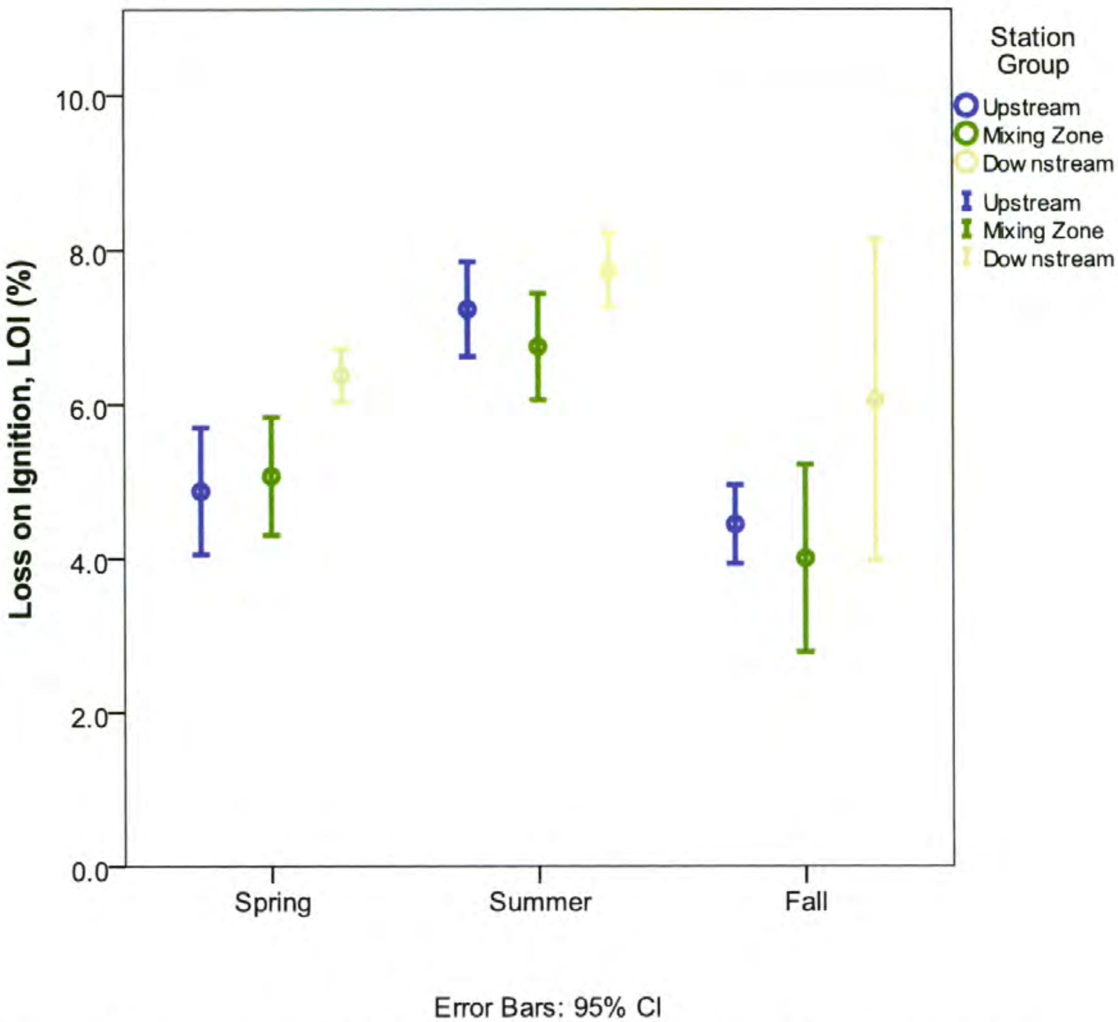

Figure 10. Error bar plot (95% CI) of the Hester-Dendy plate sediment loss on ignition (LOI) seasonally and by station for 2011. Each bar represents the individual plate samplers retrieved from each station group (N=21 at the upstream station group; N=18 at the mixing zone station group; N=12 at the downstream station group). Slightly fewer plates were retrieved from the mixing zone station group (N=15) and the downstream station group (N=9) due to lost samplers.

The 95% confidence intervals for the average number of macroinvertebrate individuals per plate sampler at each station group for each of the three seasons are presented in Figures 11 and 12. The distribution of values exhibits a non-normal distribution. Therefore, it is appropriate to evaluate differences with log-transformed values using a 95% confidence interval of the means between station groups for each season (IBM 2010). The average number of macroinvertebrate individuals collected in 2010 in the mixing zone for all seasons did not decrease appreciably when compared to the upstream control (Figure 11). Although the average number of macroinvertebrate individuals collected in the summer and fall of 2010 at the downstream station group exhibited statistically significant decreases, the mixing zone showed no decrease in the average number of macroinvertebrate individuals collected. This suggests that the thermal discharge was not the factor preventing recovery at the downstream station group.

In 2011, the average number of macroinvertebrate individuals collected in the heat-affected areas (mixing zone and downstream) for the spring decreased when compared to the upstream control (Figure 12). While there was a decrease in the downstream during summer, the mixing zone was similar to the upstream control. The average number of macroinvertebrate individuals in the fall showed a significant decrease in both the mixing zone and downstream station groups; this is likely to be a result of the documented conductivity increase or saltwater wedge (Section 3.4).

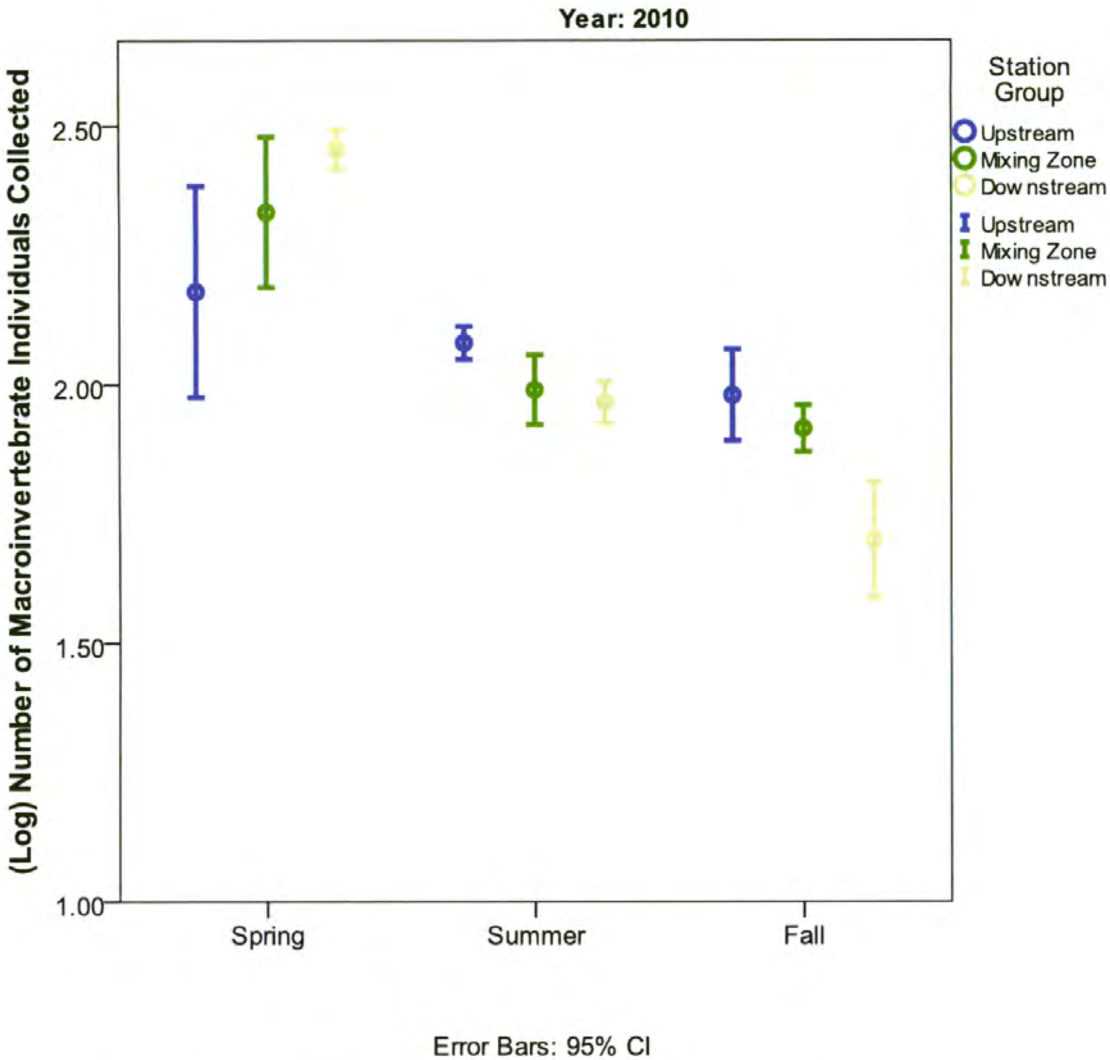

Figure 11. Error bar plot (95% CI) of the number of macroinvertebrate individuals collected per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

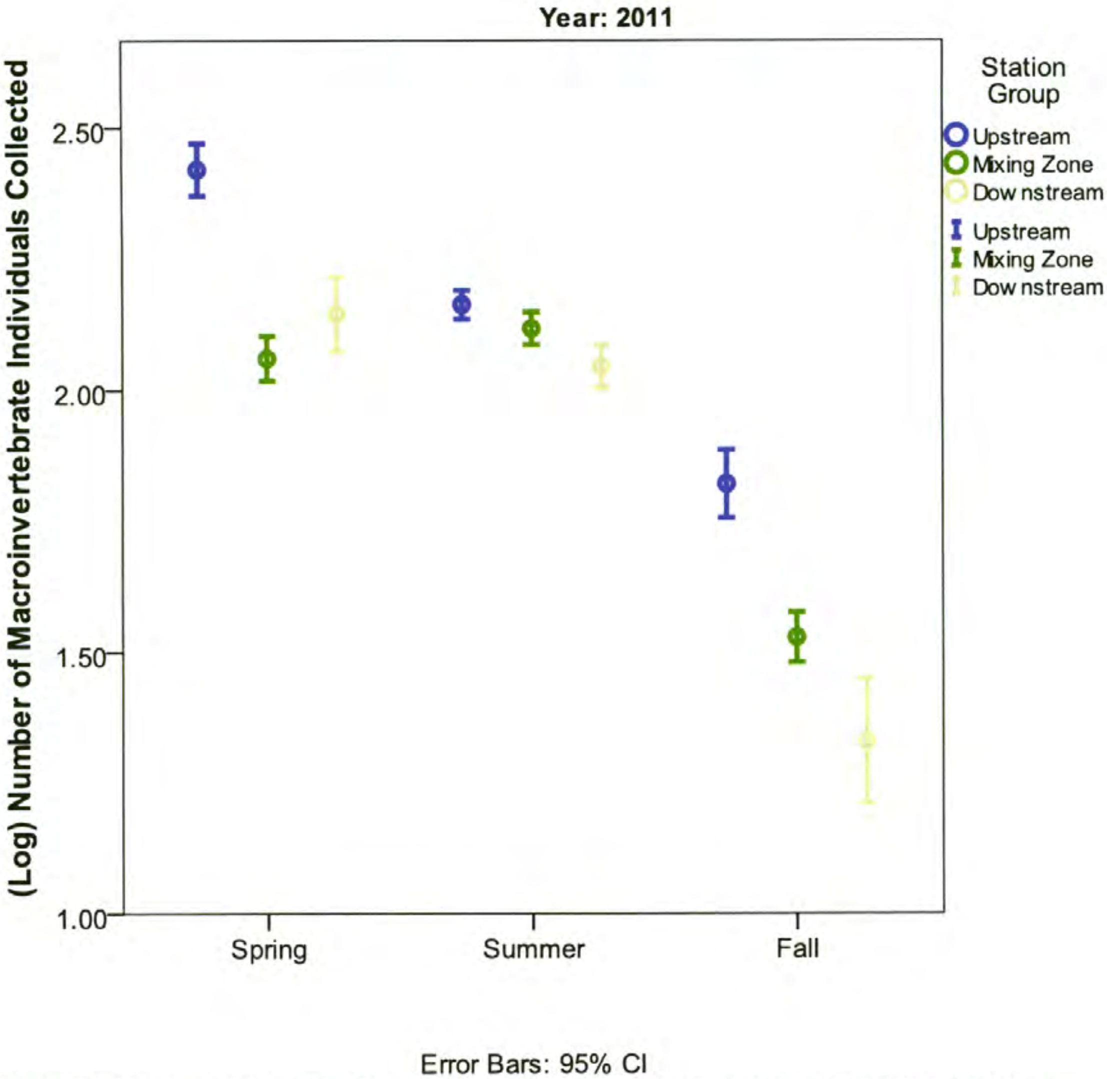

Figure 12. Error bar plot (95% CI) of the number of macroinvertebrate individuals collected per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

The 95% confidence intervals for the average number of macroinvertebrate taxa per plate sampler within each station group and each season are presented in Figures 13 and 14. In 2010, no statistically significant differences between the upstream, mixing zone, and downstream station groups were apparent during the spring or fall. There was a decrease in the average number of taxa at the mixing zone when compared to the upstream control during the summer (Figure 13); however, the downstream station group did not show a statistically significant decrease.

For 2011, no statistically significant differences between the upstream, mixing zone, and downstream station groups were apparent during the warmer summer season for the average number of taxa, suggesting no thermal impacts (Figure 14). Although there was a slight decrease in number of taxa in the spring of 2011, the 2010 data show the opposite—a slight increase in taxa for the same season. These annual changes during the spring are likely related to normal life history fluctuations in macroinvertebrate populations. The decrease in fall at both mixing zone and downstream station groups compared to the upstream station group is likely the result of the documented salinity increase or saltwater wedge (Section 3.4) in these areas.

The number of taxa is typically expected to decrease for all stations from the spring through fall seasons. This seasonal pattern is expected based on the normal lifecycle of many taxa of aquatic macroinvertebrates. The spring season has higher numbers of larger mature larvae; as development is completed and emergence occurs during the summer and early fall, many taxa are then represented by larval populations physically too small or early in the life history to be effectively sampled by the methods utilized in this study.

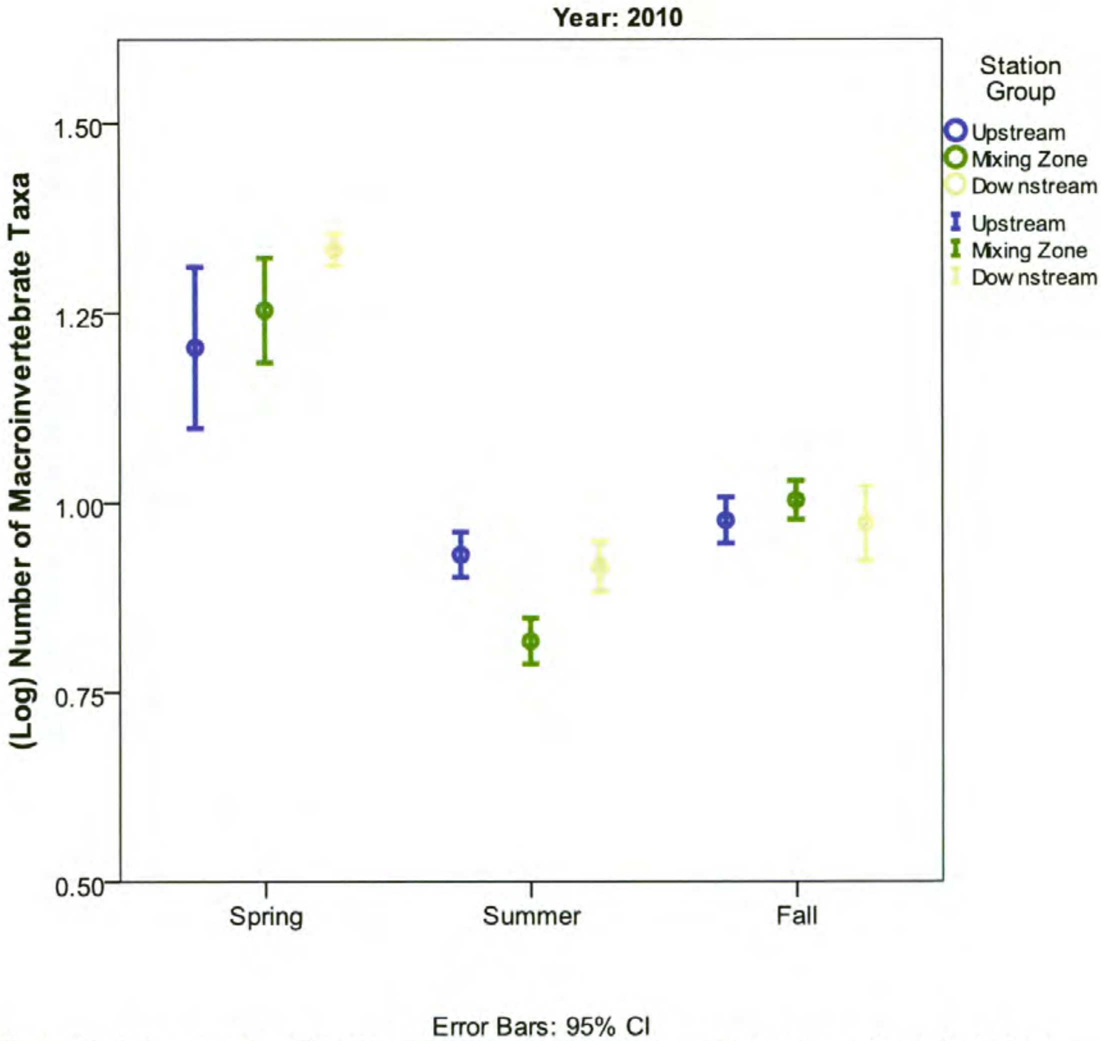

Figure 13. Error bar plot (95% CI) of the number of macroinvertebrate taxa collected per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

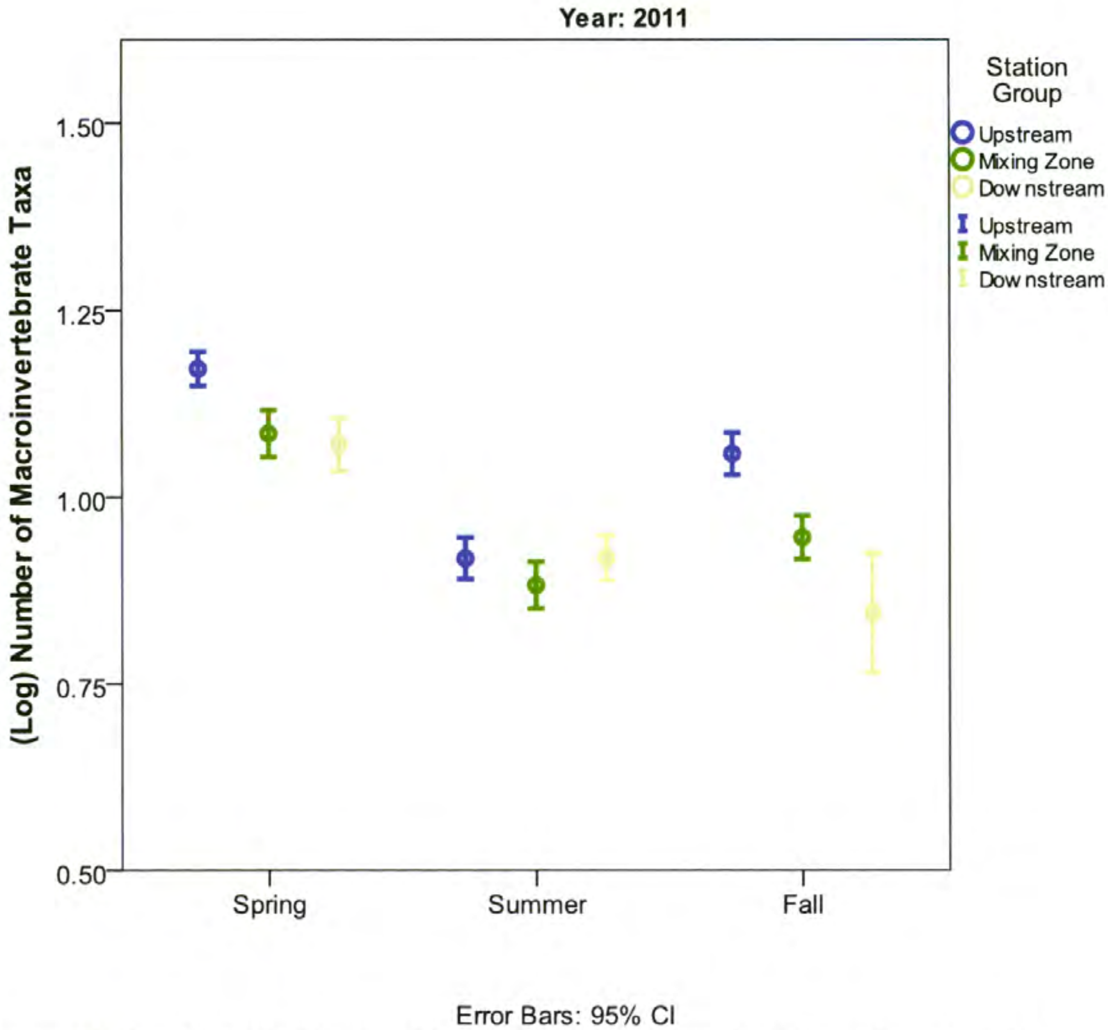

Figure 14. Error bar plot (95% CI) of the number of macroinvertebrate taxa collected per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

The most commonly collected macroinvertebrate taxa included the polycentropodid caddisfly *Cyrnellus* and the chironomid genera *Ablabesmyia*, *Dicrotendipes*, and *Tribelos*. Overall, these four genera accounted for a significant percentage of the individuals, which is typical for large rivers and impoundments in the Southeastern U.S. These genera were consistently represented in the samples, regardless of season or station group (Tables 1 and 2).

The genera *Rhithropanopeus* (estuarine mud crab) and *Mytilopsis* (brackish water mussel) were minimally present during the spring and summer, but increased in abundance in both fall 2010 and 2011 seasons. *Rhithropanopeus* can tolerate a wide range of salinities and is found in both fresh and brackish waters (Verween *et al.*, 2010). *Mytilopsis* can become established in salinities ranging from freshwater (<0.5 parts per thousand) to mesohaline (5–18 parts per thousand) conditions (Perry, 2013). *Rhithropanopeus* was a predominant taxon in most of the mixing zone and downstream station groups in 2011, while *Mytilopsis* was predominant at these same station groups in 2010.

Table 1. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2010 study.

	Spring			Summer			Fall		
Genus	Upstream	Mixing Zone	Downstream	Upstream	Mixing Zone	Downstream	Upstream	Mixing Zone	Downstream
Apocorophium	6.0	3.9	13.7	0.5	0.1	0.1	0.1	0.0	0.0
Gammarus	11.1	9.3	15.3	0.2	0.0	0.0	0.0	0.1	0.0
Rhithropanopeus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	6.9
Ablabesmyia	2.4	3.6	2.2	26.0	16.3	18.5	21.2	13.9	3.9
Dicrotendipes	1.1	2.6	1.1	20.8	14.0	14.1	10.5	8.2	4.8
Polypedilum	6.2	4.4	3.2	2.6	0.6	2.1	4.4	1.5	5.9
Tribelos	12.1	19.2	15.6	31.3	46.7	40.6	35.7	29.9	24.3
Rheotanytarsus	5.0	2.8	3.3	0.0	0.1	0.0	0.2	0.2	0.0
Maccaffertium	6.0	8.1	9.7	0.0	0.0	0.0	0.0	0.0	0.0
Hydropsyche	14.0	20.4	8.8	0.0	0.0	0.0	0.0	0.0	0.0
Cyrnellus	10.9	10.7	12.4	10.7	17.4	17.5	14.5	15.4	4.6
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.1	37.1
Total	74.7	85.2	85.5	92.1	95.3	92.9	86.6	90.0	87.5

Table 2. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2011 study.

	Spring			Summer			Fall		
Genus	Upstream	Mixing Zone	Downstream	Upstream	Mixing Zone	Downstream	Upstream	Mixing Zone	Downstream
Apocorophium	25.2	12.8	10.1	0.2	0.2	0.1	2.2	1.9	1.6
Gammarus	3.9	3.0	7.1	0.0	0.1	0.1	0.0	0.0	0.0
Rhithropanopeus	0.1	0.2	0.3	0.1	0.3	0.2	2.6	9.2	15.3
Ablabesmyia	5.6	10.1	11.9	20.4	21.4	26.6	4.3	3.3	1.4
Dicrotendipes	19.2	17.7	18.0	13.7	9.6	12.1	7.3	4.3	3.6
Polypedilum	2.1	0.8	1.5	3.8	1.4	4.4	1.1	0.7	2.3
Tribelos	10.7	21.2	20.8	23.1	30.7	28.8	38.9	41.2	34.3
Rheotanytarsus	0.5	0.4	0.2	0.0	0.0	0.0	1.2	1.3	2.2
Maccaffertium	1.8	9.2	6.8	0.0	0.0	0.0	2.0	0.6	0.0
Hydropsyche	1.9	0.9	1.5	0.1	0.0	0.1	0.1	0.3	0.1
Cyrnellus	21.3	16.6	16.3	33.5	31.5	23.2	21.1	13.1	7.6
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	1.9	6.2	1.4
Total	92.3	92.9	94.5	94.9	95.2	95.6	82.8	82.2	69.8

The number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) (EPT) taxa collected is often used as an indicator of water quality, as the individuals in these taxonomic orders are typically sensitive to low dissolved oxygen levels and elevated water temperature (Barbour *et al.* 1996). The 95% confidence intervals for the average number of EPT taxa per plate sampler at each station group by season are presented in Figures 15 and 16.

The average number of EPT taxa collected at the mixing zone for each season was similar to the upstream station group in 2010, while the downstream zone demonstrated an improvement in number of EPT taxa. For 2011, the average number of EPT taxa at the mixing zone and downstream station groups for each season were also similar to the upstream stations, except for the mixing zone and downstream station groups in the fall. The decrease in the fall of 2011 is likely a result of the documented salinity increase or saltwater wedge (Section 3.4) in the area.

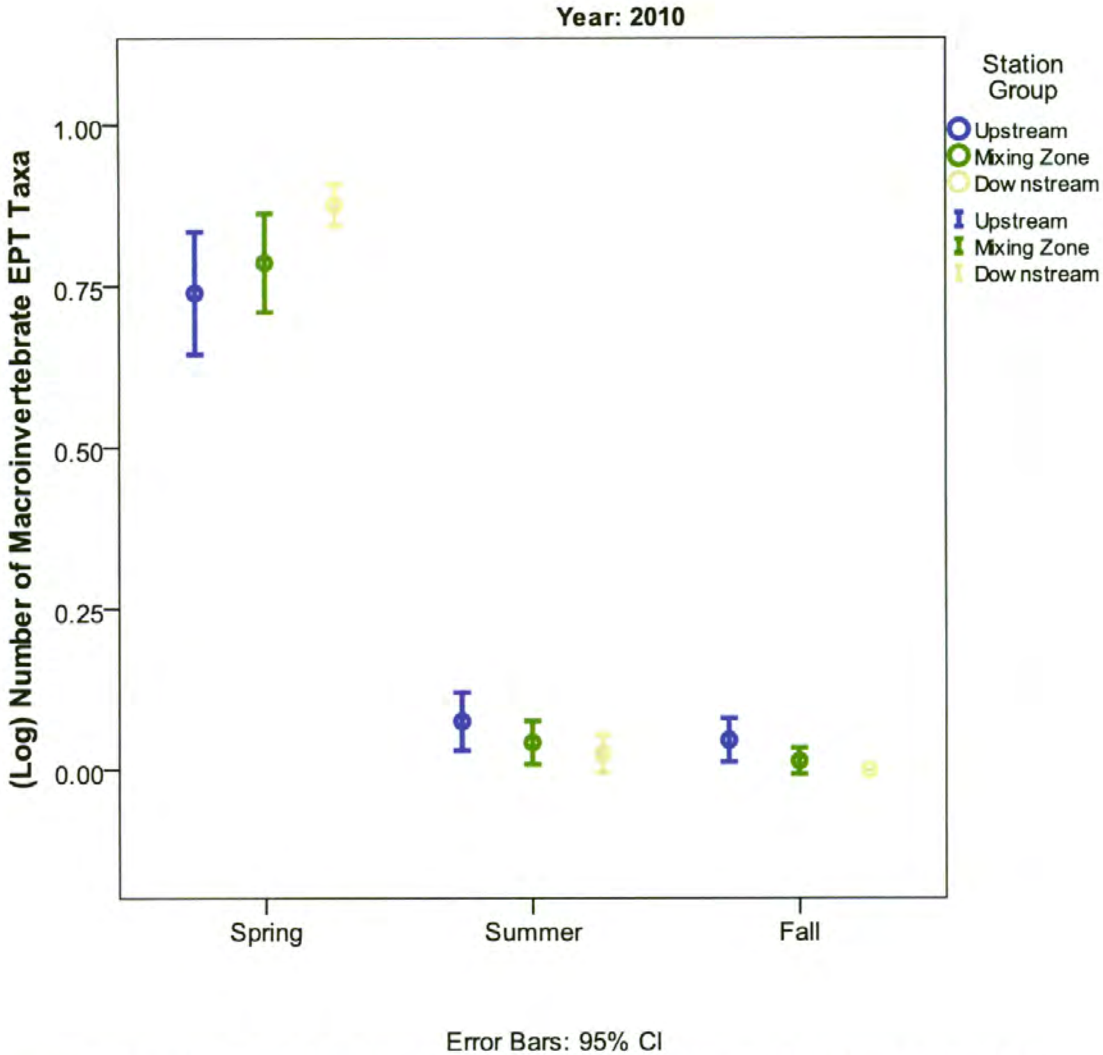

Figure 15. Error bar plot (95% CI) of the number of macroinvertebrate EPT taxa collected per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

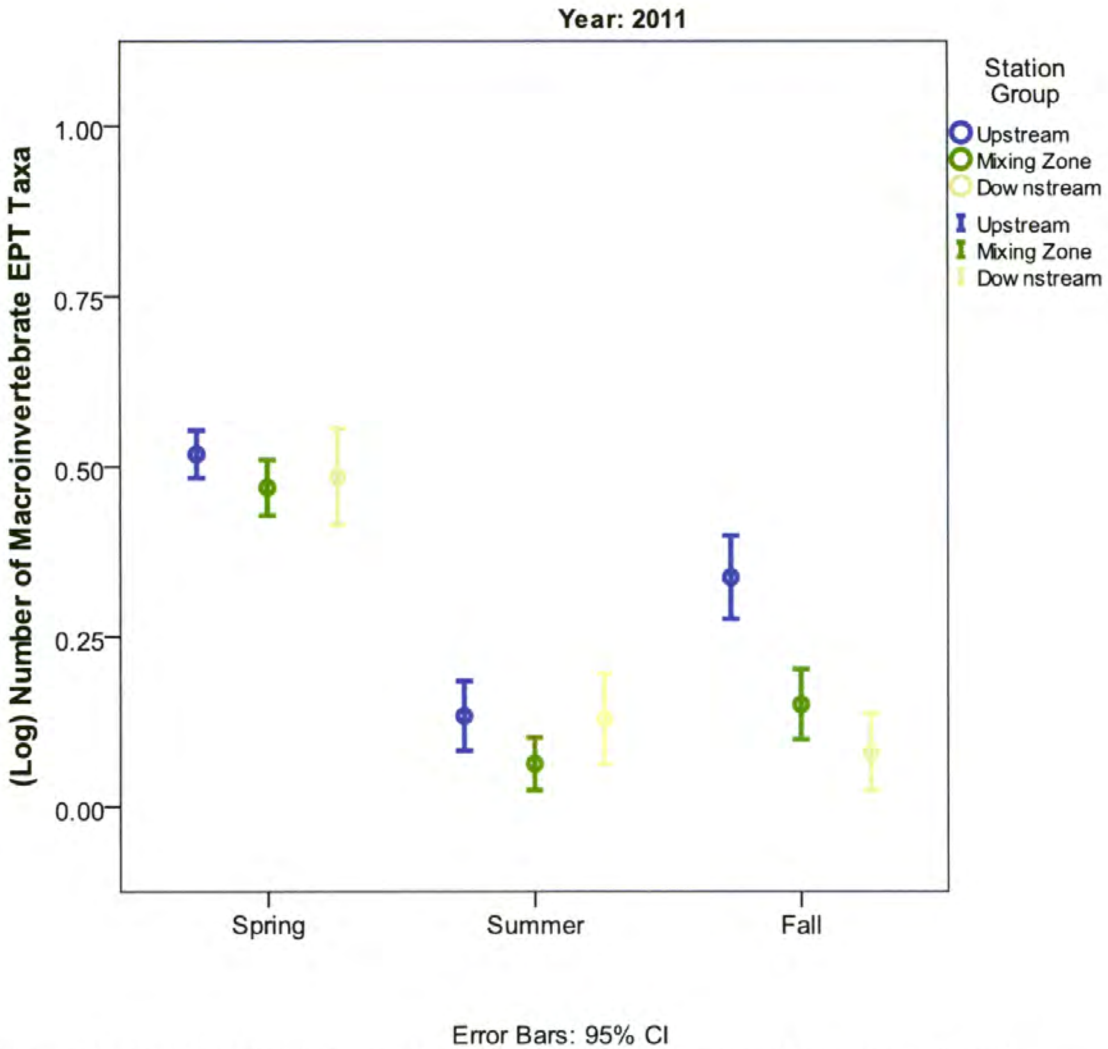

Figure 16. Error bar plot (95% CI) of the number of macroinvertebrate EPT taxa collected per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

Additional measures used to evaluate macroinvertebrate species diversity are the Shannon-Weaver diversity index and evenness. The Hilsenhoff Biotic Index (HBI), a measure of pollution sensitivity using tolerance values for individual taxa, is also evaluated. The distribution of values for each of these metrics approaches a normal distribution. Therefore, it is appropriate to evaluate differences using a 95-percent confidence interval of the means between station groups for each season (IBM 2010).

The Shannon-Weaver diversity index is used to measure the evenness of a biological community (Morin 1999). This index uses the total individuals in the sample and the number of individuals for each species. Evenness, another measure of diversity of a biological community, indicates the distribution of abundance among collected taxa (Harris *et al.* 1987). Evenness values range from 0.0 to 1.0, with 1.0 indicating a community where every taxon is equally represented. The 95% confidence intervals for the average SWDI and evenness per plate sampler at each station group by season are presented in Figures 17 through 20.

The average SWDI in 2010 indicated the mixing zone and downstream stations were similar to the upstream stations for all seasons, except for the mixing zone in the summer. Although a decrease in SWDI occurred at the mixing zone during the summer, the downstream stations were similar to the upstream stations, showing a recovery (Figure 17). For 2011, the average SWDI for all seasons did not show a significant decrease in heat-affected stations compared to heat-unaffected stations (Figure 18).

The average evenness in both 2010 and 2011 show similar trends across all station groups and did not show a significant decrease in mixing zone or downstream stations when compared to the upstream stations. In fact, the spring and fall seasons in 2011 show an increase in evenness in the heat-affected stations compared to the heat-unaffected stations, indicating a possible increase in diversity (Figures 19 and 20).

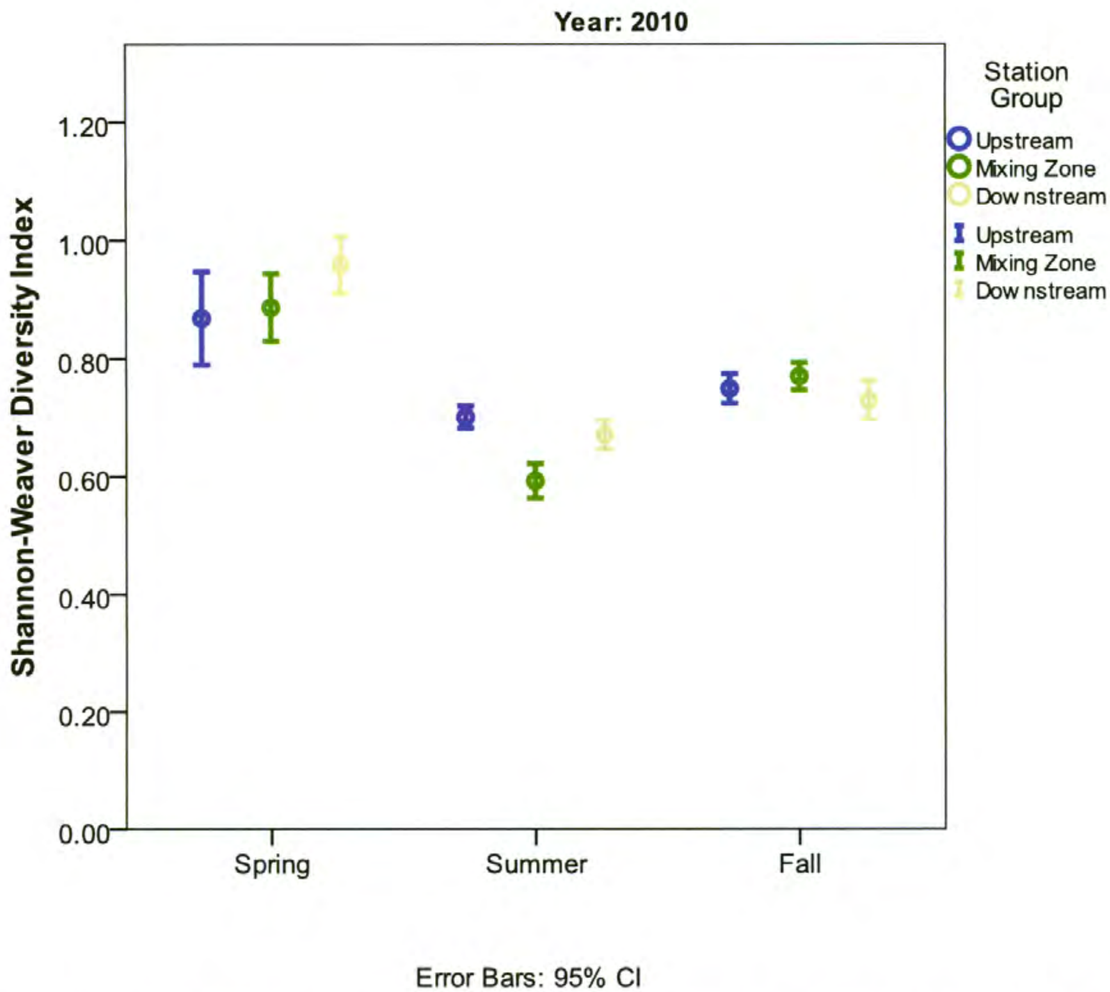

Figure 17. Error bar plot (95% CI) of the Shannon-Weaver diversity index per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

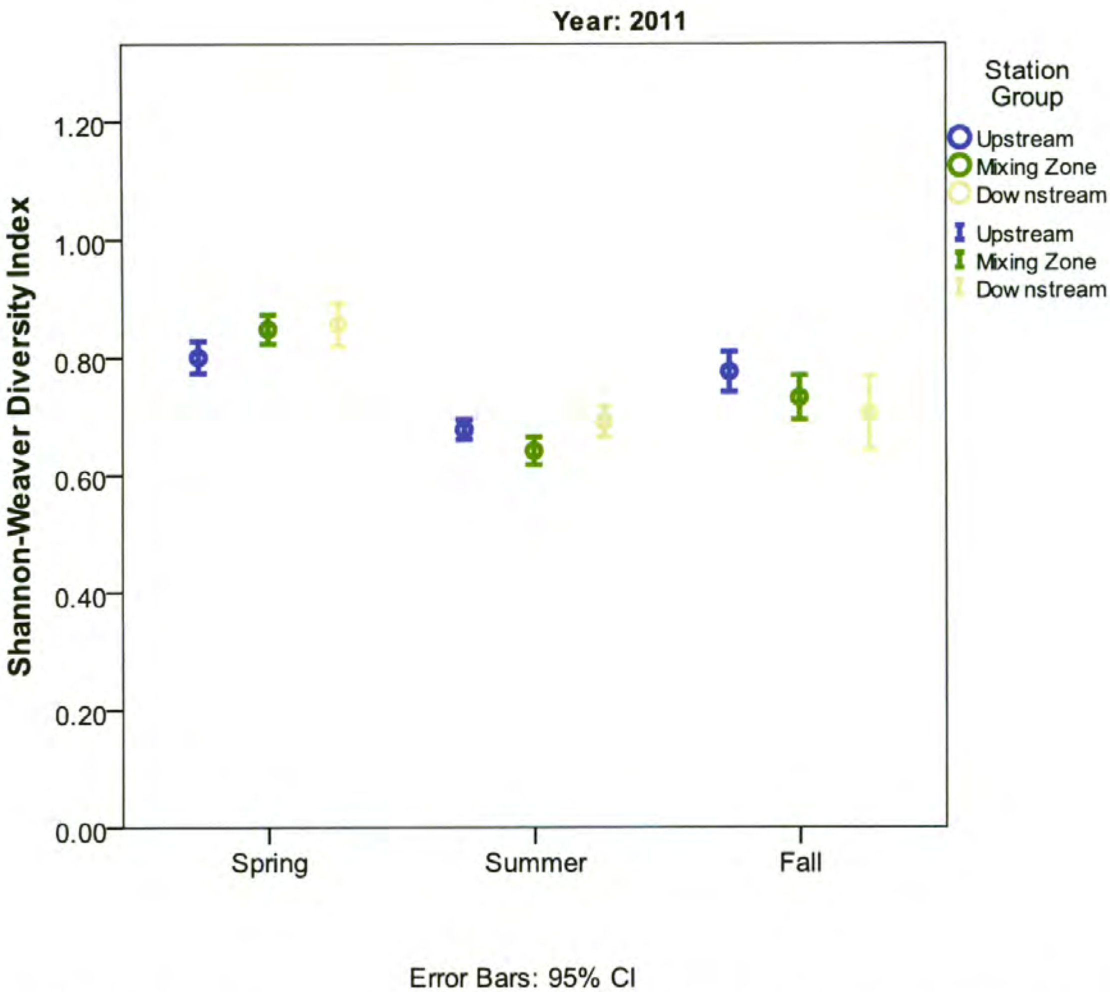

Figure 18. Error bar plot (95% CI) of the Shannon-Weaver diversity index per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

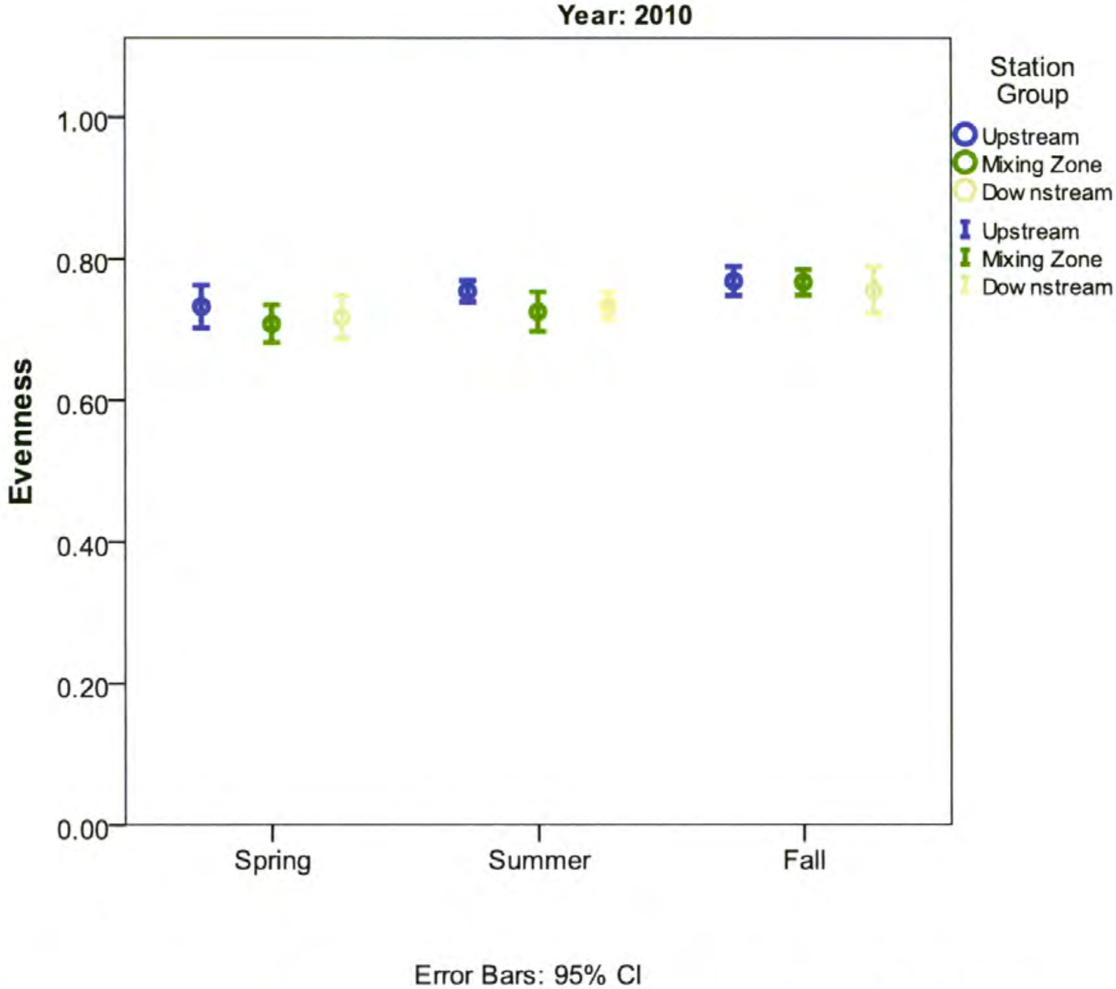

Figure 19. Error bar plot (95% CI) of evenness per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

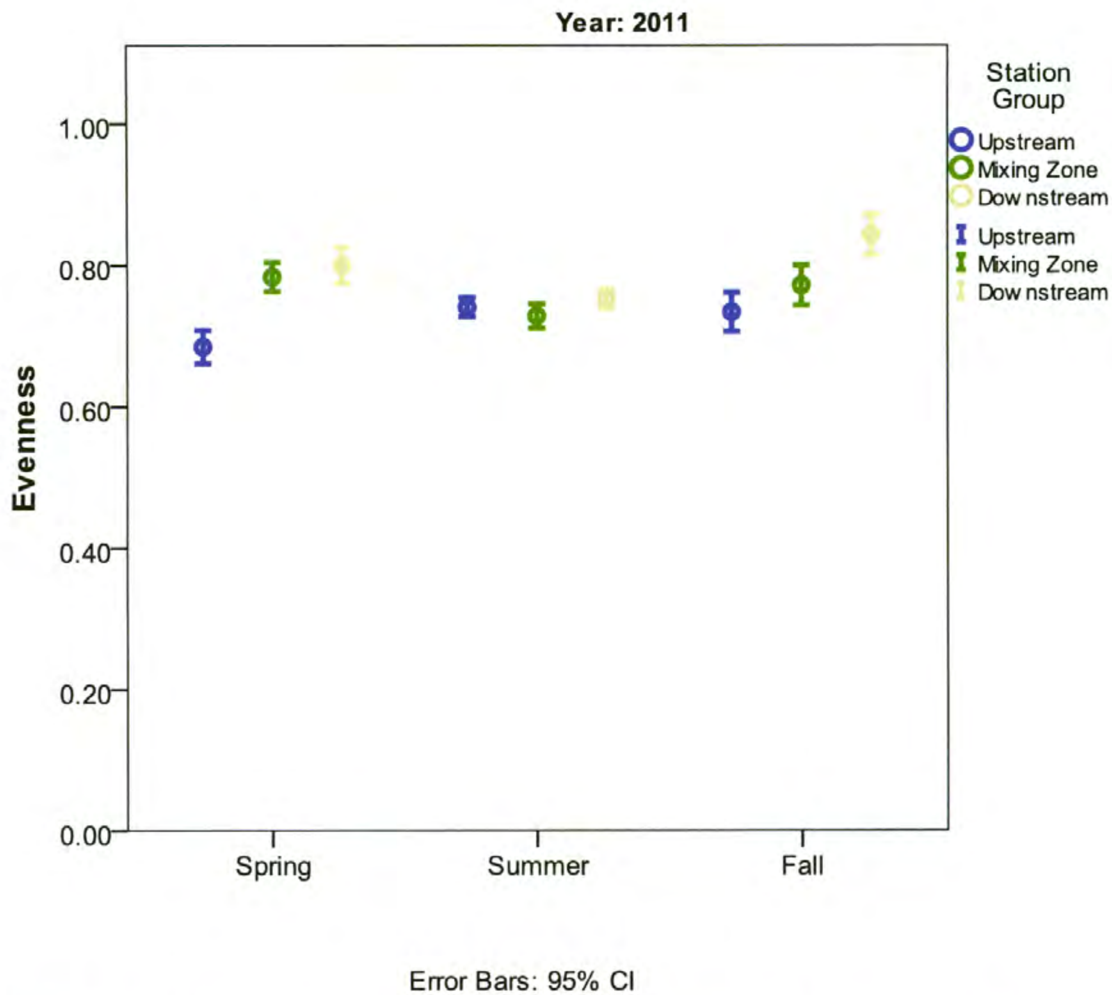

Figure 20. Error bar plot (95% CI) of evenness per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

HBI values indicate, on a scale of 0 to 10 (intolerant to tolerant), the pollution tolerance of the macroinvertebrate population based on the taxa identified (Hilsenhoff, 1987). The HBI is sometimes used to evaluate thermal effects, although the metric was originally designed to evaluate organic pollution. In contrast to the other metrics, an increase in HBI values indicates a shift to a more tolerant macroinvertebrate population. The tolerance values used in the HBI calculation were taken from the North Carolina Department of Environment and Natural Resources (NCDENR) database (NCDENR, 2006). The 95% confidence intervals for the average HBI per plate sampler at each station group by season are presented in Figure 21 and 22.

For all seasons in both 2010 and 2011, the HBI did not appreciably increase at the mixing zone and downstream station groups when compared to the upstream station group. The HBI values changed very little among season within each station group.

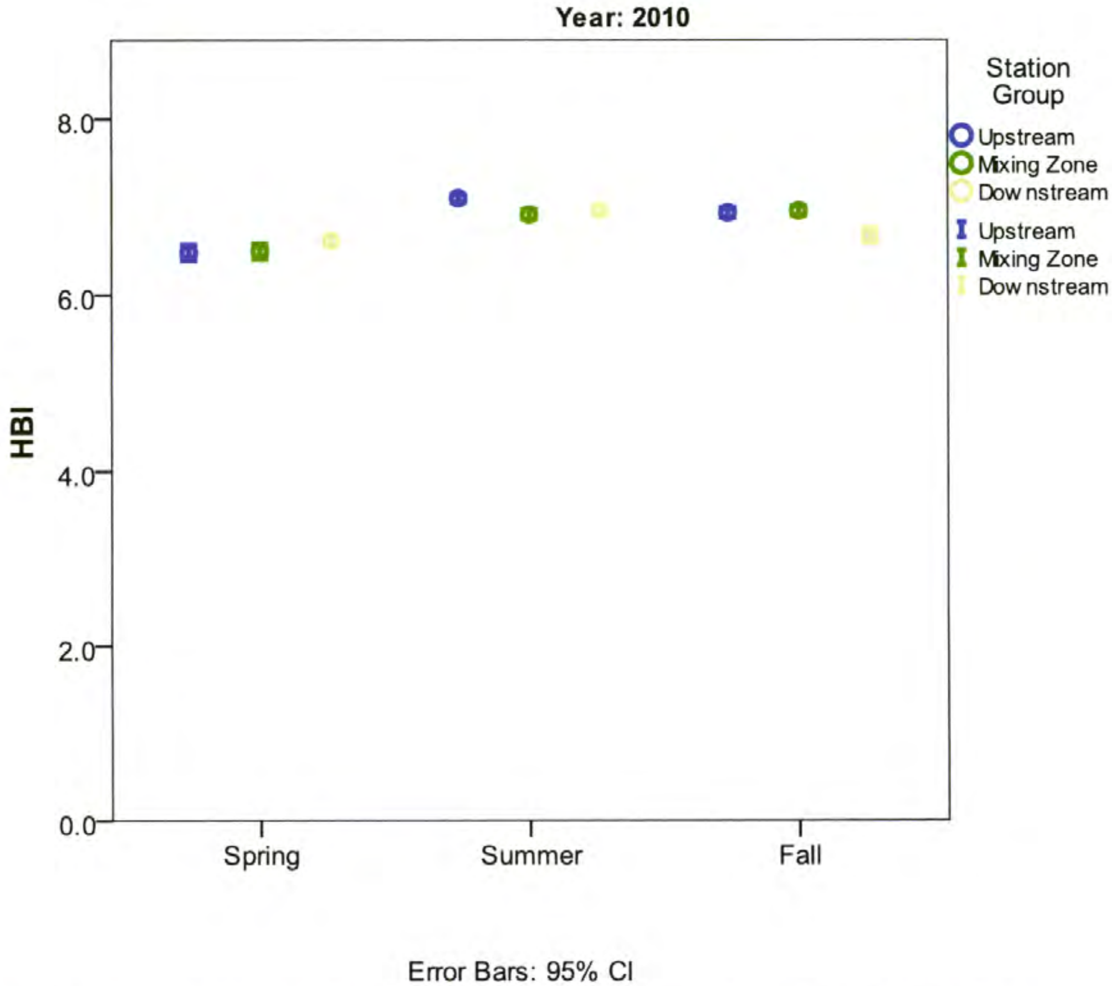

Figure 21. Error bar plot (95% CI) of the HBI per plate seasonally and by zone for the 2010 sampling. Each bar represents the individual plate samplers (N=49 for the upstream zone except in the spring, when N=44; N=42 in the mixing zone; and N=35 in the downstream zone).

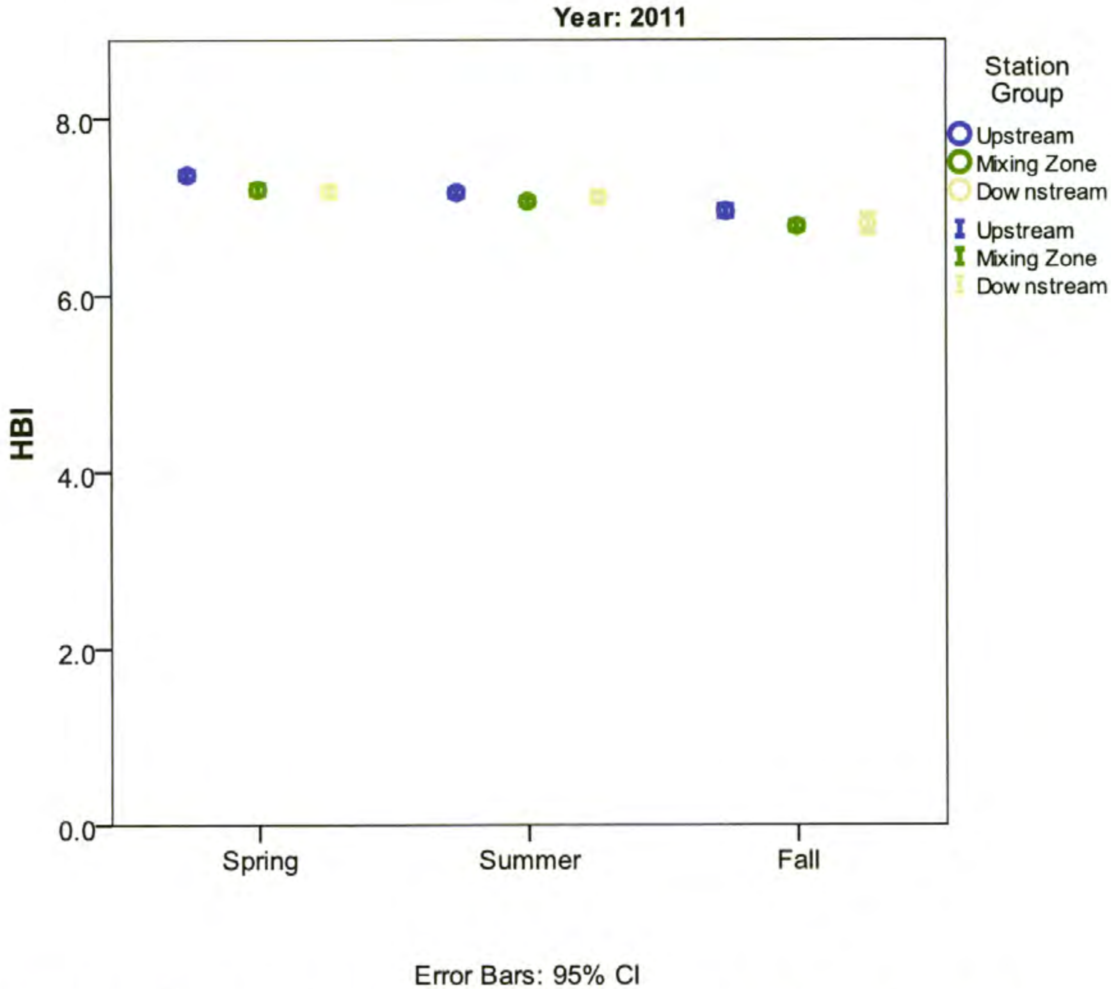

Figure 22. Error bar plot (95% CI) of the HBI per plate seasonally and by zone for the 2011 sampling. Each bar represents the individual plate samplers (N=49 upstream zone; N=42 in the mixing zone, except in the spring when N=34; and N=28 in the downstream zone, except in the spring when N=20).

3.3. Adult Fish

The adult fish sampling procedure used boat electrofishing to collect specimens, with 600 seconds of effort (pedal time) at each bank for the three zones. For a qualitative comparison using graphical analysis, the adult fish zones were grouped into heat-unaffected (upstream control) and heat-affected (mixing zone and downstream) areas. If the heat-unaffected area and the heat-affected area showed meaningful differences, then the upstream zone and the downstream zone, excluding the mixing zone, were compared to determine whether there was recovery. The metrics used to evaluate the adult fish community were catch-per-unit effort (CPUE), number of species, and relative abundance. Trophic classification and origin of each fish species collected were also evaluated.

Figures 23 and 24 summarize the total number of species collected and CPUE in the heat-unaffected and heat-affected areas. The total number of fish species collected for all seasons were similar in the heat-affected areas when compared to the heat-unaffected areas (Figure 23). Many of the species collected were represented by very few individuals. For example, during the summer, eight of the 19 fish species collected at the heat-unaffected area (upstream control) were represented by a single individual. In addition, the total number of species collected in the summer at the heat-affected area (mixing zone and downstream) included six of 17 species represented by a single individual. The high proportion of single individuals collected during the study could discount any differences between the two areas. In addition, it is recognized that there are other factors affecting variability in adult fish sampling results, including habitat differences within the same zone (e.g., left bank vs. right bank) and between zones, river flow and stage, barge traffic, and the thermal plume.

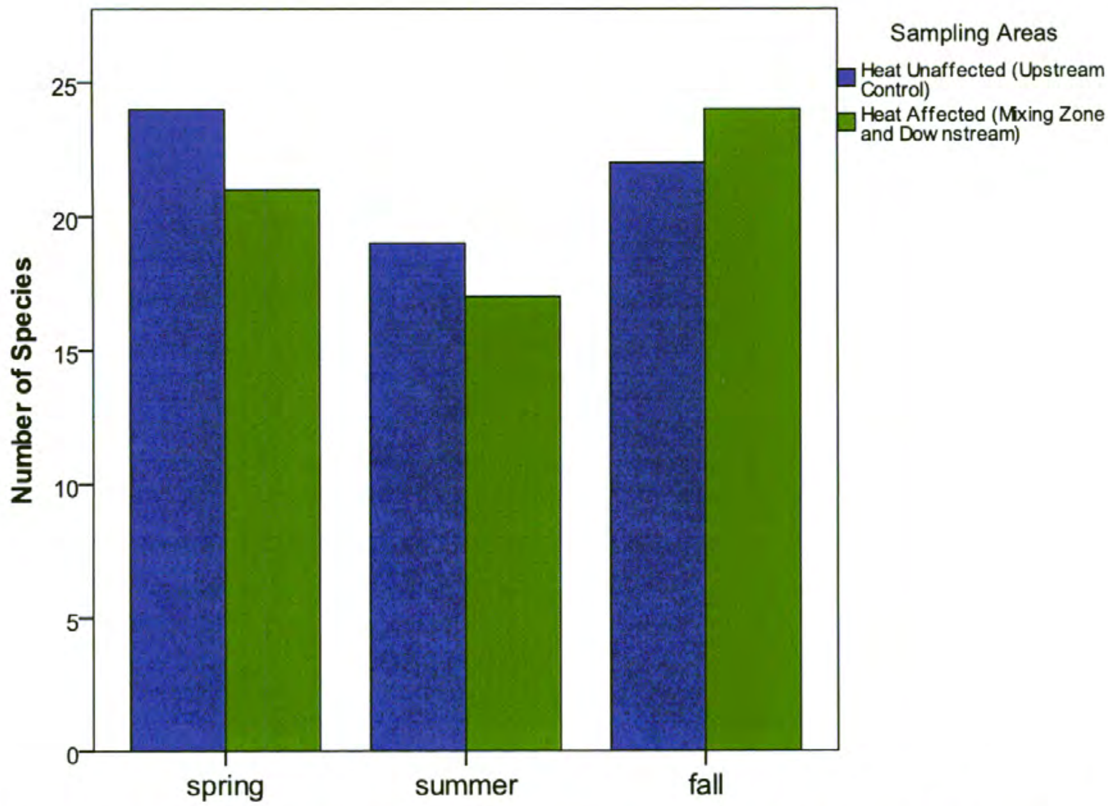

Figure 23. Bar chart for number of fish species collected seasonally and by sampling area. Each bar represents total number of fish species from electrofishing samples for each sampling area. Effort per zone (upstream, mixing zone, downstream) was 1,200 seconds.

The ranges in CPUE across all seasons showed an overlap between both heat-affected and heat-unaffected areas (Figure 24). An increasing trend in CPUE is observed with season for both sample areas. There is an observed decrease in the heat-affected areas as compared to the heat-unaffected areas; however, the lower CPUE during the fall season is likely due to changes in water quality. A saltwater wedge encroached on the study area as evidenced by the unique brackish water species collected (spotfin mojarra (*Eucinostomus argenteus*) and highfin goby (*Stonogobiops nematodes*)).

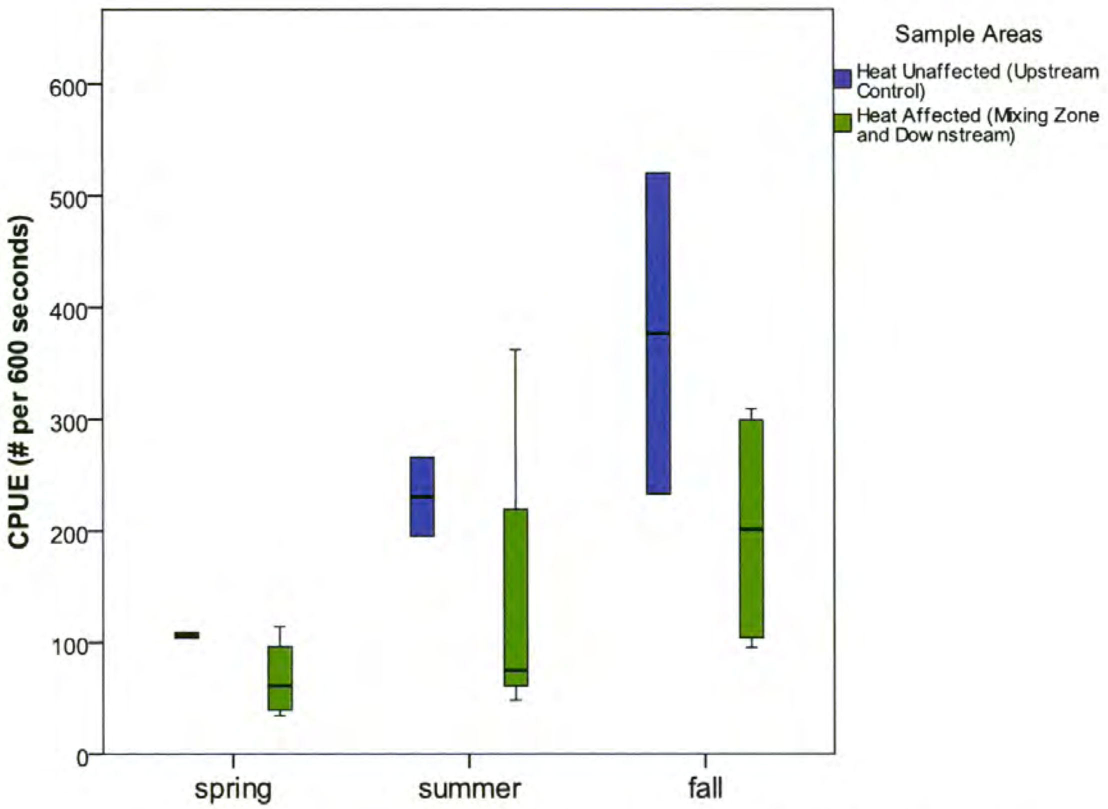

Figure 24. Boxplot of catch-per-unit effort (CPUE) per bank seasonally and by area. Each box represents electrofishing samples (N=2 for heat-unaffected areas, N=4 for heat-affected areas), for each area.

To further evaluate the differences between areas, Figure 25 presents CPUE by zones, including predominant species CPUE. During both the spring and summer, the downstream zone of the heat-affected area showed recovery when compared to the heat-unaffected upstream control zone.

In addition, the channel catfish (*Ictalurus punctatus*) population was similar in all zones during the spring season. Gulf menhaden (*Brevoortia patronus*) was least abundant during the spring season, yet recorded the highest CPUE values in the summer and fall. Similarly, silverside shiner (*Notropis candidus*) catch rates were also the highest during the summer and fall. The reduction in CPUE of channel catfish, silverside shiner, and bluegill sunfish (*Lepomis macrochirus*) in the mixing and downstream zones in the fall is likely due in part to the saltwater wedge and not temperature (Figure 4 and Table 14), as previously mentioned.

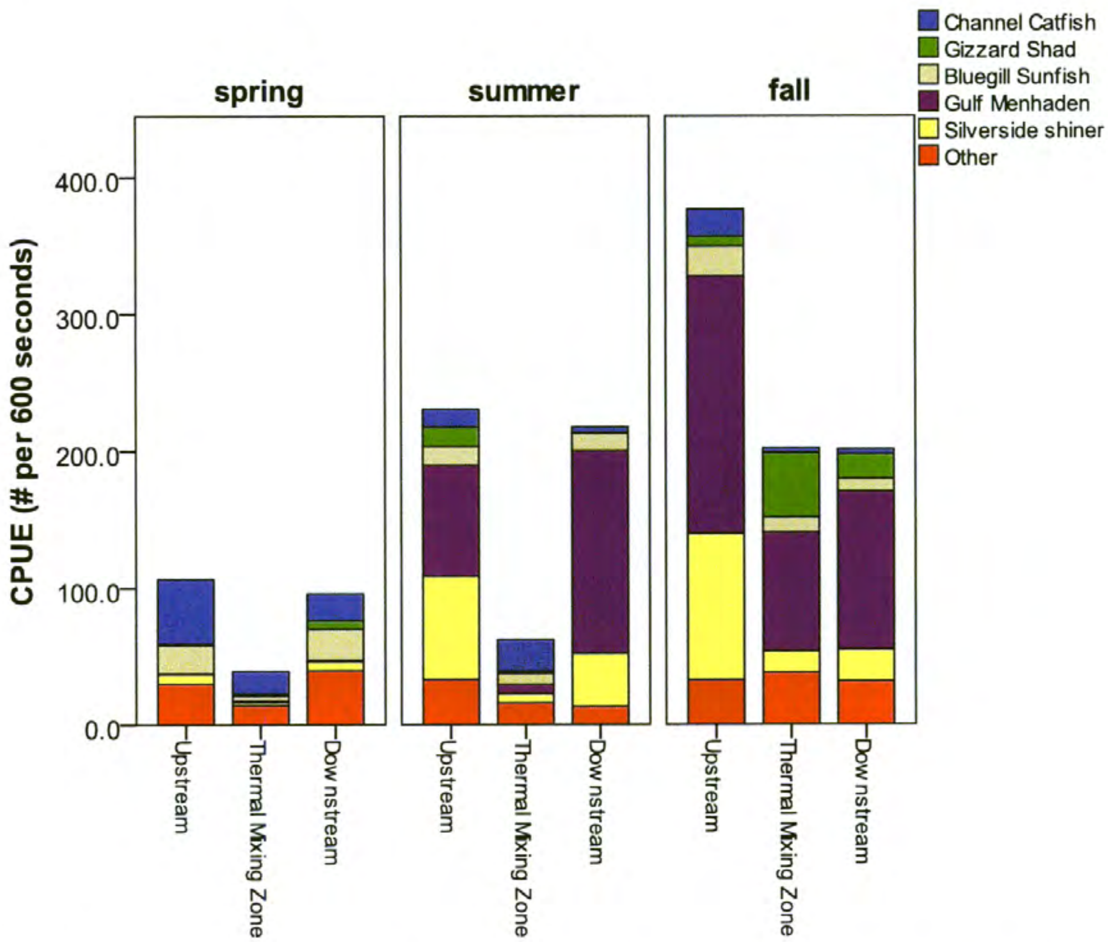

Figure 25. Stacked bar chart of CPUE (# per 600 seconds effort) results seasonally and by sampling area for the individual species collected.

Relative abundance is a measure of species composition for a sampled fish population. Table 3 indicates the average relative abundance of each species as a percentage of the total sample collected within each of the heat-unaffected and heat-affected areas. The fish population for this study, including all zones and seasons, is composed of 42 species from 19 families. The two most abundant species in the heat-unaffected area were Gulf menhaden and silverside shiner. Similarly, Gulf menhaden and silverside shiner were also the most abundant species in the heat-affected area. Bluegill sunfish and channel catfish were very similar in relative abundance across areas. The two brackish water species not typically collected, spotfin mojarra and highfin goby, were collected in the heat-affected areas only during the fall season.

Table 3. The average relative abundance (%) for each area during the adult fish collection (2010).

Family	Species	Relative Abundance (%) Heat Unaffected	Heat Affected
Lepisosteidae, Gars	Spotted gar	1.19	2.32
Amiidae, Bowfin	Bowfin	0.00	0.43
Anguillidae, Eels	American eel	0.07	0.00
Clupeidae, Shad and Herrings	Gizzard shad	3.08	9.10
	Threadfin shad	0.14	0.06
	Gulf menhaden	37.77	43.98
Engraulidae, Anchovies	Bay anchovy	1.54	0.24
Cyprinidae, Carps and Minnows	Silverside shiner	26.56	11.36
	Emerald shiner	0.35	0.06
	Silver chub	0.91	0.18
	Blacktail shiner	0.07	0.00
	Bullhead minnow	0.07	0.00
	Fluvial shiner	0.07	0.00
	Pugnose minnow	0.42	0.06
Catostomidae, Suckers	Quillback	0.49	0.67
	Highfin carpsucker	0.07	0.00
	Blacktail redhorse	0.07	0.06
	Smallmouth buffalo	0.14	0.86
Ictaluridae, Bullhead Catfish	Blue catfish	0.35	0.86
	Channel catfish	11.28	8.67
	Flathead catfish	0.21	0.06
Belonidae, Needlefish	Atlantic needlefish	0.56	0.49
Fundulidae, Topminnows	Blackspotted topminnow	0.00	0.06
Poeciliidae, Livebearers	Mosquitofish	0.07	0.00
Atherinidae, Silversides	Brook silverside	0.49	0.55
	Inland silverside	0.00	0.06
Moronidae, Striped Basses	Yellow bass	0.00	0.06
	White bass	0.21	0.12
	Striped bass	0.14	0.73
Centrarchidae, Sunfishes	Bluegill sunfish	7.92	8.25
	Spotted bass	0.42	0.06
	Black crappie	1.12	1.41
	White crappie	0.00	0.06
	Redear sunfish	0.14	0.00
	Largemouth bass	2.52	4.22
	Green sunfish	0.07	0.06
	Redspotted sunfish	0.00	0.12
Sciaenidae, Drums	Freshwater drum	0.35	1.34
Mugilidae, Mullets	Striped mullet	0.98	2.87
Soleidae, Soles	Hogchoker	0.14	0.06
Gerreidae, Mojarras	Spotfin mojarra	0.00	0.43
Gobiidae, Gobies	Highfin goby	0.00	0.06
	TOTAL:	100.00	100.00

Five dominant species, representing the families Clupeidae (shad and herrings), Ictaluridae (bullhead catfishes), Cyprinidae (carps and minnows), and Centrarchidae (sunfishes), comprised 60 to 91 percent of all fishes collected during all seasons and at all zones (Table 4). The most commonly collected species in the heat-unaffected area were Gulf menhaden and silverside shiner, except during the spring season when there was a greater abundance of channel catfish and bluegill sunfish. Similar to the heat-unaffected area, the most abundant species collected in the heat-affected area was Gulf menhaden, except during the spring season when channel catfish and bluegill sunfish comprised a high percentage.

Table 4. Relative abundance (%) of dominant adult fish species collected in 2010 study.

	Spring		Summer		Fall	
Species	Heat Unaffected	Heat Affected	Heat Unaffected	Heat Affected	Heat Unaffected	Heat Affected
Channel catfish	44.6	26.8	5.6	9.8	5.3	1.7
Gizzard shad	0.9	5.8	6.1	0.5	1.9	16.1
Bluegill sunfish	19.2	19.5	6.1	7.5	5.8	5.0
Gulf menhaden	0.5	1.5	35.1	55.5	49.9	50.4
Silverside shiner	6.6	6.7	32.8	16.3	28.4	9.6
Total	**71.8**	**60.2**	**85.7**	**89.6**	**91.4**	**82.8**

Table 5 lists the range of trophic levels (or feeding guilds) represented by the species collected during this study (O'Neil and Shepard 2010). Invertivore, insectivore, piscivore, invertivore-piscivore, algivore-herbivore-invertivore, and detritivore-algivore-herbivore groups were all found among the species collected. Of the most commonly collected species, Gulf menhaden are algivore-herbivore-invertivores; silverside shiners are insectivores; and channel catfish are invertivores. In addition, the adult fish sampling resulted in the collection of no exotic species.

Figure 26 shows the trophic classification composition of the adult fish community by season within each of the areas. There is a similar percentage distribution of trophic classification between each area during all seasons. In the spring, the distribution of invertivores is more prominent due to the greater abundance of channel catfish and bluegill sunfish.

Table 5. A list of species collected by electrofishing, indicating the trophic classification, origin, and habitat type (Boschung and Mayden 2004; Hoese and Moore 1998; Mettee *et al.* 1996).

Species	Trophic Level	Origin	Habitat Type
Spotted gar	invertivore-piscivore	native	freshwater
Bowfin	invertivore-piscivore	native	freshwater
American eel	invertivore-piscivore	native	freshwater (catadromous)
Gizzard shad	algivore-herbivore-invertivore	native	freshwater
Threadfin shad	algivore-herbivore-invertivore	native	freshwater
Gulf menhaden	algivore-herbivore-invertivore	native	estuarine
Bay anchovy	invertivore	native	estuarine
Silverside shiner	insectivore	native	freshwater
Emerald shiner	insectivore	native	freshwater
Silver chub	insectivore	native	freshwater
Blacktail shiner	insectivore	native	freshwater
Bullhead minnow	detritivore-algivore-herbivore	native	freshwater
Fluvial shiner	insectivore	native	freshwater
Pugnose minnow	algivore-herbivore-invertivore	native	freshwater
Quillback	detritivore-algivore-herbivore	native	freshwater
Highfin carpsucker	detritivore-algivore-herbivore	native	freshwater
Blacktail redhorse	invertivore	native	freshwater
Smallmouth buffalo	insectivore	native	freshwater
Blue catfish	invertivore	native	freshwater
Channel catfish	invertivore	native	freshwater
Flathead catfish	invertivore-piscivore	native	freshwater
Atlantic needlefish	piscivore	native	estuarine/freshwater
Blackspotted topminnow	invertivore	native	freshwater
Mosquitofish	insectivore	native	freshwater
Brook silverside	invertivore	native	freshwater
Inland silverside	invertivore	native	freshwater
Yellow bass	invertivore-piscivore	native	freshwater
White bass	invertivore-piscivore	native	freshwater
Striped bass	invertivore-piscivore	native	freshwater (anadromous)
Bluegill sunfish	invertivore	native	freshwater
Spotted bass	invertivore-piscivore	native	freshwater
Black crappie	invertivore-piscivore	native	freshwater
White crappie	invertivore-piscivore	native	freshwater
Redear sunfish	invertivore	native	freshwater
Largemouth bass	invertivore-piscivore	native	freshwater
Green sunfish	invertivore-piscivore	native	freshwater
Redspotted sunfish	invertivore	native	freshwater
Freshwater drum	invertivore	native	freshwater
Striped mullet	detritivore-algivore-herbivore	native	estuarine/freshwater
Hogchoker	invertivore-piscivore	native	estuarine/freshwater
Spotfin mojarra	-----------	native	estuarine
Highfin goby	-----------	native	estuarine

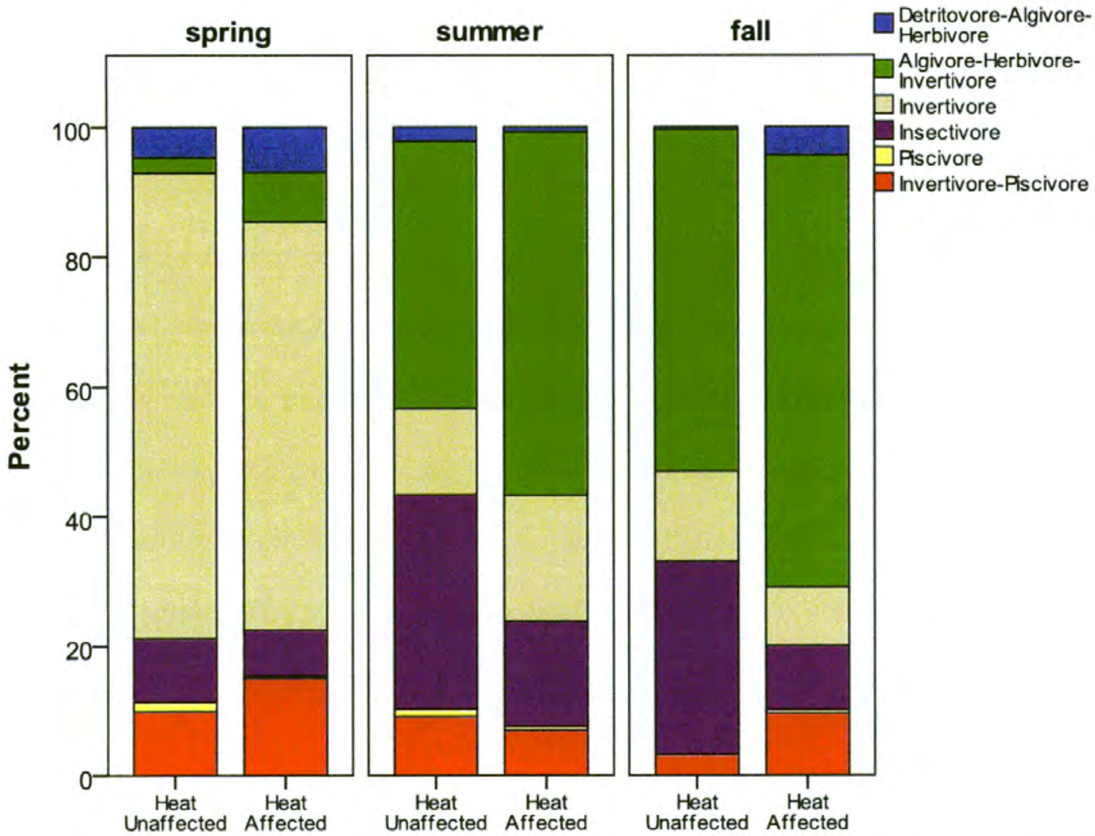

Figure 26. Trophic classification by season and area (heat-unaffected and heat-affected) from 2010 electrofishing study.

3.4. Water Quality

A water quality assessment was included during each of the biological sampling events. This included water quality profiles (water temperature, dissolved oxygen, and conductivity) for the macroinvertebrate and adult fish studies. Water quality datasondes (Hach LDO®) were deployed each season in close proximity to each of the 18 macroinvertebrate plate sampler stations. The datasondes measured continuous dissolved oxygen concentration and specific conductivity. Additional water quality data were collected for the macroinvertebrate study which included water sampling and analyses for trace metals and nutrients. Thermistor results for all biological sampling events are included in Section 3.1.

Tables 6 and 7 summarize the water quality profile measurements taken during macroinvertebrate sampler deployment and retrieval events. The measurement taken at the 5-foot depth represents the approximate elevation of the plate samplers. The dissolved oxygen measurements show similar values across stations and should not affect the macroinvertebrate population between stations. The results for conductivity show elevated conductance during the fall season, indicating the presence of a saltwater wedge. The water temperature and dissolved oxygen ranges within each profile during the summer and fall are indicative of a moderately stratified river system.

Tables 8 and 9 summarize the datasonde measurements of dissolved oxygen and conductivity. Biofouling affected dissolved oxygen readings beginning in spring 2010 and was a chronic problem at all stations in summer 2010. Beginning in fall 2010, datasondes were replaced weekly at all stations with newly calibrated instruments during the four-week deployment period. For 2010, the dissolved oxygen for six stations in spring, all stations in summer, and two stations in the fall had suspect data and were not included in the study or presented in this report. In 2011, a combination of biofouling and datasonde failures resulted in additional stations throughout the study having invalid data, primarily dissolved oxygen readings. As a result of these problems, the dissolved oxygen for five stations in spring, nine stations in summer, and eight stations in fall had suspect data and were not included in the study or presented in this report. On the other hand, the conductivity measurements were not affected by biofouling and the majority of data collected was used in this study.

The datasonde measurements of dissolved oxygen do show an expected trend of decreasing concentration with increasing temperatures by station group and by season. The average dissolved oxygen concentrations for each station group did not drop below 5.0 mg/L. The conductivity measurements are consistent with the profile data collected.

Table 6. Summary of water quality profile data measured during the plate deployment and retrieval for macroinvertebrate collection in 2010. Profiles were performed at the deepest point near each station. Measurements were taken at 0, 1, 3, 5, 10, 15, 20, 25, and 30 ft depths, continuing in 10-ft intervals, if necessary. The minimum, maximum, and mean values represent measurements from the seven stations in the upstream zone, the six stations in the mixing zone, and the five stations in the downstream zone. The 5-ft measurements are the averages of the measurements taken at the 5-ft depth at all stations within the respective zone. Note: Two additional profile dates are included.

	2010	Parameters	Upstream				Mixing Zone				Downstream			
			Min	Mean	Max	5-ft	Min	Mean	Max	5-ft	Min	Mean	Max	5-ft
Spring	11-May	Temperature (°F)	73.6	73.8	75.0	73.8	73.8	74.3	75.4	74.3	74.1	74.5	75.4	74.5
		Dissolved oxygen (mg/L)	5.66	5.75	5.90	5.77	5.67	5.77	5.86	5.79	5.67	5.78	5.87	5.80
		Conductivity (µS/cm)	145	146	146	146	146	147	149	147	146	147	148	147
	27-May	Temperature (°F)	79.2	79.4	79.7	79.4	79.5	80.1	80.8	80.1	80.1	80.3	80.6	80.3
		Dissolved oxygen (mg/L)	6.90	7.00	7.10	7.03	6.83	7.01	9.62	6.99	6.83	6.93	7.01	6.97
		Conductivity (µS/cm)	145	146	146	145	146	147	149	147	147	148	149	148
Summer	14-Jul	Temperature (°F)	88.7	89.9	93.0	90.0	89.2	91.8	100.2	92.3	89.2	91.1	93.0	91.5
		Dissolved oxygen (mg/L)	5.90	6.74	7.81	6.98	5.83	6.37	7.47	6.53	5.59	6.09	6.90	6.17
		Conductivity (µS/cm)	200	215	226	214	200	211	236	212	196	206	216	206
	29-Jul	Temperature (°F)	89.2	89.8	90.5	89.9	89.2	91.8	98.8	92.7	90.0	91.6	97.9	92.2
		Dissolved oxygen (mg/L)	5.84	6.05	6.42	6.09	5.70	6.13	7.00	6.29	5.51	6.11	6.92	6.36
		Conductivity (µS/cm)	232	242	250	241	231	236	241	236	230	237	245	237
	9-Aug	Temperature (°F)	89.8	90.9	94.1	91.2	90.1	92.3	98.8	93.7	90.5	91.8	93.0	91.9
		Dissolved oxygen (mg/L)	5.56	6.20	7.20	6.31	5.22	5.61	6.14	5.82	5.06	5.28	5.54	5.31
		Conductivity (µS/cm)	194	209	220	210	195	214	239	211	207	221	244	221
Fall	13-Sep	Temperature (°F)	87.3	88.3	89.4	88.6	87.4	90.0	95.9	90.8	88.5	90.6	94.5	91.0
		Dissolved oxygen (mg/L)	5.66	6.12	6.69	6.31	5.24	5.88	6.75	6.21	5.06	5.73	6.66	5.90
		Conductivity (µS/cm)	243	270	285	271	255	268	285	273	254	273	291	272
	23-Sep	Temperature (°F)	85.5	87.0	90.1	87.0	87.6	90.2	94.8	91.4	87.6	90.0	92.8	91.0
		Dissolved oxygen (mg/L)	1.11	5.41	6.10	5.65	.86	4.16	6.23	5.60	.75	3.99	6.09	5.43
		Conductivity (µS/cm)	247	609	7,940	276	328	3,308	11,430	557	508	5,103	17,390	1,191
	30-Sep	Temperature (°F)	82.6	83.0	83.7	83.1	83.5	84.3	84.7	84.3	84.0	85.0	87.1	85.0
		Dissolved oxygen (mg/L)	5.71	6.00	6.40	6.06	5.81	5.99	6.14	6.01	2.90	5.88	6.98	6.04
		Conductivity (µS/cm)	253	268	282	269	270	279	288	278	269	621	3,650	425

Table 7. **Summary of water quality profile data measured during the plate deployment and retrieval for macroinvertebrate collection in 2011. Profiles were performed at the deepest point near each station. Measurements were taken at 0, 1, 3, 5, 10, 15, 20, 25, and 30 ft depths, continuing in 10-ft intervals, if necessary. The minimum, maximum, and mean values represent measurements from the seven stations in the upstream zone, the six stations in the mixing zone, and the five stations in the downstream zone. The 5-ft measurements are the averages of the measurements taken at the 5-ft depth at all stations within the respective zone.**

2011		Parameters	Upstream				Mixing Zone				Downstream			
			Min	Mean	Max	5-ft	Min	Mean	Max	5-ft	Min	Mean	Max	5-ft
Spring	11-May	Temperature (°F)	74.7	75.1	75.4	75.1	75.2	76.1	77.8	76.3	76.1	76.4	77.0	76.6
		Dissolved oxygen (mg/L)	7.66	7.76	7.87	7.78	7.58	7.72	7.95	7.77	7.56	7.70	8.01	7.80
		Conductivity (µS/cm)	144	144	145	144	144	145	147	145	144	145	146	145
	7-Jun	Temperature (°F)	86.4	88.3	93.7	88.8	86.6	90.0	96.6	91.6	87.6	88.7	89.9	89.7
		Dissolved oxygen (mg/L)	5.75	6.70	9.40	6.97	5.49	6.42	7.93	6.73	5.50	6.30	7.24	6.77
		Conductivity (µS/cm)	178	187	193	188	182	187	197	186	186	188	214	186
Summer	12-Jul	Temperature (°F)	89.0	91.1	102.1	91.1	90.6	93.2	103.0	94.2	90.7	92.1	94.2	93.2
		Dissolved oxygen (mg/L)	5.60	6.20	7.59	6.27	5.59	5.98	6.87	6.17	5.41	5.68	6.24	5.93
		Conductivity (µS/cm)	231	237	241	237	24	236	245	238	233	239	246	245
	10-Aug	Temperature (°F)	89.9	91.6	97.8	92.0	90.6	93.3	102.9	94.8	91.5	92.3	94.4	94.3
		Dissolved oxygen (mg/L)	5.32	6.17	7.82	6.41	4.50	5.53	6.03	5.75	5.25	5.37	5.50	5.44
		Conductivity (µS/cm)	229	251	261	250	246	253	276	253	249	261	272	272
Fall	21-Sep	Temperature (°F)	80.1	80.6	81.9	80.7	80.4	82.1	87.9	82.5	80.8	81.7	84.7	82.6
		Dissolved oxygen (mg/L)	6.48	6.98	7.72	7.03	6.23	7.04	7.99	7.16	6.76	7.14	8.14	7.88
		Conductivity (µS/cm)	250	256	493	252	249	255	278	256	255	266	278	277
	18-Oct	Temperature (°F)	74.1	76.1	79.3	76.4	77.4	79.8	86.4	79.9	77.7	78.8	82.9	79.0
		Dissolved oxygen (mg/L)	5.99	6.25	6.62	6.25	5.45	5.97	6.71	6.03	3.77	5.66	6.91	6.00
		Conductivity (µS/cm)	251	273	405	275	366	797	1,864	641	653	3,117	13,180	3,730

Table 8. Continuous data recorded by datasondes during each 4-week macroinvertebrate deployment period in 2010.

2010	Parameters	Upstream			Mixing Zone			Downstream		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Spring	Dissolved oxygen (mg/L)	5.5	6.7	8.0	4.8	6.2	7.7	4.9	6.4	7.8
	Conductivity (µS/cm)	101	143	168	108	135	179	124	148	174
Summer	Dissolved oxygen (mg/L)	—	—	—	—	—	—	—	—	—
	Conductivity (µS/cm)	182	239	278	189	237	284	192	277	1,049
Fall	Dissolved oxygen (mg/L)	3.3	5.5	8.3	2.8	5.4	8.3	2.6	5.2	7.9
	Conductivity (µS/cm)	175	275	1,100	225	478	3,852	236	1,081	5,266

Table 9. Continuous data recorded by datasondes during each 4-week macroinvertebrate deployment period in 2011.

2011	Parameters	Upstream			Mixing Zone			Downstream		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Spring	Dissolved oxygen (mg/L)	5.5	7.3	9.8	5.1	7.0	9.4	5.0	7.0	9.6
	Conductivity (µS/cm)	137	168	194	145	168	201	150	173	211
Summer	Dissolved oxygen (mg/L)	3.4	5.5	8.5	2.7	5.2	7.6	2.6	5.2	8.4
	Conductivity (µS/cm)	184	237	321	175	233	276	206	242	282
Fall	Dissolved oxygen (mg/L)	5.3	7.2	9.7	4.1	6.8	9.5	2.6	6.9	10.0
	Conductivity (µS/cm)	174	271	1,439	197	542	6,962	210	872	9,935

Water samples were taken during each macroinvertebrate plate deployment and retrieval event and submitted for analysis to the APC General Test Laboratory. Tables 10 and 11 show the summary of laboratory results for priority pollutant metal concentrations at the 5-foot depth. Tables 12 and 13 present summaries of the laboratory results for nutrient concentrations. These measurements were also collected at the 5-foot depth. The chlorophyll *a* and nutrient results do not indicate any meaningful differences among station groups.

Table 10. Summary of water sampling analysis results for priority pollutant metals from the 2010 macroinvertebrate plate deployment and retrieval events for each station (N=6). Samples were collected from a depth of 5 feet.

		Station 1			Station 9			Station 18		
	Units	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Antimony, Total	mg/L	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004
Arsenic, Total	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Beryllium, Total	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, Total	mg/L	<0.005	<0.005	0.009	<0.005	<0.005	0.006	<0.005	<0.005	0.007
Copper, Total	mg/L	<0.005	<0.005	0.01	<0.005	<0.005	0.009	<0.005	<0.005	0.006
Lead, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.025	<0.005	<0.005	<0.005
Mercury, Total*	ng/L	<1.4	4.9	15.4	<1.4	4.4	14	<1.4	3.6	9.3
Nickel, Total	mg/L	<0.001	0.002	0.005	0.001	0.003	0.004	0.001	0.002	0.004
Selenium, Total	mg/L	<0.005	<0.005	0.007	<0.005	<0.005	0.007	<0.005	<0.005	0.007
Silver, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium, Total	mg/L	<0.002	0.003	0.006	<0.002	0.002	0.004	<0.002	0.002	0.005
Zinc, Total	mg/L	0.008	0.015	0.023	0.008	0.019	0.034	0.007	0.013	0.02

*EPA Method 245.7

Table 11. Summary of water sampling analysis results for priority pollutant metals from the 2011 macroinvertebrate plate deployment and retrieval events for each station (N=6). Samples were collected from a depth of 5 feet.

		Station 1			Station 9			Station 18		
	Units	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Antimony, Total	mg/L	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	0.003
Arsenic, Total	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Beryllium, Total	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper, Total	mg/L	<0.005	0.005	0.013	<0.005	0.006	0.011	<0.005	<0.005	0.006
Lead, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury, Total*	ng/L	1.8	3.0	5.8	1.8	3.0	5.3	1.9	2.9	1.9
Nickel, Total	mg/L	<0.001	0.001	0.003	<0.001	0.001	0.002	<0.001	0.001	0.002
Selenium, Total	mg/L	<0.005	0.006	0.010	<0.005	0.006	0.009	<0.005	0.006	0.011
Silver, Total	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.010
Thallium, Total	mg/L	<0.002	0.003	0.004	<0.002	0.002	0.007	<0.002	0.003	0.007
Zinc, Total	mg/L	0.006	0.013	0.018	0.010	0.014	0.025	0.009	0.011	0.016

*EPA Method 245.7

Table 12. Summary of water sampling analysis results for chlorophyll, nitrogen, and phosphorus for the 2010 macroinvertebrate plate deployment and retrieval events for each station (N=6). Samples were collected from a depth of 5 feet.

	Station 1			Station 9			Station 18		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Chlorophyll A, Spectro, Corrected (μg/L)	7.03	13.91	17.27	5.83	11.07	14.35	5.98	9.81	12.48
Nitrogen, Nitrite + Nitrate	0.02	0.14	0.40	<0.01	0.15	0.44	0.02	0.15	0.41
Ortho-Phosphate, Total (mg/L)	0.03	0.05	0.14	0.02	0.05	0.14	0.02	0.06	0.14
Phosphorus, Total (mg/L)	0.04	0.09	0.20	0.04	0.07	0.14	0.04	0.07	0.14

Table 13. Summary of water sampling analysis results for chlorophyll, nitrogen, and phosphorus for the 2011 macroinvertebrate plate deployment and retrieval events for each station (N=6). Samples were collected from a depth of 5 feet.

	Station 1			Station 9			Station 18		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Chlorophyll A, Spectro, Corrected (μg/L)	13.61	18.23	24.78	12.16	18.15	23.03	4.63	12.99	21.23
Nitrogen, Nitrite + Nitrate	<0.01	0.07	0.19	<0.01	0.07	0.21	<0.01	0.07	0.20
Ortho-Phosphate, Total (mg/L)	0.03	0.04	0.07	0.02	0.04	0.05	0.03	0.04	0.05
Phosphorus, Total (mg/L)	0.04	0.06	0.10	0.04	0.06	0.08	0.04	0.05	0.06

Table 14 summarizes the water quality profile data measured during the adult fish collection events. For the adult fish profiles, both dissolved oxygen and conductivity had similar readings during each measurement date and zone, except for the mixing zone and downstream zone in the fall. Average dissolved oxygen concentrations decreased slightly from the spring to the summer months, then increased slightly in the fall months at the upstream zone. The mixing zone and downstream dissolved oxygen concentrations showed decreases in the fall, which is likely due to the effects of the salinity changes. Conductivity also showed a slight increase with each sampling period, increasing significantly in the mixing zone and downstream zone during the fall season. This increase in conductivity is consistent with other measurements taken during the fall and indicates the presence of a saltwater wedge in the study area.

Both sets of water quality parameters were not observed to significantly increase or decrease when compared to the upstream zone, except for the mixing zone and downstream zone in the fall. For the adult fish water quality profiles, the results indicate that dissolved oxygen and conductivity should not affect adult fish populations between zones, except for the mixing zone and downstream zone in the fall.

Table 14. Summary of water quality profile data measured during the adult fish collection events in 2010. Profiles were performed at the deepest point near each sampling zone. Measurements were taken at 0, 1, 3, 5, 10, 15, 20, 25, and 30 ft depths, continuing in 10 ft intervals, if necessary.

2010	Parameters	Upstream			Mixing Zone			Downstream		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
June 7	Temperature (°F)	82.0	82.6	82.8	83.1	83.9	84.2	83.7	83.9	84.0
	Dissolved oxygen (mg/L)	7.10	7.10	7.10	7.00	7.00	7.10	7.00	7.10	7.10
	Conductivity (µS/cm)	129	129	130	132	133	133	133	134	134
Aug. 23	Temperature (°F)	89.4	90.0	90.3	89.8	92.9	97.0	89.2	92.2	95.5
	Dissolved oxygen (mg/L)	6.40	6.50	6.70	5.80	6.10	6.40	5.20	5.60	6.10
	Conductivity (µS/cm)	205	205	206	215	219	225	220	222	223
Oct. 19	Temperature (°F)	73.8	74.2	74.5	75.1	76.8	80.2	75.0	75.5	75.7
	Dissolved oxygen (mg/L)	6.80	7.10	7.30	2.60	5.20	6.80	2.40	5.40	6.80
	Conductivity (µS/cm)	307	309	312	368	5,738	15,880	715	6,255	19,580

3.5. Thermal Modeling

The EFDC thermal model was developed using flow, stage, and water temperature monitoring data. The model also used extensive bathymetry data and meteorological data. The Barry thermal model was calibrated based on a measurement period from August 1 to September 16 in 2010, and from April 26 to August 29 in 2011. Plant Barry is situated on the Mobile River between the Alabama–Tombigbee confluence and Mobile Bay.

The final model grid contains 2,881 horizontal grids and six vertical layers. There were more than 100,000 temperature measurements collected from APC temperature monitoring and USGS stream measurements used in the model calibration.

Approximately 50,000 water level measurements were collected for use in the model calibration. Approximately 400 flow measurements using ADCP methods were collected and used in the model calibration. The calibration results for stage or water level, river flows, and water temperature were completed and the report is presented in Appendix E. The results indicate this initial model can predict water level and flow with reasonable accuracy.

The thermal component of the modeling effort was calibrated using stationary continuous monitors and a series of vertical profiles. For the 2011 model simulations, the root-mean-square errors (RMSEs) comparing modeled and observed water temperatures at the intake canal (middle depth) for units 1–3 and units 4–5 were 0.32 °C and 0.29 °C. The RMSEs for four mixing zone stations ranged from 0.76 °C to 1.07 °C.

The primary factors affecting the thermal loading to the Mobile River in the vicinity of Plant Barry are the season, plant load, and tidal fluctuation or river flow.

3.6. Biothermal Modeling

The biothermal modeling analyses implemented as a GAM assessed if water temperature had a significant effect on the biological endpoints after adjusting for the environmental variables. The GAM approach was chosen because it is capable of constructing a multiple variable prediction equation that combines both continuous (temperature, conductivity, sediment weight, LOI) and categorical (season, station group, year) variables. The GAM can also represent the continuous variables in curvilinear functions to quantify the relationships between dependent and independent variables and are best assessed through graphics. In addition to the GAM, an added variable plot is then used to assess the relationship of each biological endpoint to temperature after adjusting for other factors in the model. Finally, a series of traditional ANOVA and ANCOVA tests were performed to evaluate the differences in the biological endpoints by station group and season with and without the environmental variables to address effects from a spatial perspective.

The biological endpoints (dependent variables) or metrics used to evaluate the macroinvertebrate community include:

- Total number of individuals,
- Total number of taxa,
- Total number of EPT taxa,
- Shannon-Weaver diversity index,
- Evenness, and
- HBI.

The environmental variables considered in the model in addition to water temperature include:

- Conductivity,
- Sediment weight,
- LOI,
- River mile,
- Season, and
- Year.

Another environmental variable is DO; however, it was not considered because of data reliability issues and the concentrations were sufficient to not result in stress on the macroinvertebrate individuals (Nebeker, 1972).

Table 15 shows the results from the GAM for number of taxa. Reviewing the results for number of taxa (number of taxa, log transformed), it seems that all variables except season, year and percent organic (LOI) are important predictors in determining the number of taxa. The summer temperature trend has slightly better significance (p=0.03) when a logarithm transformation is used than when no transformation is applied (p=0.11), confirming a more powerful analysis. The important predictors identified, in addition to water temperature, include station river mile, specific conductivity, and sediment weight.

Table 15. Number of taxa (dependent variable log transformed) ANOVA results from GAM approach. A p-value less than 0.05 indicates a significant difference in the multiple variable equation.

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	1.5647	0.2099
	as.factor(Year)	1	0.1530	0.6958
	RiverMile	1	32.0673	<0.0001
	as.factor(Season):RiverMile	2	11.1209	<0.0001
smoothed terms	s(Sp. Conductivity)	7.92	12.2403	<0.0001
	s(LOI)	1	1.9239	0.1659
	s(Sediment weight)	8.9	18.6744	<0.0001
	s(Spring temperature)	1.00	114.1486	<0.0001
	s(Summer temperature)	1.08	4.5288	0.0291
	s(Fall temperature)	1.92	8.3880	0.0003

r-square (adjusted) = 0.7015
sample size = 714

Figure 27 shows the GAM curvilinear model results for number of taxa. Although the number of taxa tends to decrease with increasing temperature, this trend occurs even when the increase in temperature is due to changing season rather than caused by the thermal discharge. For example, the spring season had the lowest water temperature of the study, but still followed this trend. Fall tends to have fewer taxa than spring even when temperature is similar as shown by the spring and fall of 2011 data; this seasonal difference is likely due to normal life history changes in the macroinvertebrate population. Summer tends to be warmer and have fewer taxa than spring or fall. The trend line for summer shows that there is a slight decrease in taxa with increasing temperature from 1.0 to 0.9 taxa in the logarithmic scale which corresponds to a change from 10 to 7.9 in the original count of taxa scale. In spring and fall, the two years have different temperatures ($p<0.05$, Table 15), thus it is difficult to separate the temperature trend from a year effect. However, temperature effect for these seasons seems unlikely because the maximum temperature is less than what would be expected to cause temperature stress on the macroinvertebrate community.

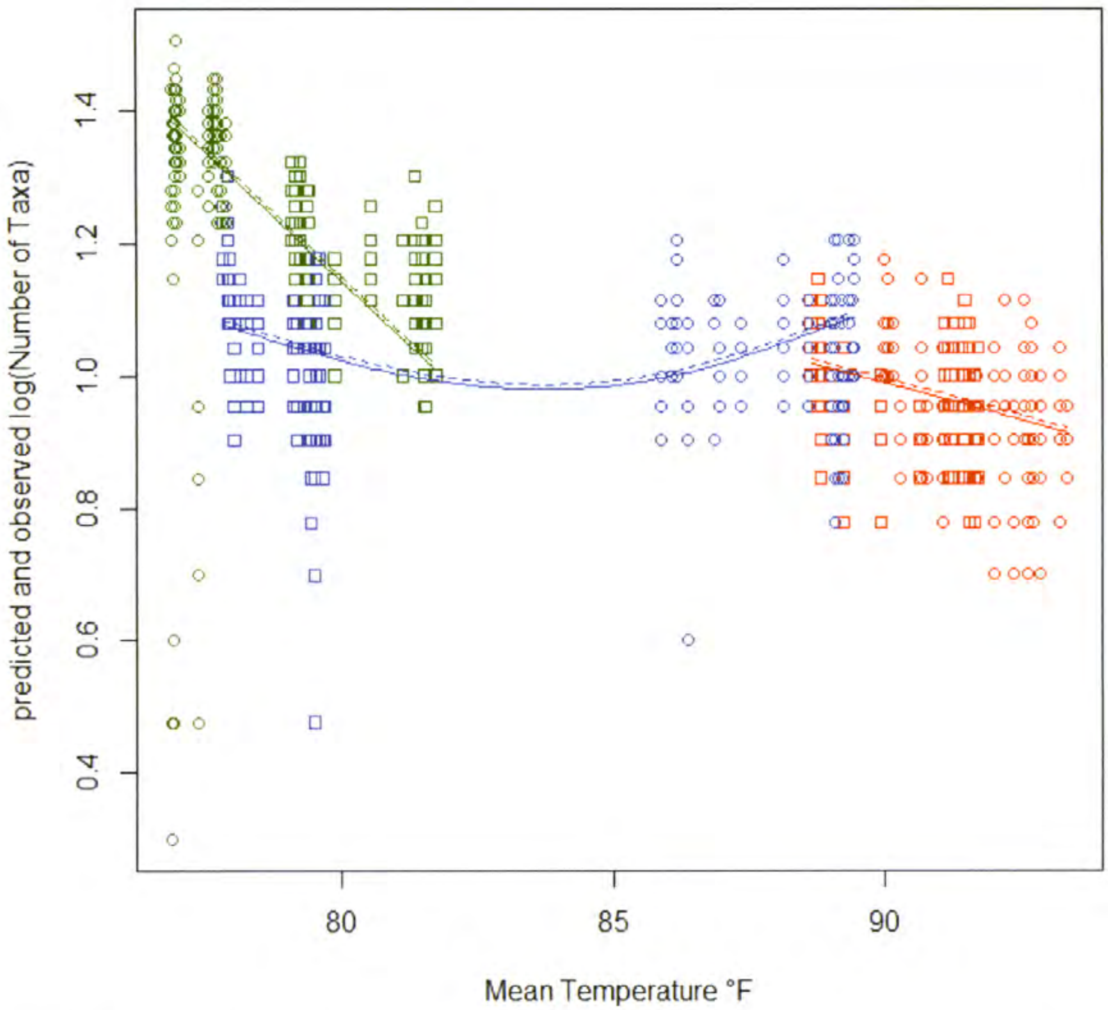

Figure 27. Number of taxa GAM curvilinear plot, where lines indicate predicted values (solid for 2010, dashed for 2011) and points indicate observed values (green for spring, red for summer, blue for fall; circles for 2010, boxes for 2011).

The added variable plot (Figure 28) is for summer data only and shows that when adjusting for other factors in the model, loss of taxa as a result of increased temperature is *de minimis*. From the minimum to the maximum value of adjusted temperature (temperature residual), there is less than a 0.1 change on the log(number of taxa) scale which corresponds to 1.26 in the number of taxa. The fact that the predicted change in the added variable plots (Figure 28) of 1.26 taxa is somewhat less than the predicted change from the GAM (Figure 27) of 2.1 taxa implies that some of the effect being shown as temperature effect by the GAM is in fact due to the other covariates that are confounded with temperature. In the added variable plot, these confounded effects are being removed by the adjustment process. It is also apparent (Figure 28) that the largest part of this change in number of taxa occurs only at the very highest values of adjusted temperature which was an ephemeral event at one station group.

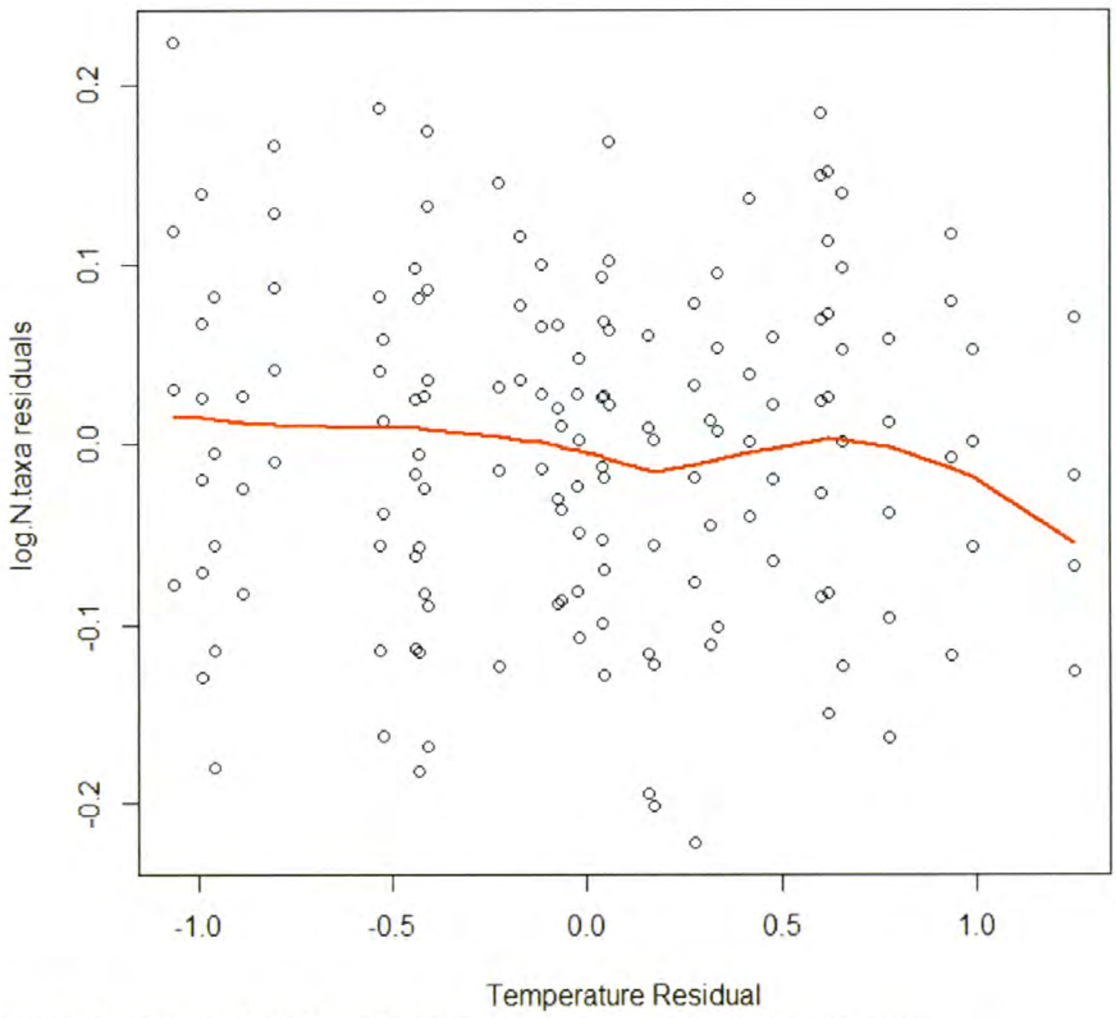

Figure 28. Number of taxa (log transformed) added variable plot for summer season.

Table 16 shows the results from the GAM for number of macroinvertebrate individuals. For total abundance (log transformed), conductivity and sediment weight appear to be the important predictive variables. River mile by season interaction is also significant. For all seasons, temperature is an important predictor, although the effect appears smallest in summer which can be inferred because summer temperature has the smallest F-value of the seasonal temperatures.

Table 16. Total abundance (log transformed) ANOVA results from GAM approach. A p-value less than 0.05 indicates a significant difference in the multiple variable equation.

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	2.5475	0.079
	as.factor(Year)	1	0.3615	0.5479
	RiverMile	1	1.1898	0.2758
	as.factor(Season):RiverMile	2	5.9987	0.0026
smoothed terms	s(Sp. Conductivity)	8.57	9.0337	<0.0001
	s(LOI)	3.67	1.6454	0.1511
	s(Sediment weight)	8.96	14.6762	<0.0001
	s(Spring temperature)	3.71	17.1536	<0.0001
	s(Summer temperature)	3.74	3.2812	0.0118
	s(Fall temperature)	1.83	18.8298	<0.0001

r-square (adjusted) = 0.6902
sample size = 714

The predicted values for summer indicate a reduction in total abundance at only the very highest temperatures in the summer as described in Figure 29. The trend of total abundance with temperature in the fall indicates a steady or an increase in numbers. As with number of taxa, the number of individuals in the spring shows a decrease despite the coolest water temperatures (<82 °F) of the study.

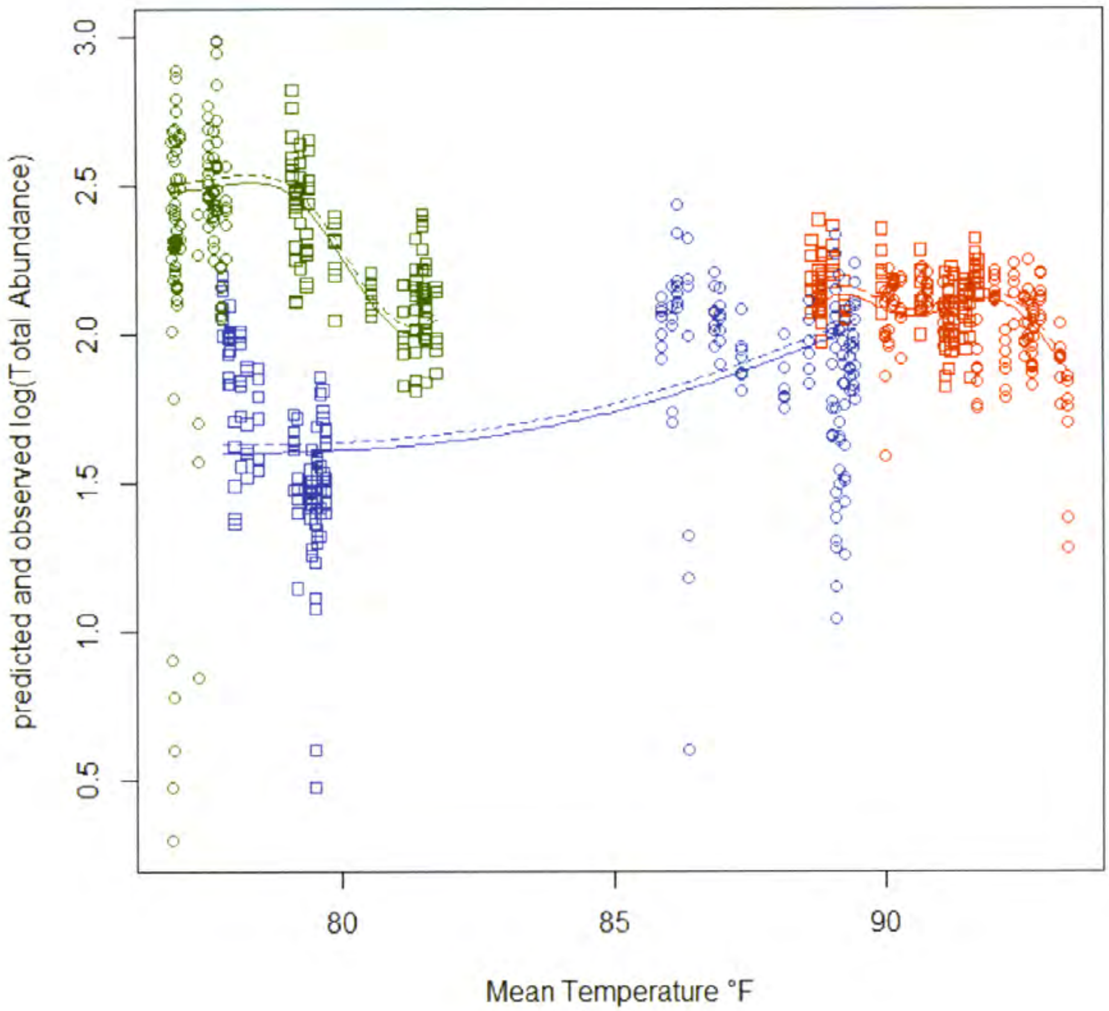

Figure 29. Total abundance GAM curvilinear plot, where lines indicate predicted values (solid for 2010, dashed for 2011) and points indicate observed values (green for spring, red for summer, blue for fall; circles for 2010, boxes for 2011).

The fact that the added variable plot does not show the drop off in abundance at the maximum temperatures suggests that one of the independent variables in the model might be explaining the apparent temperature effect (Figure 30). Of the environmental variables, conductivity and sediment weight are statistically significant and more likely to be causal factors.

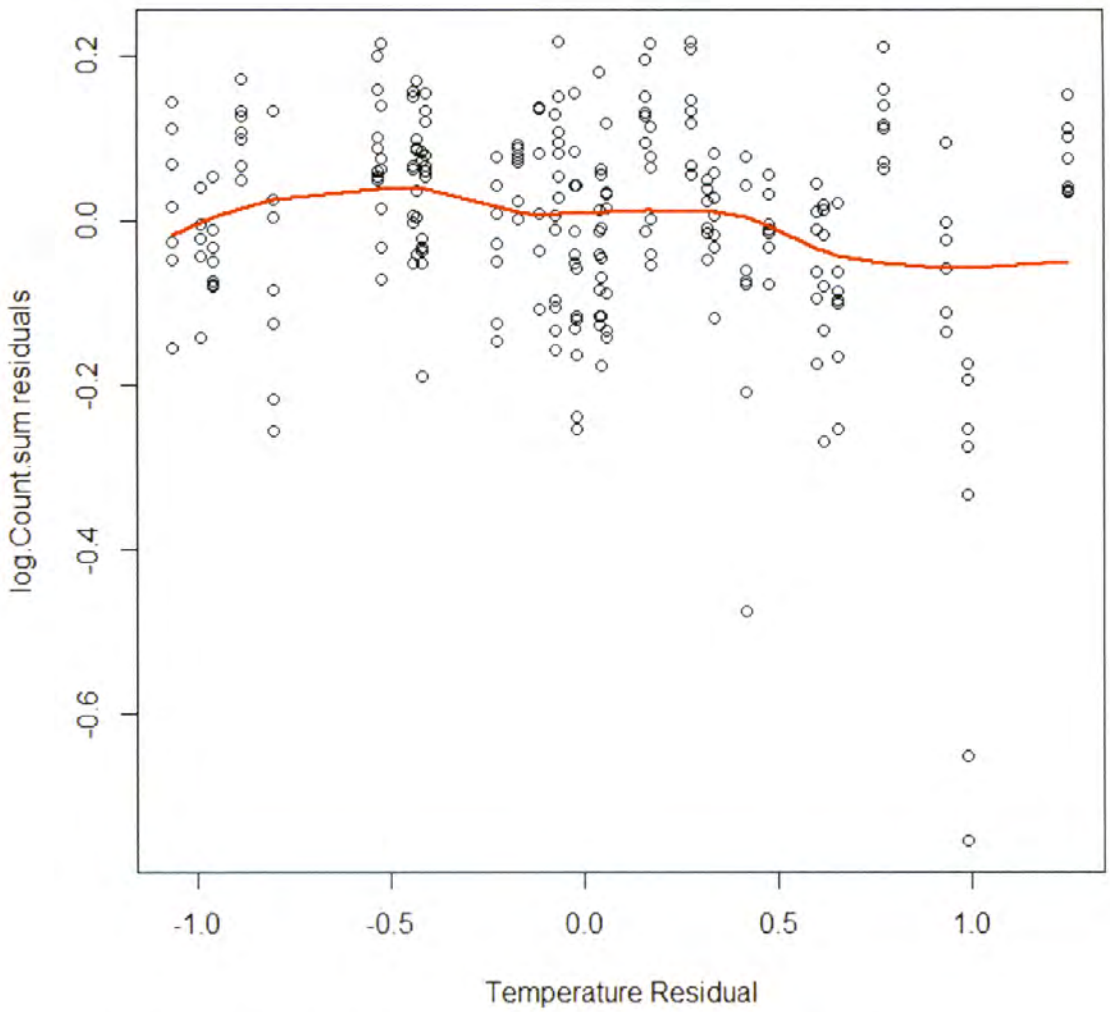

Figure 30. Total abundance (log transformed) added variable plot for summer season.

Table 17 shows the results from the GAM for number of EPT taxa. All factors except year, season, and summer temperature are significant for the number of EPT taxa model.

Table 17. Number of EPT taxa (log transformed) ANOVA results from GAM approach. A p-value less than 0.05 indicates a significant difference in the multiple variable equation.

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	2.0451	0.1302
	as.factor(Year)	1	0.6848	0.4082
	RiverMile	1	4.7546	0.0296
	as.factor(Season):RiverMile	2	4.6157	0.0102
smoothed terms	s(Sp. Conductivity)	7.34	8.0646	<0.0001
	s(LOI)	8.8	3.3814	0.0005
	s(Sediment weight)	8.85	10.222	<0.0001
	s(Spring temperature)	3.68	36.227	<0.0001
	s(Summer temperature)	1	1.8157	0.1783
	s(Fall temperature)	1.81	9.8778	<0.0001

r-square (adjusted) = 0.7791
sample size = 714

Figure 31 describes the curvilinear GAM results for number of EPT taxa. Predicted values for EPT taxa show generally decreasing trend with increasing temperature. Both the warmer summer and fall seasons indicate a slightly decreasing trend in number of EPT taxa.

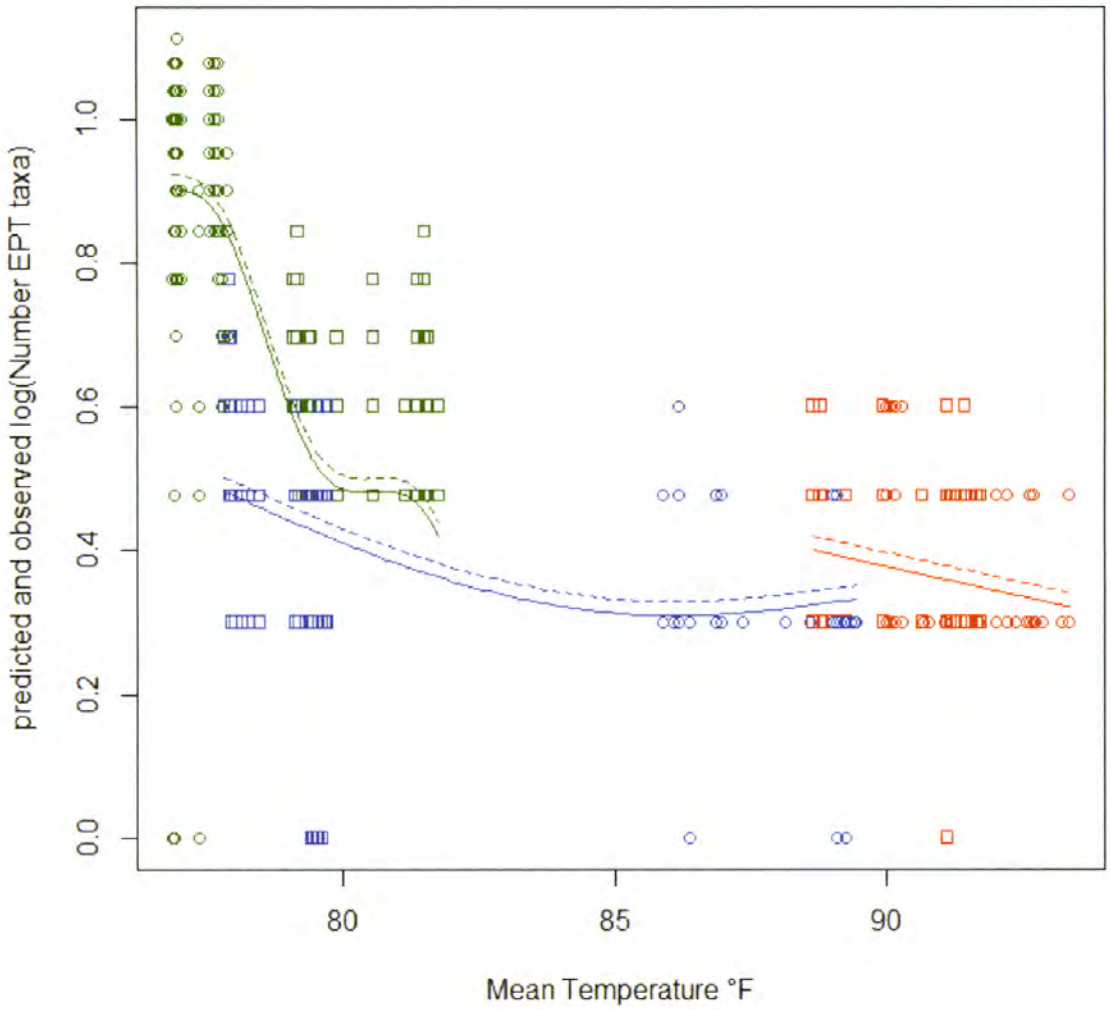

Figure 31. Number of EPT taxa GAM curvilinear plot, where lines indicate predicted values (solid for 2010, dashed for 2011) and points indicate observed values (green for spring, red for summer, blue for fall; circles for 2010, boxes for 2011).

The added variable plot in Figure 32 shows only a slight decreasing trend of EPT taxa with increasing temperature in summer. This trend of decreasing EPT taxa is not significant for summer water temperature. The other biological endpoints (SWDI, evenness and HBI), as with number of EPT taxa, did not indicate a significant change with water temperature in summer and are included in the Appendix C.

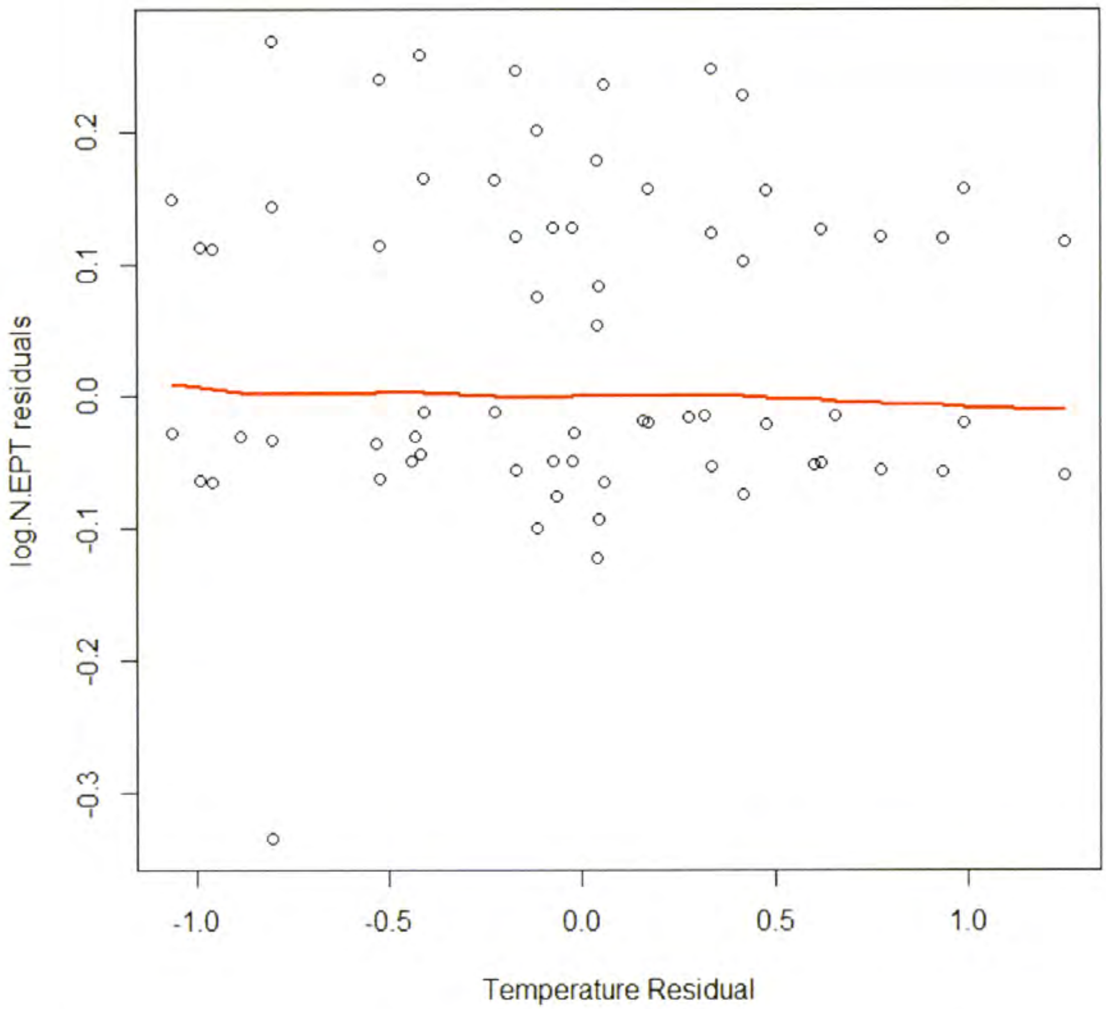

Figure 32. Number of EPT taxa (log transformed) added variable plot for summer season.

Overall, the GAM and added variable plot results showed that environmental variables other than water temperature, namely conductivity and sedimentation, have a greater effect on the biological endpoints. By adjusting for these confounding environmental variables, the effect of water temperature on the macroinvertebrate community is minimal and ephemeral.

Additional statistical tests performed were a simple two-way ANOVA and an ANCOVA. The ANOVA used season and zones as grouping variables, but year was not included because previous testing showed no difference in all the metrics between 2010 and 2011. By combining years, greater statistical power is created for the season and station group comparison analyses. Tables 18 and 19 show the ANOVA results by season for comparing both mixing zone and downstream zone to the upstream control. Among SWDI, evenness, and HBI, there are statistically significant differences that occur, but all are 10 percent or less between the means, indicating there are no biologically meaningful differences. These include a decrease in SWDI and evenness in summer at the mixing zone and a decrease in SWDI in the fall at the downstream zone. For the number of individuals, there is a decrease in the fall in the mixing zone and downstream station groups by 35 and 59 percent, respectively. Also, the number of individuals decreased in the summer at the downstream zone by 24 percent. For number of taxa, the mixing zone decreased by 13 percent in the summer and the downstream zone decreased by 23 percent in the fall. For number of EPT taxa, there were decreases in the fall at both the mixing zone and downstream station groups by 16 and 38 percent, respectively. There were only three occurrences with differences greater than 25 percent among all of the macroinvertebrate metrics and seasons. These differences occurred in the fall, with two at the downstream station group and one at the mixing zone, suggesting that variables other than water temperature, such as salinity, are likely causal factors.

In contrast, several metrics showed positive or statistically significant increases at both the mixing zone and downstream compared to the upstream control. SWDI showed a significant increase in spring at both mixing zone and downstream station groups. Evenness showed an increase in spring at the mixing zone and again in the fall at the downstream zone. HBI showed a small yet significant decrease, where decrease represents improvement, for all seasons in the mixing zone and two of the seasons (spring and fall) at the downstream zone. There was a significant increase in number of taxa in the spring at the downstream station group by 11.8 percent. In addition, the number of EPT taxa increased in the spring at the downstream station group by 25.5 percent.

Table 18. Upstream control versus mixing zone summary of ANOVA results.

Variable	Season	Upstream Mean	Mixing Zone Mean	Difference	p-value	Percent Difference
Number of taxa(log)	Spring	1.2220	1.2154	-0.0065	0.7355	-1.5
Number of taxa(log)	Summer	0.9752	0.9147	-0.0605	0.0013	-13.0*
Number of taxa(log)	Fall	1.0590	1.0252	-0.0338	0.0704	-7.5
Number of individuals(log)	Spring	2.3170	2.2432	-0.0738	0.0767	-15.6
Number of individuals(log)	Summer	2.1262	2.0512	-0.0750	0.0624	-15.9
Number of individuals(log)	Fall	1.9087	1.7222	-0.1865	<0.0001	-34.9*
Number of EPT taxa(log)	Spring	0.7122	0.7514	0.0392	0.0924	9.5
Number of EPT taxa(log)	Summer	0.3646	0.3329	-0.0318	0.1584	-7.1
Number of EPT taxa(log)	Fall	0.4181	0.3406	-0.0776	0.0006	-16.4*
SWDI	Spring	0.8329	0.8874	0.0544	0.0023	6.5
SWDI	Summer	0.6893	0.6196	-0.0697	0.0001	-10.1*
SWDI	Fall	0.7627	0.7566	-0.0061	0.7235	-0.8
Evenness	Spring	0.7074	0.7527	0.0453	0.0001	6.4
Evenness	Summer	0.7479	0.7246	-0.0234	0.0365	-3.1*
Evenness	Fall	0.7517	0.7709	0.0192	0.0858	2.6
HBI**	Spring	6.9690	6.8217	-0.1473	0.0006	-2.1
HBI**	Summer	7.1326	6.9871	-0.1454	0.0004	-2.0
HBI**	Fall	6.9450	6.8611	-0.0839	0.0403	-1.2

*Statistically significant decrease (p<0.05) from upstream

**HBI decrease represents improvement

Table 19. Upstream control versus downstream summary of ANOVA results.

Variable	Season	Upstream Mean	Downstream Mean	Difference	p-value	Percent Difference
Number of taxa(log)	Spring	1.2220	1.2705	0.0486	0.0478	11.8
Number of taxa(log)	Summer	0.9752	0.9733	-0.0019	0.935	-0.4
Number of taxa(log)	Fall	1.0590	0.9456	-0.1134	<0.0001	-23.0*
Number of individuals(log)	Spring	2.3170	2.3307	0.0137	0.7949	3.2
Number of individuals(log)	Summer	2.1262	2.0064	-0.1198	0.0152	-24.1*
Number of individuals(log)	Fall	1.9087	1.5241	-0.3846	<0.0001	-58.8*
Number of EPT taxa(log)	Spring	0.7122	0.8110	0.0988	0.0009	25.6
Number of EPT taxa(log)	Summer	0.3646	0.3406	-0.0241	0.383	-5.4
Number of EPT taxa(log)	Fall	0.4181	0.2110	-0.2072	<0.0001	-37.9*
SWDI	Spring	0.8329	0.9014	0.0685	0.0025	8.2
SWDI	Summer	0.6893	0.6934	0.0041	0.8445	0.6
SWDI	Fall	0.7627	0.6980	-0.0647	0.0022	-8.5*
Evenness	Spring	0.7074	0.7266	0.0192	0.1896	2.7
Evenness	Summer	0.7479	0.7523	0.0044	0.7482	0.6
Evenness	Fall	0.7517	0.7993	0.0476	0.0005	6.3
HBI**	Spring	6.9690	6.8106	-0.1584	0.0034	-2.3
HBI**	Summer	7.1326	7.0457	-0.0869	0.0828	-1.2
HBI**	Fall	6.9450	6.7192	-0.2258	<0.0001	-3.3

*Statistically significant decrease (p<0.05) from upstream

**HBI decrease represents improvement

The ANCOVA results indicated differences between the heat-unaffected area and heat-affected area, including the mixing zone and the downstream zone. In an effort to determine if there was recovery, APC compared the upstream zone with the mixing zone (Table 20) and with the downstream zone (Table 21). The ANCOVA model includes the significant environmental variables and adjusts for those effects on the biological endpoints for each of the zones.

Among SWDI, evenness and HBI, only a significant decrease in SWDI in the summer at the mixing zone remained after adjusting for environmental covariates. The fall decrease in SWDI at the downstream zone and the evenness in the summer at the mixing zone are no longer significant when compared to the ANOVA results. Although for the number of individuals the ANCOVA results now show all seasons in the mixing zone as a significant decrease from the upstream control; however, the magnitude of the decrease at the downstream zone was lower, and the fall season is no longer a significant difference from the upstream control. For the number of taxa, the significant decrease at the mixing zone in the summer remained; however, the downstream station group in the fall no longer shows a significant decrease. For the number of EPT taxa, the significant decrease still persists in the fall at the mixing zone, but the downstream station group in the fall no longer shows a significant decrease.

As with the ANOVA results, these ANCOVA results also demonstrated metrics showing positive or significant increases in both the mixing zone and downstream zone compared to the upstream control. SWDI continued to show a significant increase in spring at both the mixing zone and downstream station groups. Evenness continued to show an increase in spring at the mixing zone, but the increase in fall at the downstream zone became not significant while the spring increase became significant after adjusting for covariates. The HBI continued to show an improving response (decrease) with only statistically significant differences in the spring and summer at the mixing zone and spring at the downstream zone. The significant increase in the number of taxa in the spring at the downstream zone is no longer apparent, although the number of EPT taxa still showed an increase in the spring at the downstream zone. The complete set of ANOVA and ANCOVA analyses are included in Appendix C.

Table 20. Upstream Control vs. Mixing Zone summary of ANCOVA results.

Variable	Season	Upstream Mean	Mixing Zone Mean	Difference	p-value	Percent Difference
Number of taxa(log)	Spring	1.2023	1.1845	-0.0177	0.3786	-4.0
Number of taxa(log)	Summer	0.9747	0.9090	-0.0657	0.0005	-14.0*
Number of taxa(log)	Fall	1.0485	1.0407	-0.0078	0.7199	-1.8
Number of individuals(log)	Spring	2.3157	2.1853	-0.1305	0.0022	-26.0*
Number of individuals(log)	Summer	2.0760	1.9784	-0.0976	0.0132	-20.1*
Number of individuals(log)	Fall	1.8972	1.8014	-0.0958	0.037	-19.8*
Number of EPT taxa(log)	Spring	0.6950	0.7137	0.0187	0.4378	4.4
Number of EPT taxa(log)	Summer	0.3790	0.3374	-0.0416	0.063	-9.1
Number of EPT taxa(log)	Fall	0.4028	0.3355	-0.0673	0.01	-14.4*
SWDI	Spring	0.8318	0.8766	0.0449	0.0171	5.4
SWDI	Summer	0.6901	0.6162	-0.0739	<0.0001	-10.7*
SWDI	Fall	0.7589	0.7578	-0.0010	0.9593	-0.1
Evenness	Spring	0.7161	0.7712	0.0550	<0.0001	7.7
Evenness	Summer	0.7481	0.7292	-0.0189	0.0889	-2.5
Evenness	Fall	0.7580	0.7633	0.0053	0.6855	0.7
HBI**	Spring	6.9832	6.8205	-0.1627	0.0003	-2.3
HBI**	Summer	7.0992	6.9481	-0.1511	0.0002	-2.1
HBI**	Fall	6.9501	6.8994	-0.0507	0.2902	-0.7

*Statistically significant decrease (p<0.05) from upstream

**HBI decrease represents improvement

Table 21. Upstream Control vs Downstream summary of ANCOVA results.

Variable	Season	Upstream Mean	Downstream Mean	Difference	p-value	Percent Difference
Number of taxa(log)	Spring	1.2023	1.2395	0.0372	0.1502	8.9
Number of taxa(log)	Summer	0.9747	0.9829	0.0082	0.7182	1.9
Number of taxa(log)	Fall	1.0485	1.0586	0.01	0.7993	2.3
Number of individuals(log)	Spring	2.3157	2.2401	-0.0757	0.1651	-16.0
Number of individuals(log)	Summer	2.076	1.9744	-0.1016	0.0342	-20.9*
Number of individuals(log)	Fall	1.8972	1.8517	-0.0455	0.5831	-10.0
Number of EPT taxa(log)	Spring	0.695	0.774	0.079	0.0109	20.0
Number of EPT taxa(log)	Summer	0.379	0.3715	-0.0075	0.7834	-1.7
Number of EPT taxa(log)	Fall	0.4028	0.3159	-0.0869	0.0655	-18.1
SWDI	Spring	0.8318	0.8881	0.0563	0.0196	6.8
SWDI	Summer	0.6901	0.6992	0.0091	0.6679	1.3
SWDI	Fall	0.7589	0.7356	-0.0233	0.5253	-3.1
Evenness	Spring	0.7161	0.7467	0.0306	0.0479	4.3
Evenness	Summer	0.7481	0.7458	-0.0024	0.8611	-0.3
Evenness	Fall	0.758	0.7316	-0.0265	0.2597	-3.5
HBI**	Spring	6.9832	6.7913	-0.1919	0.0008	-2.8
HBI**	Summer	7.0992	7.0104	-0.0887	0.0766	-1.3
HBI**	Fall	6.9501	6.801	-0.1491	0.0853	-2.2

*Statistically significant decrease ($p<0.05$) from upstream

**HBI decrease represents improvement

The analysis separated the mixing zone, which is in the immediate area of the thermal discharge, from the downstream zone to determine whether there was recovery.

At the downstream zone, only one of the 18 metrics (6 metrics × 3 seasons) showed a significant decrease (Table 22). These results show, at most, only a minor impact to the macroinvertebrate community, which is indicative of no appreciable harm to the BIP of shellfish, fish, and wildlife in and around the Mobile River near Plant Barry.

4. DISCUSSION

The overall weight of evidence from the results of the macroinvertebrate and adult fish community evaluations in both the heat-affected (mixing zone and downstream) and heat-unaffected (upstream) areas of the Mobile River show that a BIP has been maintained for the Mobile River in the vicinity of Plant Barry. Overall, the adult fish results using the number of species, CPUE, relative abundance, and trophic diversity show no differences in the heat-affected areas when compared to the heat-unaffected areas, indicating no appreciable harm to the BIP of adult fish. Likewise, the macroinvertebrate results indicating minimal differences in the heat-affected area compared to the heat-unaffected area, again indicating no appreciable harm to the BIP of adult fish.

4.1. Macroinvertebrates

Results of the macroinvertebrate study performed in 2010 and 2011 show that the thermal discharge from Plant Barry has caused no appreciable harm to the BIP of shellfish, fish, and wildlife, as indicated by the overall condition of the macroinvertebrate community in the Mobile River, as outlined in the sections below. Macroinvertebrates from the heat-affected areas of the river were diverse, sustained through cyclic seasonal changes, sufficient in numbers to support the food chain, and not dominated by pollution-tolerant species, when compared to heat-unaffected areas of the river. There was no evidence of diminishing indigenous macroinvertebrate populations. Finally, water quality of the Mobile River in the vicinity of Plant Barry was typical for operations under the present thermal variance.

4.1.1. Macroinvertebrates: Diversity

Diversity was evaluated by number of taxa or species richness, Shannon-Weaver diversity index, and evenness of the biological community. The simplest measure of diversity is the species richness. A 24 percent decrease in the average number of macroinvertebrate taxa from the upstream to mixing zone stations for the summer deployment occurred; however, recovery occurred in the downstream station group to numbers consistent with the upstream control (Figure 13). The spring and fall seasons during 2011, a time period where average water temperatures were relatively low, show a decrease in number of macroinvertebrate taxa collected between the heat-unaffected and heat-affected stations (Figures 5 and 14). The much warmer summer season in 2011 showed similar numbers of taxa between station groups. The difference in the number of taxa in spring 2011 may be due to the normal lifecycle and different stages of development through the 15-mile study area. In the fall of 2011, it is evident that the reduction in taxa is due to the changing water quality affecting the heat-affected stations only. The more robust measure of diversity, the Shannon-Weaver diversity index, indicates that the macroinvertebrate community was comparably diverse throughout the study area, with only a small reduction in the summer of 2010 at the mixing zone, with subsequent recovery at the downstream station group (Figure 17). Similarly, evenness values indicate a moderately diverse community throughout the study area, with no discernible negative effect due to the thermal discharge from Plant Barry (Figures 19 and 20). The biothermal modeling, given consideration for confounding factors such as conductivity and sedimentation, shows a temperature effect only on number of taxa in the mixing zone during the summer, with no difference in the downstream station group compared to the upstream control. In fact, the Shannon-Weaver diversity index and evenness metrics both showed a positive response in the spring at the downstream station group with no other differences for summer and fall. Therefore, these diversity metrics indicate that the macroinvertebrates were diverse throughout the heat-affected areas of the river.

4.1.2. Macroinvertebrates: Cyclic Seasonal Changes

The number of individuals collected at each station group by season can be used to evaluate cyclical seasonal changes in the macroinvertebrate population. At first glance, a decrease in the number of individuals from upstream to downstream zones for both summer deployments in 2010 and 2011 might indicate a negative response in the thermally affected areas. However, the most heat-affected station group, the mixing zone, showed no significant decrease during both years (Figures 11 and 12). The spring season actually showed an improved difference in number of individuals in 2010, while the collection in 2011 did not show any differences. The differences seen in the fall seasons of both 2010 and 2011 are likely affected by the saltwater wedge due to decreases in macroinvertebrate individuals intolerant to elevated salinity. It is difficult to compare seasonal differences in macroinvertebrate populations due to life history changes, which are also seasonal. Given that the thermal discharge variance has been in effect prior to 2010, the higher density during the spring and summer compared to the fall indicate that the normal cyclic seasonal changes did occur. Also, the numbers of macroinvertebrate individuals in 2011 are similar by season to 2010, indicating normal cyclic seasonal changes did occur. An evaluation of the majority of the remaining metrics reveals that the same general cyclical seasonal pattern exhibited at the upstream station group was not only repeated at the mixing zone and downstream zones, but a similar seasonal pattern in 2010 was repeated in 2011. The biothermal modeling analyses showed comparable results, that is, there was no difference between years for each of the seasons indicating that 2011 was similar to 2010. Therefore, based on the majority of metrics evaluated, the Mobile River in the vicinity of Plant Barry demonstrated sustainability of the macroinvertebrate community through seasonal changes.

4.1.3. Macroinvertebrates: Presence of Food Chain Species

Based on diversity and seasonal sustainability, the macroinvertebrate community was present in sufficient numbers to support the food chain in the Mobile River near Plant Barry. There was no evidence that higher trophic levels were impacted from changes in the macroinvertebrate community in the heat-affected areas of the river. Therefore, the macroinvertebrate population in the study area was sufficiently present as a necessary food chain component.

4.1.4. Macroinvertebrates: Pollution-Tolerant Species

EPT, relative abundance and HBI metrics were used to assess substantial increases or dominance of pollution-tolerant species within the macroinvertebrate community. Based on EPT taxa, there was no significant difference in number of EPT taxa between the heat-affected and heat-unaffected station groups on the Mobile River, except for the fall of 2011. As previously discussed, the fall results were likely affected by the saltwater wedge. The increase in salinity will almost certainly cause the more sensitive EPT taxa to decrease in favor of more brackish water–tolerant taxa. Therefore, the 38 and 63 percent reduction in EPT taxa during the fall at the heat-affected mixing zone and downstream station groups is not a result of water temperature. The application of the biothermal modeling results shows that a significant reduction occurs only during the fall in the mixing zone, and that the downstream stations have no apparent change compared to the upstream control. When evaluating relative abundance, the same predominant genera collectively dominated the sample collections consistently throughout the study area (Tables 1 and 2). In fact, the fall seasons showed a unique set of taxa, including *Rhithropanopeus* and *Mytilopsis*, which are tolerant of much higher salinity environments. In addition, the HBI metric (Figures 21 and 22) indicated similar values regardless of station group or season. In fact, the HBI results from the biothermal modeling demonstrate improvement in the spring at both the mixing zone and downstream station groups as well as in the summer at the mixing zone. The HBI values are consistent with an impacted waterbody due to organic pollution, as the Mobile River is a large river system rich in organics and nutrients. Although organic loading is evident, there was no pronounced shift to a more pollution-tolerant community in the vicinity of the thermal discharge. Therefore, based on EPT, relative abundance and HBI values, there has been no substantial increase of pollution tolerant species within the macroinvertebrate community.

4.1.5. Macroinvertebrates: Indigenous Species

The community structure of the macroinvertebrate fauna did not appreciably change during this study from the upstream station group to the heat-affected zones. It cannot be determined whether the taxa collected are not indigenous to the Mobile River basin. Overall, the macroinvertebrate fauna collected from the multiplate samplers were no different in the vicinity of the thermal discharge when compared to the upstream control area (Tables 1 and 2). There was no evidence to suggest that indigenous species are diminishing or being replaced by non-native or exotic species due to effects of the thermal discharge.

4.1.6. Macroinvertebrates: Representative Important Species

An analysis of representative important species for aquatic macroinvertebrates is not applicable.

4.1.7. Macroinvertebrates: Water Quality

Dissolved oxygen and conductivity showed ranges typical of Mobile River warm season conditions. While the macroinvertebrate plate samplers were deployed, they were exposed to temperatures that were relatively cool in the spring, up to the thermal variance limit during the summer and cooler temperatures during the fall (Figures 4 and 5). A marked increase in conductivity was recorded in the mixing zone and downstream stations during the fall of 2010 and 2011 (Tables 6 through 9). These changes in water quality are due to the pronounced tidal influence during extremely low river flow conditions typical in late summer and fall in the Mobile River. The sediment data indicated that the degree and type of sedimentation was similar across station group and season, except for the spring and summer deployments in 2010 (Figures 7 through 10). Dissolved oxygen was similar across station groups. Water quality sampling and monitoring for this study demonstrates typical concentrations and conditions and does not show substantial changes across station group for each season, except conductivity in the fall.

4.2. Adult Fish

Results of the adult fish study performed in 2010 indicate that the thermal discharge from Plant Barry has caused no appreciable harm to the BIP of the adult fish community in the Mobile River, as outlined in the sections below. Adult fish populations from the heat-affected areas of the river were diverse, sustained through cyclic seasonal changes, sufficiently present as a part of the food chain, and not dominated by pollution-tolerant or non-indigenous species. No threatened or endangered species were collected in this study. In addition, representative important species, such as recreational or commercial species, were not appreciably different in heat-affected areas when compared to heat-unaffected areas. Finally, water quality of the Mobile River in the vicinity of Plant Barry was typical for operations under the present thermal variance.

4.2.1. Adult Fish: Diversity

Diversity was evaluated by number of species, relative abundance, and CPUE for the adult fish population. The number of species was similar in the heat-affected areas when compared to the heat-unaffected areas in the spring, summer, and fall (Figure 23). The catch-per-unit effort (CPUE) showed overlapping ranges between sample areas for all seasons (Figure 24). A lower CPUE in the heat-affected areas was observed; however, further review of the data on a zone level shows that this decrease is associated only with the mixing zone and recovery occurs downstream. The dominant species were largely the same between each area, and the number of species was similar in both areas (Tables 3 and 4, Figure 23). The diversity indicators, such as number of species, species composition, and CPUE of the adult fish community, demonstrated no appreciable differences at the heat-affected areas when compared to the heat-unaffected areas.

Therefore, the diversity metrics indicate that the adult fish community was diverse throughout the heat-affected areas in the Mobile River.

4.2.2. Adult Fish: Cyclic Seasonal Changes

The number of species collected was similar from spring through fall (Figure 23). The CPUE across both areas showed an increasing trend from the spring to summer collection and again with the fall showing an increase compared to the summer (Figure 24). In addition, the dominant species did not substantially change from season to season, either in the heat-affected or heat-unaffected areas (Table 4). Therefore, the Mobile River in the vicinity of Plant Barry demonstrates sustainability of the adult fish community through seasonal changes.

4.2.3. Adult Fish: Presence of Food Chain Species

Based on total numbers of species and CPUE numbers across seasons, the adult fish community is present in sufficient numbers to support the food chain of the Mobile River. The evaluation of the trophic level or feeding guild among the collected population indicated that all sampling zones, including the thermal mixing zone, had an equally diverse range of trophic levels (Table 5 and Figure 26). Trophic levels collected included invertivores, piscivores, insectivores, algivore-herbivore-invertivores, and detritivore-algivore-herbivores. Within each season, there was no evidence of appreciable differences in the feeding guild composition of the adult fish community in the heat-affected areas when compared to the heat-unaffected areas. The adult fish population in the study area was sufficiently present with a variety of trophic levels to function as a necessary part of the food chain.

4.2.4. Adult Fish: Pollution-Tolerant Species

There was no change in predominance of species of any type, including pollution-tolerant species, in the heat-affected areas when compared to the heat-unaffected areas. Pollution tolerance classifications were only available for a small fraction of the fish species collected during this study (O'Neil and Shepard 2010). The available data classified the fish collected during this study as either 'tolerant' or no classification determined. Two of the dominant species identified at all zones and seasons, bluegill and gizzard shad (*Dorosoma cepedianum*), are both classified as pollution-tolerant. The other dominant species, Gulf menhaden, silverside shiner, and channel catfish, are not classified as pollution-tolerant species. By using available classification data, no change to a more pollution-tolerant species from heat-unaffected areas to heat-affected areas or across seasons is determinable. However, as additional supporting evidence, the relative abundance (Table 3) and dominant species data (Table 4) were used to show no substantial change in the species composition at the heat-affected areas. Therefore, there was not a shift toward a more pollution-tolerant community in the heat-affected areas of the Mobile River.

4.2.5. Adult Fish: Indigenous Species

Of the 42 species collected, all were classified as indigenous. No exotic species were collected at any zone during any season. Therefore, the Mobile River in the vicinity of Plant Barry was dominated by indigenous adult fish species in both the heat-affected and heat-unaffected areas.

4.2.6. Adult Fish: Representative Important Species

For the purposes of this discussion, fish classified as representative important species are recreationally or commercially important or threatened or endangered species. A significant number of adult fish species collected during this study are considered important for either sportfishing, including largemouth bass (*Micropterus salmoides*), spotted bass (*M. punctulatus*), black crappie (*Pomoxis nigromaculatus*), bluegill, and channel catfish, or commercial fishing, including freshwater drum (*Aplodinotus grunniens*), flathead catfish (*Pylodictis olivaris*), and channel catfish. Most of the sportfishing species were collected from both heat-unaffected and heat-affected areas (Table 3). Of the commercial species, freshwater drum and channel catfish were collected in similar numbers in both sample areas.

From an ADCNR (2008) report, the largemouth bass fishery in the Mobile River upper delta area (from the confluence of the Tombigbee and Alabama rivers downstream to the Interstate-65 bridge) is considered to be stable. This fall 2007 fish sampling by ADCNR included electrofishing data from a group of 10 random sites in the upper delta area. Sites included backwater lakes and main-stem rivers, including sites in the Mobile River upstream and downstream of Plant Barry. Catch rates of age 0+ largemouth bass, an indicator of year-class strength and recruitment, were highly variable annually.

However, from 2002 to 2007, the year-class strength has been above the 14-year historical average for five of the six years. The Mobile River upper delta has been sampled and monitored by ADCNR since 1988.

No federally or state listed species are believed to reside in the immediate vicinity of the thermal discharge. No federally or state listed species were collected during this study. There was one species, striped bass, with a conservation status of "moderate concern", collected in the study area.

4.2.7. Adult Fish: Water Quality

Dissolved oxygen and conductivity showed ranges typical of Mobile River warm season conditions. Adult fish were exposed to temperatures that were relatively cool in the spring and fall and warmer water temperatures in the summer (Figure 4). Dissolved oxygen and conductivity were similar across zones, with the exception of high conductivity measurements in the heat-affected areas in the fall, indicating saltwater encroachment. Water quality monitoring for this study demonstrated typical conditions and did not show substantial changes across zones for each season.

5. CONCLUSIONS

The results of the two-year study in 2010 and 2011 of the macroinvertebrate and a one-year study in 2010 of the adult fish communities demonstrated that the thermal variance issued to Plant Barry continues to assure the protection and propagation of the BIP of the shellfish, fish, and wildlife of the Mobile River. Six of the criteria evaluated in this study were taken from the EPA definition of a BIP and were derived from 40 CFR 125.71 (c). In addition, water quality was evaluated as the seventh criteria.

The macroinvertebrates and adult fish study results were evaluated separately using the EPA criteria for a BIP. The analysis of the study results which supports each of the definition criteria is summarized below:

(1) "a population typically characterized by ***diversity***."

- Macroinvertebrates: Number of taxa, Shannon-Weaver diversity index, and evenness metrics indicated a diverse community throughout the heat-affected areas of the river.
- Adult fish: Number of species, relative abundance, and the Catch Per Unit Effort metric indicated a diverse community throughout the heat-affected areas of the river.

(2) "the capacity to sustain itself through ***cyclic seasonal changes***."

- Macroinvertebrates: Number of individuals and taxa demonstrated no appreciable differences between both heat-affected stations within seasons and between years.
- Adult fish: In general, predominant species relative abundance and CPUE demonstrated little difference between seasons.

(3) "***presence of*** necessary ***food chain species***."

- Macroinvertebrates: Number of individuals demonstrates a population sufficient to support the food chain in the heat-affected areas of the river.
- Adult fish: CPUE and the range of trophic levels demonstrate a population sufficient to support the food chain in heat-affected areas of the river.

(4) "lack of domination of ***pollution-tolerant species***."

- Macroinvertebrates: EPT taxa and HBI did not change appreciably, indicating no change to a pollution-tolerant community in heat-affected areas of the river.
- Adult fish: Predominant species abundance did not change indicating no change to a pollution-tolerant community in heat-affected areas of the river.

(5) "***indigenous species***."

- Macroinvertebrates: No collection of non-indigenous taxa demonstrates a predominantly indigenous population throughout study area.
- Adult fish: No collection of non-indigenous species demonstrates a predominantly indigenous population throughout study area.

(6) "***representative important species*** (ris) identification."

- Macroinvertebrates: No ris are presented in this study.
- Adult fish: Recreational (sportfish) and commercially important species were present in the study area, although no federally or state-listed species were collected in the study area.

(7) ***water quality*** and ***temperature monitoring***

- Macroinvertebrates: Typical concentrations and temperatures for each zone and season, including a substantial increase in conductivity during the fall, affecting heat-affected areas.
- Adult fish: Typical concentrations and temperatures for each zone and season, including a substantial increase in conductivity during the fall, affecting heat-affected areas.

The results and analysis of the macroinvertebrate and adult fish communities should be considered in terms of a BIP as the sum total of these interacting communities associated with the aquatic ecosystem of the Mobile River in the vicinity of Plant Barry. To discern water temperature effects from other environmental variables on the macroinvertebrate community, multivariate statistical analysis was necessary. The results of the analysis revealed the importance of a seasonal saltwater wedge overlapping the heat-affected areas of the river, and the potential of sediment deposition from barge traffic on the macroinvertebrate community. An assessment of significant decrease or difference for a particular metric from the heat-affected zone may not be biologically meaningful. Only one of the 18 seasonal (spring, summer, and fall) metrics for macroinvertebrates suggests a possible effect at the downstream zone as a response to water temperature. As the macroinvertebrate community is generally considered to be more sensitive to thermal changes than the adult fish community, any response in the macroinvertebrates could be considered a conservative indicator of potential effects to the more tolerant and vagile adult fish community. The qualitative assessment of the adult fish metrics indicated similar results between heat-affected and heat-unaffected areas. Therefore, all but one of the metrics for macroinvertebrates (Table 22) and all metrics for the adult fish communities indicate no appreciable changes in the heat-affected areas of the Mobile River. The overall weight of evidence supports the conclusion that the 316(a) variance assures the protection and propagation of the BIP of the Mobile River.

Table 22. Summary of the statistically significant percent reductions of metrics for the macroinvertebrate community using the ANCOVA results which combine 2010 and 2011 for more power, with determinations of non-significant (NS) or significant ($p<0.05$) decreases for means at the downstream station group compared to the upstream control station group.

Community	Metric	Upstream - Downstream (%Δ)		
		Spring	Summer	Fall
Macroinvertebrates	Total (N)	NS	21	NS
	Taxa, genera (N)	NS	NS	NS
	Relative Abundance (%)	NS	NS	NS
	EPT taxa (N)	NS	NS	NS
	SWDI	NS	NS	NS
	Evenness	NS	NS	NS
	HBI	NS	NS	NS

These studies, along with numerous prior studies, have verified, with scientific data, that the macroinvertebrate and adult fish community in the Mobile River in the vicinity of Plant Barry meets the definition of a BIP of shellfish, fish, and wildlife as outlined in 40 CFR 125.71 (c). Therefore, the thermal discharge from Plant Barry has caused no appreciable harm to these biological communities in the Mobile River. ADEM should reissue Plant Barry's 316(a) thermal variance.

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7. APPENDICES

7.1. Appendix A Biological Sampling Data Tables

Macroinvertebrate raw data table for Station 1 during spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	2	4	5	6	8	9	10
Amphipoda	Corophiidae	Gammarus			7				
		Apocorophium	9	13	11	6	7	5	20
	Gammaridae	Gammarus	23	15		10	15	14	7
Coleoptera	Gyrinidae	Dineutus							2
Diptera	Ceratopogonidae	Ceratopogonidae sp.					2		
	Chironomidae	Chironomidae sp.			1				
		Chironomid pupae	1	3		3	2	2	1
		Coelotanypus	2		2	6	3	7	1
		Ablabesmyia	3	6	5	8	4	13	7
		Corynoneura			2				
		Thienemanniella	1	4		1	3	16	
		Nanocladius		3	2			4	1
		Chironomus			3		2		
		Cryptochironomus	1	1	1	1	1	2	5
		Dicrotendipes		2		1	3	4	3
		Harnischia			1	1	1	2	
		Kiefferulus		1			1		
		Polypedilum	2	4	2	3	8	7	3
		Tribelos	33	44	31	39	31	39	43
		Stempellina				1			
		Stelechomyia	1	1				2	
		Pseudochironomus		2	1	1		2	1
		Cladotanytarsus					1		
		Rheotanytarsus	3	13		1	1	22	11
		Tanytarsus		1	1	2	1		1
Ephemeroptera	Caenidae	Caenis	10	5	8	4	2	4	2
	Ephemeridae	Hexagenia	1						
	Heptageniidae	Heptageniidae sp.	1	1					1
		Stenacron	11	3	4	2	5	1	
		Maccaffertium	34	30	26	24	13	39	14
	Leptohyphidae	Tricorythodes			1	2		2	2
Eulamellibranchia	Corbiculidae	Corbicula		2				1	1
Isopoda	Asellidae	Caecidotea					1		
Lymnophila	Planorbidae	Menetus			1		1		
Trichoptera	Hydropsychidae	Trichoptera sp.	1	1				2	1
		Hydropsyche	1	14	1			4	
	Leptoceridae	Oecetis		1					
	Polycentropodidae	Cyrnellus	6	33	16	12	2	27	15
		Neureclipsis	2	4	13		15	3	1
Tubificida	Naididae (Naidinae)	Naididae sp.			1				
	Naididae (Tubificinae)	Tubificidae sp.		1	1	2			

Macroinvertebrate raw data table for Station 1 during summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	1	2	3	4	6	7	9
Amphipoda	Corophiidae	Apocorophium	1	2	1	1	1	4	
	Gammaridae	Gammarus		3	1	1	1	1	1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1		1	1			
	Chironomidae	Chironomid pupae	2	9		1	7	2	3
		Coelotanypus	5	4	6	2	4	2	
		Ablabesmyia	15	41	43	19	41	50	25
		Chironomus			2				
		Dicrotendipes	14	28	16	16	15	37	36
		Glyptotendipes					1	4	
		Parachironomus							3
		Polypedilum	4	11	6	2	1		3
		Stictochironomus				1		2	
		Tribelos	27	31	43	41	20	22	75
		Tanytarsus						2	
Ephemeroptera	Ephemeridae	Hexagenia			1				
	Leptohyphidae	Tricorythodes			1				
Odonata	Coenagrionidae	Argia	1		1				1
	Corduliidae	Neurocordulia	1						
Trichoptera	Polycentropodidae	Cyrnellus	5	7	8	7	11	9	18

Macroinvertebrate raw data table for Station 1 during fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	2	4	6	7	8	9	10
Amphipoda	Corophiidae	Apocorophium		1				1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1	1			
	Chironomidae	Chironomidae sp.	2	5	2		1		1
		Chironomid pupae	2	3		3	1	2	
		Coelotanypus	5	10	19	3	4	3	6
		Ablabesmyia	33	35	37	11	18	30	35
		Subfamily Orthocldiinae	1						
		Nanocladius	2	3				2	
		Dicrotendipes	16	5	21		9	22	14
		Microchironomus				1			
		Polypedilum	4	10	7	6	1	4	2
		Stictochironomus				1			1
		Tribelos	28	52	28	17	10	29	36
		Tanytarsus	3	5	2		2	3	2
Eulamellibranchia	Corbiculidae	Corbicula							1
Odonata	Coenagrionidae	Argia			1				
Trichoptera	Polycentropodidae	Cyrnellus	10	14	6	6	8	10	14

Macroinvertebrate raw data table for Station 2 during spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	1	4	5	6	7	8	10
Amphipoda	Corophiidae	Apocorophium			30	37	82	8	
	Gammaridae	Gammarus	2		74	215	108	66	
Coleoptera	Elmidae	Dubiraphia					1	1	
		Stenelmis				2			
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		
	Chironomidae	Chironomidae sp.					1		
		Chironomid pupae			1	3			
		Coelotanypus				1			
		Ablabesmyia			3	6	3		
		Thienemanniella				1			
		Chironomus			1			1	
		Cryptochironomus				4		1	
		Dicrotendipes			1	1			
		Kiefferulus			1				
		Polypedilum			9	36	11	3	
		Tribelos			18	18	22	2	
		Stempellina				1			
		Rheotanytarsus		1	1	8	5		
		Tanytarsus				1			
	Empididae	Hemerodromia			1	1	1		
Ephemeroptera	Caenidae	Caenis			21	36	11	10	
	Heptageniidae	Heptageniidae sp.				1	1		
		Stenacron				1			
		Maccaffertium			1	2	7		
	Leptohyphidae	Tricorythodes			1	10		2	
Eulamellibranchia	Corbiculidae	Corbicula			3	8	3	1	
Isopoda	Asellidae	Caecidotea	5			1		1	
Lymnophila	Ancylidae	Ferrissia					1	1	
Trichoptera	Hydropsychidae	Cheumatopsyche				1			
		Hydropsyche			8	38	1	1	
	Leptoceridae	Nectopsyche						1	
	Polycentropodidae	Cyrnellus			5	12	5	2	
		Neureclipsis				1			
Tubificida	Naididae (Naidinae)	Naididae sp.			1				
	Naididae (Tubificinae)	Tubificidae sp.		1					1

Macroinvertebrate raw data table for Station 2 during summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	1	4	6	7	8	9	10
Amphipoda	Corophiidae	Apocorophium	4					2	
	Gammaridae	Gammarus			1	1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.		2		3	4	4	1
	Chironomidae	Chironomidae sp.							2
		Chironomid pupae	4	1	2	1		2	
		Coelotanypus	7	2	8	8	10	6	8
		Ablabesmyia	35	21	42	18	28	36	28
		Nanocladius		1			1	1	
		Dicrotendipes	24		11	4	11	10	18
		Glyptotendipes						1	
		Microchironomus	2						
		Polypedilum	2	2	2	4	7	2	4
		Stictochironomus						1	
		Tribelos	46	4	21	27	24	18	49
		Cladotanytarsus							2
Ephemeroptera	Caenidae	Caenis			1				
	Ephemeridae	Hexagenia	2	1	3	1	1	2	
Eulamellibranchia	Corbiculidae	Corbicula			1				
Odonata	Corduliidae	Neurocordulia	1					1	
Trichoptera	Polycentropodidae	Cyrnellus	11	3	8	4	10	10	15
Tubificida	Naididae (Naidinae)	Naididae sp.					1		
	Naididae (Tubificinae)	Tubificidae sp.		1					

Macroinvertebrate raw data table for Station 2 during fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	1	3	5	6	7	8	9
Diptera	Chironomidae	Chironomidae sp.						2	3
		Chironomid pupae	1			2	1		2
		Coelotanypus	24	8		5	17	2	8
		Ablabesmyia	27	20	48	21	38	53	33
		Nanocladius		1	4		2		1
		Dicrotendipes	7	15	18	20	10	19	20
		Microchironomus							1
		Polypedilum	2	4	6	10	16	2	13
		Tribelos	19	17	20	15	14	35	12
		Stelechomyia							1
		Rheotanytarsus	1						
		Tanytarsus	1		4		1	5	3
Ephemeroptera	Heptageniidae	Maccaffertium				1			
	Leptohyphidae	Tricorythodes					1		
Odonata	Coenagrionidae	Argia				1			
Trichoptera	Polycentropodidae	Cyrnellus	17	16	22	15	17	14	17
Tubificida	Naididae (Naidinae)	Naididae sp.					1		

Macroinvertebrate raw data table for Station 3 during the spring of 2010.

Order	Family	Genus	Spring 2010 Sample No. 1	2
Diptera	Chironomidae	Polypedilum	1	
		Rheotanytarsus		1
Isopoda	Asellidae	Caecidotea		3
Tubificida	Naididae (Tubificinae)	Tubificidae sp.	2	1

Macroinvertebrate raw data table for Station 3 during the summer of 2010.

Order	Family	Genus	Summer 2010 Sample No. 1	2	3	4	6	8	9
Amphipoda	Corophiidae	Apocorophium	2	1		4	1		
	Gammaridae	Gammarus				1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1	2				1	
	Chironomidae	Chironomid pupae	2	7	7			6	8
		Coelotanypus			5	2			6
		Ablabesmyia	22	25	34	25	31	20	26
		Nanocladius				2			
		Dicrotendipes	35	23	12	40	34	36	11
		Parachironomus					2		
		Polypedilum	6	2	5	2	2	5	4
		Stictochironomus							2
		Tribelos	47	56	58	52	59	63	40
		Rheotanytarsus							2
		Tanytarsus	2	11	7				9
Ephemeroptera	Leptohyphidae	Tricorythodes						1	
Lymnophila	Planorbidae	Menetus		1					
Odonata	Coenagrionidae	Argia	1		2		2	2	1
Trichoptera	Hydropsychidae	Hydropsyche					1	1	
	Polycentropodidae	Cyrnellus	11	19	14	22	14	17	14

Macroinvertebrate raw data table for Station 3 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	1	2	3	4	5	8	9
Amphipoda	Corophiidae	Apocorophium		1			1		
Diptera	Ceratopogonidae	Ceratopogonidae sp.				4			
	Chironomidae	Chironomidae sp.		7	4				
		Chironomid pupae	4	3	4	2	4	4	4
		Coelotanypus	4		2	2	5		
		Ablabesmyia	35	27	22	31	37	23	20
		Cricotopus/Orthocladius						2	
		Nanocladius	12	3	4		2	2	2
		Dicrotendipes	51	44	10	12	19	19	20
		Microchironomus		10			2		
		Parachironomus							2
		Polypedilum	35	10	6	12	12	10	4
		Stictochironomus					2		
		Tribelos	78	63	50	61	35	51	40
		Pseudochironomus		3					
		Rheotanytarsus		10				2	
		Tanytarsus	23	17	6	14	10	4	10
Ephemeroptera	Heptageniidae	Maccaffertium			1		1		
Eulamellibranchia	Corbiculidae	Corbicula		1					
Odonata	Coenagrionidae	Argia		3	1	3		1	1
Trichoptera	Hydropsychidae	Hydropsyche					1		
	Polycentropodidae	Cyrnellus	28	15	17	8	12	18	18

Macroinvertebrate raw data table for Station 4 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	11	13	14	15	17	18	20
Amphipoda	Corophiidae	Apocorophium	7	3	13	11	6	18	14
	Gammaridae	Gammarus	3	5	4	2	7	1	3
Coleoptera	Elmidae	Stenelmis					1		
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1					
	Chironomidae	Chironomidae sp.				2			
		Chironomid pupae	2	5	3	6	3		
		Ablabesmyia	2	9	3	16	6	5	12
		Natarsia							
		Thienemanniella	7	8	3	13		3	5
		Nanocladius	5	7	2			1	2
		Rheocricotopus							2
		Chironomus					1		
		Cryptochironomus			1				
		Dicrotendipes	7	4	7	4	1	8	2
		Glyptotendipes	2			2			
		Harnischia			1				
		Polypedilum	25	10	11	33	1	10	31
		Tribelos	63	40	34	24	22	49	66
		Stelechomyia		1					
		Pseudochironomus			1				
		Rheotanytarsus	34	20	9	29	2	7	14
		Tanytarsus						2	
	Empididae	Hemerodromia	1		1	2			1
Ephemeroptera	Baetidae	Baetidae sp.				1			
		Pseudocloeon		1					
	Caenidae	Caenis	3	4		5	1	1	4
	Heptageniidae	Heptageniidae sp.	5	2	1	1		1	1
		Stenacron				1			
		Maccaffertium	34	27	19	23	8	18	20
	Isonychiidae	Isonychia							1
	Leptohyphidae	Tricorythodes	5	5	4	2		1	4
Hydroida	Hydridae	Hydra					1		
Megaloptera	Sialidae	Sialis							1
Trichoptera	Hydropsychidae	Trichoptera sp.	7	2	3	26			9
		Cheumatopsyche		1	1				
		Hydropsyche	85	25	29	222			96
		Potamyia	1	1					
	Polycentropodidae	Cyrnellus	18	20	30	18		21	18
		Neureclipsis	78	4	15	39		6	4
Tubificida	Naididae (Naidinae)	Naididae sp.	1						1

Macroinvertebrate raw data table for Station 4 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	11	12	14	16	17	18	19
Amphipoda	Corophiidae	Apocorophium			1				1
Diptera	Chironomidae	Chironomidae sp.			2	3	3		
		Chironomid pupae	1	9		1		3	2
		Coelotanypus	1						
		Ablabesmyia	45	32	52	27	34	37	24
		Nanocladius			4	1	1	1	
		Dicrotendipes	11	27	31	30	26	4	19
		Polypedilum		3			1		
		Tribelos	39	67	35	34	30	20	49
		Pseudochironomus				1	1		
		Tanytarsus							1
Ephemeroptera	Leptohyphidae	Tricorythodes		1					
Trichoptera	Polycentropodidae	Cyrnellus	20	13	24	19	24	16	16
		Neureclipsis		1					

Macroinvertebrate raw data table for Station 4 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	11	12	13	14	16	17	18
Diptera	Chironomidae	Chironomidae sp.	2			1	2	9	
		Chironomid pupae	3		1		2		2
		Coelotanypus				1	2	6	
		Ablabesmyia	19		3	4	26	39	25
		Nanocladius						3	
		Cryptochironomus	1					3	
		Cryptotendipes					2		
		Dicrotendipes	1		2	3	4	9	
		Polypedilum	1	1			2	6	5
		Stictochironomus			1				2
		Tribelos	42	1	3	7	64	97	76
		Xenochironomus			1				
		Tanytarsus	9			1	4	9	7
Odonata	Coenagrionidae	Coenagrionidae							1
Trichoptera	Polycentropodidae	Cyrnellus	18		2	3	44	28	26
Tubificida	Naididae (Naidinae)	Naididae sp.	1						
	Naididae (Tubificinae)	Tubificidae sp.	1	1	1				

Macroinvertebrate raw data table for Station 5 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	22	23	24	27	28	29	30
Amphipoda	Corophiidae	Apocorophium	2	11	9	12	2	6	1
	Gammaridae	Gammarus			1		1	1	
Diptera	Chaoboridae	Chaoborus				1			
	Chironomidae	Chironomidae sp.	1	1		2			1
		Chironomid pupae	1	2	2	1	2		
		Coelotanypus		1					
		Procladius		1					
		Ablabesmyia	9	8	10	25	4	18	12
		Thienemanniella	3	1	2	7	6	2	3
		Nanocladius	4	3	5	12	11	4	3
		Chironomus						1	
		Cryptochironomus	1	1	4	2	2		1
		Dicrotendipes	6	10	5	10	4	4	3
		Glyptotendipes		2					1
		Polypedilum	9	7	6	15	23	7	4
		Tribelos	57	38	38	47	60	41	55
		Stelechomyia	1				2		1
		Pseudochironomus		2	2			2	2
		Rheotanytarsus	5	3	6	10	4	8	
		Tanytarsus			1				
	Empididae	Empididae sp.						1	
		Hemerodromia			1				
Ephemeroptera	Caenidae	Caenis	2	1			2	4	1
	Heptageniidae	Heptageniidae sp.	1				1		
		Maccaffertium			1	4	1	1	
	Leptohyphidae	Tricorythodes			1		1		
Lymnophila	Ancylidae	Ferrissia	1		2	2	3	3	1
Trichoptera	Hydropsychidae	Hydropsyche	12	10	11	14	31	11	
	Polycentropodidae	Cyrnellus	80	63	79	121	98	73	66
		Neureclipsis	10	4	8	16	15	6	2
Tubificida	Naididae (Tubificinae)	Tubificidae sp.		1		2			1

Macroinvertebrate raw data table for Station 5 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	23	24	25	26	27	28	30
Amphipoda	Corophiidae	Apocorophium						2	
Decapoda	Cambaridae	Cambaridae sp.							
	Panopeidae	Rhithropanopeus						1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1					
	Chironomidae	Chironomid pupae		9	6		8	4	4
		Coelotanypus	2	3			2		2
		Ablabesmyia	45	27	31	34	17	31	36
		Chironomus		3	2		2		
		Cryptochironomus	2						
		Dicrotendipes	24	68	41	52	43	47	40
		Microchironomus					2	4	2
		Polypedilum	2	3	2	5		4	
		Stictochironomus	2	5					
		Tribelos	37	18	38	57	36	18	26
		Stelechomyia		3					
		Tanytarsus	2	3		3		2	
Odonata	Coenagrionidae	Argia	1	1			1		1
Trichoptera	Polycentropodidae	Cyrnellus	2	8	13	16	7	16	6
Tubificida	Naididae (Naidinae)	Naididae sp.							3
	Naididae (Tubificinae)	Tubificidae sp.							1

Macroinvertebrate raw data table for Station 5 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	21	22	23	24	26	27	29
Amphipoda	Corophiidae	Apocorophium		1					
Coleoptera	Elmidae	Stenelmis	1						
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1		1	1	1	3	
	Chironomidae	Chironomid pupae	1	2	2	1	3	3	
		Coelotanypus	1		1	2		2	
		Procladius					3		
		Ablabesmyia	21	14	25	18	26	22	12
		Subfamily Orthocldiinae					3		
		Nanocladius		2	1				
		Dicrotendipes	8	16	14	5	18	8	16
		Microchironomus	3	6	3	3	3	4	
		Polypedilum	6	8	3	5	5	7	6
		Stictochironomus		2		3	5		
		Tribelos	35	53	46	36	56	38	63
		Xenochironomus						1	
		Tanytarsus	10	8		5	10	5	10
Ephemeroptera	Ephemeridae	Hexagenia	1		1				
Trichoptera	Polycentropodidae	Cyrnellus	14	32	19	11	27	11	11
Tubificida	Naididae (Tubificinae)	Tubificidae sp.						2	1

Macroinvertebrate raw data table for Station 6 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	31	33	35	37	38	39	40
Amphipoda	Corophiidae	Apocorophium	19	13	10	21	14	1	5
	Gammaridae	Gammarus	19	17	10	23	6	14	10
Diptera	Chironomidae	Chironomidae sp.	4						
		Chironomid pupae	2	1	6	2	5		7
		Coelotanypus	4						
		Ablabesmyia	18	5	10	8	8		12
		Thienemanniella	4	8	16		16	4	18
		Cricotopus/Orthocladius			3				
		Nanocladius	2	8	12	1	14	2	18
		Cryptochironomus		1					3
		Dicrotendipes	4	4	16	3			9
		Glyptotendipes				1			
		Polypedilum	13	19	64	17	27	61	21
		Stenochironomus	2						
		Tribelos	53	30	53	31	27	45	43
		Stelechomyia							6
		Pseudochironomus	7	2	3		3		6
		Rheotanytarsus	7	18	34	9	59	13	39
		Tanytarsus	2						
	Empididae	Hemerodromia					1	1	
	Simuliidae	Simulium					1		
Ephemeroptera	Baetidae	Baetidae sp.			2	1			
		Pseudocloeon					1	1	1
	Caenidae	Caenis	8	6	10	5	4	2	2
	Heptageniidae	Heptageniidae sp.	2	8	2	1	3		6
		Stenacron		1		1			
		Maccaffertium	24	14	36	21	35	39	27
	Leptohyphidae	Tricorythodes	2	2	2		1	2	3
Eulamellibranchia	Corbiculidae	Corbicula	1	1					
Hoplonemertea	Tetrastemmatidae	Nematoda sp.	1						
Lymnophila	Ancylidae	Ferrissia	2						
Trichoptera	Hydropsychidae	Trichoptera sp.	7	6	25	3	35	24	20
		Cheumatopsyche			1	2	1		1
		Hydropsyche	153	177	389	121	232	464	296
		Potamyia	1		1		1		
		Macrostemum							1
	Leptoceridae	Oecetis			1				
	Polycentropodidae	Cyrnellus	70	59	47	53	46	29	48
		Neureclipsis	5	7	8	8	10	20	14
Tubificida	Naididae (Chaetogasterinae)	Chaetogasterinae sp.	1				1		
	Naididae (Naidinae)	Naididae sp.	6	2	5		11		3
	Naididae (Pristininae)	Pristinella	2		1	1	1		
	Naididae (Tubificinae)	Tubificidae sp.	1	3	1				

Macroinvertebrate raw data table for Station 6 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	31	33	34	35	37	38	40
Amphipoda	Corophiidae	Apocorophium				1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.				1			
	Chironomidae	Chironomid pupae		2	3	6	10	2	6
		Coelotanypus						2	
		Ablabesmyia	18	19	36	46	36	36	32
		Dicrotendipes	23	30	48	33	25	18	36
		Polypedilum	4	6	9	2	2	5	9
		Stictochironomus	4					7	
		Tribelos	64	61	54	39	55	60	52
		Tanytarsus	2				2		
Neuroptera	Sisyridae	Climacia					1		
Odonata	Coenagrionidae	Argia			1				
Trichoptera	Polycentropodidae	Cyrnellus	6	8	10	8	8	15	12

Macroinvertebrate raw data table for Station 6 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	33	34	35	36	37	38	39
Diptera	Chironomidae	Chironomidae sp.					2		1
		Chironomid pupae	1	2		2		4	
		Coelotanypus	1	1				2	
		Ablabesmyia	23	8	12	20	14	14	9
		Nanocladius	5	5	2		2	2	7
		Cryptochironomus		1					
		Dicrotendipes	3	11	8	9	8	16	15
		Microchironomus				2	1		
		Polypedilum	3	3	1		3	2	1
		Stictochironomus			1				
		Tribelos	43	48	35	81	40	50	37
		Xenochironomus				2			
		Tanytarsus	7	3	2	11	3	10	1
Ephemeroptera	Heptageniidae	Heptageniidae sp.			1				
Eulamellibranchia	Dreissenidae	Mytilopsis	1						
Maxillopoda	Argulidae	Argulus				1			
Odonata	Coenagrionidae	Argia	1						
	Corduliidae	Neurocordulia	1						
Trichoptera	Polycentropodidae	Cyrnellus	13	33	16	13	19	23	41

Macroinvertebrate raw data table for Station 7 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	41	42	44	45	46	47	50
Amphipoda	Corophiidae	Apocorophium	57	54		24	18	32	55
	Gammaridae	Gammarus	96	43	53	50	81	50	57
		Apocorophium			61				
Coleoptera	Elmidae	Stenelmis				1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1			1		1
	Chironomidae	Chironomidae sp.	1		2			1	
		Chironomid pupae	1			2			6
		Coelotanypus		1	2		1	2	2
		Ablabesmyia	3	3	6	4	4	4	7
		Thienemanniella	6	5	13	2	3	1	
		Nanocladius	6	8	9	3	2	4	11
		Chironomus	1						
		Cryptochironomus		1		3	1	1	2
		Dicrotendipes	1	1		1	2	3	2
		Harnischia		1					
		Kiefferulus							2
		Paralauterborniella						1	
		Polypedilum	15	17	26	13	3	5	40
		Stenochironomus	1						
		Stictochironomus						1	
		Tribelos	14	34	50	21	14	35	30
		Pseudochironomus	1		2				
		Rheotanytarsus	10	9	11	1	1	4	23
	Empididae	Hemerodromia							1
	Simuliidae	Simulium			1				
Ephemeroptera	Caenidae	Caenis	3	8	6	16	10	7	10
	Heptageniidae	Heptageniidae sp.			3		4		3
		Stenacron					2		
		Maccaffertium	60	42	26	30	17	33	30
	Isonychiidae	Isonychia	1						
	Leptohyphidae	Tricorythodes	4	8	11	3	8	2	17
Eulamellibranchia	Corbiculidae	Corbicula	1				2		1
Hoplonemertea	Tetrastemmatidae	Nematoda sp.			2			1	
Isopoda	Asellidae	Caecidotea				3			
Lymnophila	Ancylidae	Ferrissia	2				8		
	Planorbidae	Planorbidae sp.					1		
Trichoptera	Hydropsychidae	Trichoptera sp.		5	12				4
		Cheumatopsyche							1
		Hydropsyche	19	36	116	3	1	3	97
		Potamyia	2		1				
	Leptoceridae	Triaenodes							1
	Polycentropodidae	Trichoptera sp.	1						
		Cyrnellus	16	30	48	8	13	35	49
		Neureclipsis	8	5	8			8	5
Tubificida	Naididae (Naidinae)	Naididae sp.			1		5		
	Naididae (Tubificinae)	Tubificidae sp.			1	5	6		

Macroinvertebrate raw data table for Station 7 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	41	42	43	45	47	48	50
Amphipoda	Corophiidae	Apocorophium						1	
Diptera	Chironomidae	Chironomidae sp.						1	
		Chironomid pupae		2	4	2	8	1	4
		Coelotanypus			2	2			
		Ablabesmyia	32	34	23	41	33	34	31
		Nanocladius							2
		Cryptochironomus						1	
		Cryptotendipes							2
		Dicrotendipes	15	12	45	28	20	23	37
		Polypedilum	2	4	10		2	2	2
		Tribelos	27	27	33	28	41	27	24
		Cladotanytarsus				2			
		Tanytarsus						1	
Trichoptera	Polycentropodidae	Cyrnellus	14	21	30	18	18	17	23

Macroinvertebrate raw data table for Station 7 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	44	45	46	47	48	49	50
Amphipoda	Gammaridae	Gammarus			1				
Decapoda	Palaemonidae	Macrobrachium	1			1		2	
	Portunidae	Callinectes		1					
Diptera	Chironomidae	Chironomidae sp.		2				2	1
		Chironomid pupae			1			2	1
		Coelotanypus	2	4		1	2		1
		Ablabesmyia	30	13	17	15	23	21	18
		Nanocladius	4	6	4	3		6	4
		Dicrotendipes	16	10	1	11	4	6	7
		Microchironomus							1
		Polypedilum	2		1	1	7	1	1
		Tribelos	53	23	30	39	38	41	26
		Stempellina					1		
		Tanytarsus		1		3	1	2	4
Eulamellibranchia	Dreissenidae	Mytilopsis		1					
Trichoptera	Polycentropodidae	Cyrnellus	12	11	8	8	11	7	9

Macroinvertebrate raw data table for Station 8 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	51	52	54	55	56	57	59
Amphipoda	Corophiidae	Apocorophium	1	5	5	1	4	7	2
	Gammaridae	Gammarus	2	2	2	7	9	10	2
Diptera	Ceratopogonidae	Ceratopogonidae sp.		2	3		2	2	
	Chironomidae	Chironomidae sp.					2		
		Chironomid pupae		1		2	1	1	2
		Coelotanypus			4	1	2		
		Procladius					1		
		Ablabesmyia	6	12	15	7	6	13	12
		Natarsia				1			
		Thienemanniella			2	1	4	4	6
		Nanocladius	2	4	13	3	4	23	6
		Cryptochironomus		2		1		2	4
		Dicrotendipes	24	13	6	6	13	19	10
		Glyptotendipes		1		1	1		2
		Harnischia					1	4	
		Kiefferulus		1	2				
		Polypedilum	11	7	8	5	12	8	10
		Tribelos	48	50	48	43	37	36	51
		Pseudochironomus		4		1	2		2
		Rheotanytarsus	6	2	2	4	4	2	2
		Tanytarsus	4	1	2		2		
	Empididae	Empididae sp.						1	
	Simuliidae	Simulium							1
Ephemeroptera	Baetidae	Pseudocloeon	1						
	Caenidae	Caenis	2	1	1	1	1	2	
	Heptageniidae	Heptageniidae sp.				3			
		Stenacron				1		2	
		Maccaffertium	4		9	5	1	8	
	Leptohyphidae	Tricorythodes			1	1	2	1	2
Eulamellibranchia	Corbiculidae	Corbicula		2				1	
Hydroida	Hydridae	Hydra					1		
Trichoptera	Hydropsychidae	Trichoptera sp.	2	2	1	1		1	1
		Cheumatopsyche			1			1	
		Hydropsyche	24	29	18	8	51	27	26
	Polycentropodidae	Trichoptera sp.			1				
		Cyrnellus	46	48	51	51	82	62	53
		Neureclipsis	9	3	6	7	5	9	8
Tubificida	Naididae (Naidinae)	Naididae sp.	6	2	4		1		
	Naididae (Tubificinae)	Tubificidae sp.	1		1				

Macroinvertebrate raw data table for Station 8 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	51	52	53	56	57	58	59
Amphipoda	Corophiidae	Apocorophium				1		1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.			2	2		1	1
	Chironomidae	Chironomidae sp.					1		
		Chironomid pupae	6	5	4	1	5		2
		Coelotanypus	1		1	2	2	2	3
		Ablabesmyia	24	11	19	18	18	15	22
		Nanocladius	1						
		Dicrotendipes	24	5	12	7	18	4	8
		Polypedilum	1	2	1			2	1
		Stictochironomus			1				1
		Tribelos	29	18	23	10	30	21	23
		Tanytarsus	2						
Trichoptera	Polycentropodidae	Cyrnellus	22	14	13	16	13	22	14

Macroinvertebrate raw data table for Station 8 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	51	52	53	57	58	59	60
Amphipoda	Gammaridae	Gammarus					1		
Decapoda	Panopeidae	Rhithropanopeus							1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1						
	Chironomidae	Chironomidae sp.						1	1
		Chironomid pupae	1	1	2	3	1	2	1
		Coelotanypus		5	3	5	7	2	4
		Ablabesmyia	14	9	9	15	8	10	17
		Nanocladius	11	1	1		3	1	1
		Dicrotendipes	13	9	2	8	1	7	11
		Microchironomus	2	1					2
		Polypedilum	2	3		2		4	1
		Stictochironomus		1					
		Tribelos	19	21	15	15	23	9	24
		Xenochironomus				1			
		Tanytarsus	1				2		1
Eulamellibranchia	Corbiculidae	Corbicula							1
	Dreissenidae	Mytilopsis	25	1	9	3	1	3	4
Odonata	Corduliidae	Neurocordulia	1						
Trichoptera	Polycentropodidae	Cyrnellus	9	8	14	12	17	14	7

Macroinvertebrate raw data table for Station 9 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	62	64	65	66	67	69	70
Amphipoda	Corophiidae	Apocorophium	23	14	1	13	25	16	7
	Gammaridae	Gammarus	44	84	96	110	81	46	81
Diptera	Chironomidae	Chironomidae sp.	4					1	
		Chironomid pupae		7		1			3
		Coelotanypus				1	1	1	
		Ablabesmyia	6	16			5	2	1
		Thienemanniella	14	7	1		2	2	2
		Nanocladius	12	5	2	1	3	1	4
		Cryptochironomus			1	1	3	1	
		Dicrotendipes	2	2		1	2	1	2
		Glyptotendipes					1		
		Harnischia	2	5					1
		Paralauterborniella			1				
		Polypedilum	12	26		1	18	3	4
		Tribelos	39	44	7	20	21	29	18
		Cladotanytarsus						1	
		Rheotanytarsus	18	21		1	8	2	3
		Tanytarsus	2				1		
	Empididae	Hemerodromia		1			2		
	Simuliidae	Simulium	1	1					
Ephemeroptera	Baetidae	Pseudocloeon					1		
	Caenidae	Caenis	8	4	6	11	9	5	6
	Heptageniidae	Heptageniidae sp.		1	2	2	2		2
		Stenacron						3	
		Maccaffertium	39	49	24	19	36	17	39
	Leptohyphidae	Tricorythodes	7	15	4	2	8		6
Eulamellibranchia	Corbiculidae	Corbicula			1	1			
Isopoda	Asellidae	Caecidotea			1	1			
Lymnophila	Ancylidae	Ferrissia				6	4		1
Trichoptera	Hydropsychidae	Trichoptera sp.	10	9			2		
		Cheumatopsyche					1		
		Hydropsyche	85	100			204		2
		Potamyia	1	4	2		16		1
	Leptoceridae	Triaenodes		1					
	Polycentropodidae	Cyrnellus	24	30	4	7	20	4	14
		Neureclipsis	9	1			6		
Tubificida	Naididae (Naidinae)	Naididae sp.	12	2	4	1	1	3	2
	Naididae (Pristininae)	Pristinella	2	1		5			
	Naididae (Tubificinae)	Tubificidae sp.	4	1	40	4	7	66	59

Macroinvertebrate raw data table for Station 9 during the summer of 2010.

Order	Family	Genus	Summer 2010						
			Sample No.						
			62	63	64	65	67	69	70
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1		1	1	
	Chironomidae	Chironomidae sp.		4	1	2			
		Chironomid pupae		2		8	2	3	
		Ablabesmyia	34	45	24	28	31	37	31
		Dicrotendipes	19	19	11	17	17	26	29
		Parachironomus				2			
		Polypedilum		2	3		12		2
		Tribelos	60	41	30	62	44	73	64
		Tanytarsus			1				
Trichoptera	Polycentropodidae	Cyrnellus	35	42	35	28	28	31	21
Tubificida	Naididae (Tubificinae)	Tubificidae sp.					1	1	

Macroinvertebrate raw data table for Station 9 during the fall of 2010.

Order	Family	Genus	Fall 2010						
			Sample No.						
			61	62	63	65	67	68	70
Decapoda	Palaemonidae	Macrobrachium		2	1		1		
Diptera	Chironomidae	Chironomidae sp.		5	4	1	3		1
		Chironomid pupae	1	1		1			1
		Ablabesmyia	14	19	23	12	12	22	40
		Nanocladius	1	7	6	4		3	4
		Dicrotendipes		6	5	2	3	5	6
		Microchironomus						1	1
		Polypedilum	3	4	3	4		1	4
		Stictochironomus						1	
		Tribelos	37	41	33	34	29	34	31
		Xenochironomus							3
		Rheotanytarsus		1					
		Tanytarsus	1		1	1	1	2	1
Eulamellibranchia	Dreissenidae	Mytilopsis	2	17	2		5	1	3
Trichoptera	Polycentropodidae	Cyrnellus	16	26	16	16	13	15	15

Macroinvertebrate raw data table for Station 10 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	71	72	73	74	77	78	79
Amphipoda	Corophiidae	Apocorophium		1	12		21	1	
	Gammaridae	Gammarus			46	19	5	49	27
Diptera	Chironomidae	Chironomidae sp.						1	
		Chironomid pupae			2				
		Coelotanypus					2		
		Ablabesmyia			4		2	3	1
		Thienemanniella					10	2	
		Nanocladius						4	
		Cryptochironomus					2		
		Dicrotendipes					2		
		Paratendipes		1					
		Polypedilum	1	3	16	5	6	12	2
		Tribelos	5	1	74	7	74	51	13
		Stelechomyia					2	1	
		Rheotanytarsus			4		2	6	
Ephemeroptera	Caenidae	Caenis			7	1	2	4	
	Heptageniidae	Heptageniidae sp.					1	2	
		Stenacron					2	3	
		Maccaffertium			39	1	35	38	5
	Leptohyphidae	Caenis							1
		Tricorythodes			4		3	1	
Lumbriculida	Lumbriculidae	Lumbriculidae sp.				1			
Trichoptera	Hydropsychidae	Trichoptera sp.			1				
		Hydropsyche			35	1		4	
		Potamyia			1				
	Polycentropodidae	Cyrnellus			6		13	1	
Tubificida	Naididae (Naidinae)	Naididae sp.			1		1	1	
	Naididae (Tubificinae)	Tubificidae sp.				1			

Macroinvertebrate raw data table for Station 10 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	71	73	75	77	78	79	80
Decapoda	Palaemonidae	Macrobrachium					1		
Diptera	Chironomidae	Chironomidae sp.						1	
		Chironomid pupae		1	2			3	3
		Coelotanypus		1	4		1	1	1
		Ablabesmyia	8	3	12	4	8	5	10
		Nanocladius	2				1		
		Dicrotendipes	17	4	8	3	6	19	23
		Parachironomus						1	
		Tribelos	24	7	28	12	45	18	30
		Tanytarsus	2						
Ephemeroptera	Caenidae	Caenis			1				
	Heptageniidae	Maccaffertium				1			
Odonata	Coenagrionidae	Argia	1			1			
Trichoptera	Polycentropodidae	Cyrnellus	2	2	4	2	6	1	4

Macroinvertebrate raw data table for Station 10 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	72	74	75	77	78	79	80
Amphipoda	Gammaridae	Gammarus			2				
Decapoda	Palaemonidae	Macrobrachium			1				
	Panopeidae	Rhithropanopeus		1				1	
Diptera	Chironomidae	Chironomidae sp.	1	5	1	1		1	1
		Chironomid pupae			1		1		
		Coelotanypus							2
		Ablabesmyia	8	9	5	8	9	8	6
		Nanocladius	6	2	5	2	2		2
		Dicrotendipes	10	3	5	8	4	9	5
		Glyptotendipes			1				
		Polypedilum						1	
		Tribelos	16	30	10	22	29	25	5
		Xenochironomus		2					
		Rheotanytarsus	1			1			
		Tanytarsus	2	1		3	2	2	1
Eulamellibranchia	Dreissenidae	Mytilopsis	17	18	19	26	17	29	22
Neuroptera	Sisyridae	Climacia							1
Odonata	Corduliidae	Neurocordulia		1					
Trichoptera	Polycentropodidae	Cyrnellus	10	15	15	17	7	12	13
Tubificida	Naididae (Naidinae)	Naididae sp.		11	1	2			3
	Naididae (Pristininae)	Pristinella	1			1	1		2
	Naididae (Tubificinae)	Tubificidae sp.				1			

Macroinvertebrate raw data table for Station 11 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	81	82	83	85	86	88	89
Amphipoda	Corophiidae	Apocorophium	76	48	15	36	34	16	18
	Gammaridae	Gammarus	33	38	13	21	34	25	27
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1					1
	Chironomidae	Chironomidae sp.		2					
		Chironomid pupae		2	4	11	4		3
		Coelotanypus					2		3
		Ablabesmyia	9	7	2	2	15	12	17
		Thienemanniella	2	5	7	5	2	24	9
		Nanocladius	9	9		2	2	29	14
		Cryptochironomus	2				2		
		Dicrotendipes	4	2	2		4	4	9
		Glyptotendipes		2	2		2		
		Kiefferulus					2		3
		Polypedilum	26	26	43	26	29	66	40
		Stenochironomus				2			
		Tribelos	45	50	24	46	36	45	37
		Stelechomyia						4	
		Rheotanytarsus	22	24	44	33	21	24	40
		Tanytarsus		5			2		
	Empididae	Hemerodromia	1	2	3	1	1	2	2
Ephemeroptera	Baetidae	Pseudocloeon			4				1
	Caenidae	Caenis	10	6	7	14	9	7	7
	Heptageniidae	Heptageniidae sp.	7	6			1	4	2
		Stenacron				1			
		Maccaffertium	24	48	56	42	29	33	60
	Isonychiidae	Isonychia				1			1
	Leptohyphidae	Tricorythodes	7	3	6	8	3	10	7
Eulamellibranchia	Corbiculidae	Corbicula		1					
Hoplonemertea	Tetrastemmatidae	Nematoda sp.		1			1		
Lymnophila	Ancylidae	Ferrissia					1		
Odonata	Corduliidae	Corculiidae sp.						1	
Plecoptera	Perlidae	Neoperla						1	
Trichoptera	Hydropsychidae	Trichoptera sp.	10	12	25	25	11	27	36
		Cheumatopsyche	1		1	3			1
		Hydropsyche	188	116	669	357	159	489	582
		Potamyia	2		3			3	
	Leptoceridae	Pleuroceridae sp.		1					
		Nectopsyche					1		
		Triaenodes						1	
	Polycentropodidae	Cyrnellus	39	25	24	36	30	39	30
		Neureclipsis	7	1	8	11	5	7	8
Tubificida	Naididae (Naidinae)	Naididae sp.			1	1		1	
	Naididae (Tubificinae)	Tubificidae sp.				1			1

Macroinvertebrate raw data table for Station 11 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	81	82	83	84	85	86	89
Decapoda	Cambaridae	Cambaridae sp.					1		
Diptera	Chironomidae	Chironomidae sp.				2	1		
		Chironomid pupae	2	1		2		2	1
		Coelotanypus				1			
		Ablabesmyia	21	15	12	18	18	29	15
		Nanocladius		1		1	1		1
		Dicrotendipes	23	22	10	14	16	6	20
		Parachironomus		1					
		Polypedilum		1			1	2	
		Tribelos	73	48	81	58	55	66	54
		Rheotanytarsus		1				2	2
Odonata	Coenagrionidae	Argia		1					
Trichoptera	Hydropsychidae	Hydropsyche					1		1
	Polycentropodidae	Cyrnellus	44	42	34	35	35	43	61

Macroinvertebrate raw data table for Station 11 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	82	83	85	86	87	88	90
Amphipoda	Amphilochidae	Hourstonia						1	
Decapoda	Panopeidae	Rhithropanopeus	1	1	2	3	1	1	1
Diptera	Chironomidae	Chironomid pupae	2			4	3		
		Ablabesmyia	6	9	4	13	13	4	7
		Nanocladius	1	4	2	2	2		3
		Cryptochironomus		1			1		
		Dicrotendipes	2	12		12	17	3	6
		Polypedilum			1				
		Tribelos	17	30	19	31	33	26	9
		Rheotanytarsus				1	1		1
		Tanytarsus	1			1	5	1	1
Ephemeroptera	Heptageniidae	Stenacron				1			
Eulamellibranchia	Dreissenidae	Mytilopsis	21	15	7	20	18	3	7
Odonata	Coenagrionidae	Argia	1						
	Corduliidae	Neurocordulia		1			3		
Trichoptera	Polycentropodidae	Cyrnellus	6	5	9	11	6	6	5

Macroinvertebrate raw data table for Station 12 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	91	94	95	96	98	99	100
Amphipoda	Corophiidae	Apocorophium	14	30	36	7	18	12	18
	Gammaridae	Gammarus	19	8	14		11	1	10
Diptera	Ceratopogonidae	Ceratopogonidae sp.			2				
	Chironomidae	Chironomid pupae		4		4	2		7
		Coelotanypus	1						
		Procladius			6				
		Ablabesmyia	15	21	16	5	7	15	7
		Thienemanniella	10	6	25	7	7	15	25
		Nanocladius	3	6	16		9	7	7
		Cryptochironomus	1						
		Dicrotendipes	2	10	3	2		5	2
		Polypedilum	16	19	22	28	37	17	41
		Tribelos	37	52	43	44	34	49	14
		Pseudochironomus	2					2	2
		Cladotanytarsus		2					
		Rheotanytarsus	10	17	38	28	32	20	32
		Tanytarsus				2		2	2
	Empididae	Hemerodromia			1	2	1		2
	Simuliidae	Simulium		1			2		
Ephemeroptera	Baetidae	Pseudocloeon		2			1		
	Caenidae	Caenis	2	5	5	2	7	3	9
	Heptageniidae	Heptageniidae sp.	1	1	1	3	1	2	2
		Maccaffertium	28	37	20	29	45	20	45
	Leptohyphidae	Tricorythodes	3	5	7		4	6	2
Eulamellibranchia	Corbiculidae	Corbicula		1			1		
Trichoptera	Hydropsychidae	Trichoptera sp.	1	13	11	6	26	5	18
		Hydropsyche	68	71	64	120	251	90	302
		Potamyia		1					
	Polycentropodidae	Cyrnellus	46	28	51	53	37	49	26
		Neureclipsis	12	5	11	4	5	6	8
Tubificida	Naididae (Tubificinae)	Tubificidae sp.	1						

Macroinvertebrate raw data table for Station 12 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	91	93	94	95	96	99	100
Diptera	Chironomidae	Chironomidae sp.				2			
		Chironomid pupae	2	3	2	2	1	1	2
		Ablabesmyia	6	11	15	17	12	7	8
		Cryptotendipes							1
		Dicrotendipes	8	2	14	6	4	8	9
		Parachironomus					1		
		Polypedilum							1
		Tribelos	87	65	52	82	74	66	76
		Pseudochironomus			1				
		Tanytarsus						2	
Odonata	Corduliidae	Neurocordulia						1	
Trichoptera	Polycentropodidae	Cyrnellus	17	15	19	8	21	20	23

Macroinvertebrate raw data table for Station 12 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	91	93	94	95	96	97	100
Amphipoda	Amphilochidae	Hourstonia	1						
	Corophiidae	Apocorophium						1	
	Melitidae	Melita						1	
Decapoda	Palaemonidae	Macrobrachium				1			
	Panopeidae	Rhithropanopeus	2						1
	Portunidae	Callinectes		1					
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1						1
	Chironomidae	Chironomidae sp.			1	1			1
		Chironomid pupae	2	2	2	1	2	1	3
		Ablabesmyia	7	6	14	8	11	8	4
		Nanocladius		3	2	4	14	2	1
		Dicrotendipes	6	26	14	7	18	19	7
		Parachironomus				1	4		
		Polypedilum	1	1	2	2	2	2	1
		Tribelos	24	43	43	22	49	24	17
		Rheotanytarsus				1			
		Tanytarsus	1	1	2	1	5	3	1
Ephemeroptera	Leptohyphidae	Tricorythodes			1				
Eulamellibranchia	Dreissenidae	Mytilopsis	29	36	69	48	83	51	12
Odonata	Corduliidae	Neurocordulia			1	1			
Trichoptera	Polycentropodidae	Cyrnellus	14	20	32	15	25	9	6
Tubificida	Naididae (Naidinae)	Naididae sp.				1			

Macroinvertebrate raw data table for Station 13 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	101	102	105	106	108	109	110
Amphipoda	Corophiidae	Apocorophium			4		2	19	2
	Gammaridae	Gammarus	2	1	5	3	3	3	4
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1		1	2	2		1
	Chironomidae	Chironomidae sp.			2			2	
		Chironomid pupae			2	1	2	4	1
		Coelotanypus		2			2		
		Ablabesmyia	18	8	11	13	13	16	14
		Thienemanniella	6	8	7	2	4	2	2
		Nanocladius		2	3	4		4	5
		Chironomus							1
		Cryptochironomus		1					
		Dicrotendipes	10	6	2	6	13	24	11
		Harnischia	2	1	1	4	2		3
		Kiefferulus				1			
		Microtendipes				1	2		
		Paralauterborniella		1					
		Polypedilum	3	2	3	1			3
		Robackia				1			
		Stictochironomus						2	
		Tribelos	43	39	51	52	85	43	58
		Stempellina				1			
		Pseudochironomus	3	1		1		2	
		Rheotanytarsus	1		3				1
		Tanytarsus	1		1	1		6	
Ephemeroptera	Caenidae	Caenis		1	1		2	2	
	Ephemeridae	Hexagenia						1	
	Heptageniidae	Heptageniidae sp.		1		1	1		
		Stenacron	1			1	1		
		Maccaffertium	7	9	6	9	11	9	9
	Isonychiidae	Isonychia			1				
	Leptohyphidae	Tricorythodes	1	3		3	3	1	2
Eulamellibranchia	Corbiculidae	Corbicula	1	1		2			
Hydroida	Hydridae	Hydra		1					
Lymnophila	Planorbidae	Menetus		1					
Trichoptera	Polycentropodidae	Cyrnellus	22	23	11	14	21	27	27
		Neureclipsis						1	

Macroinvertebrate raw data table for Station 13 during the summer of 2010.

Order	Family	Genus	Summer 2010						
			Sample No.						
			101	102	104	105	107	109	110
Amphipoda	Corophiidae	Apocorophium					1		
Diptera	Chironomidae	Chironomid pupae	5	2	1	5	7		6
		Ablabesmyia	14	13	25	14	16	31	8
		Dicrotendipes	14	20	10	11	27	12	32
		Polypedilum	1						
		Tribelos	48	85	62	53	67	119	69
		Tanytarsus					2		
Ephemeroptera	Heptageniidae	Stenacron				1			1
Lymnophila	Ancylidae	Ferrissia		3		1			
Trichoptera	Polycentropodidae	Cyrnellus	13	17	10	13	9	15	9

Macroinvertebrate raw data table for Station 13 during the fall of 2010.

Order	Family	Genus	Fall 2010						
			Sample No.						
			101	103	104	106	107	109	110
Decapoda	Palaemonidae	Macrobrachium							1
	Panopeidae	Rhithropanopeus	1	1	2				
	Portunidae	Callinectes							1
Diptera	Chironomidae	Chironomidae sp.			1				2
		Chironomid pupae	2	3		3		3	1
		Coelotanypus						1	
		Ablabesmyia	14	8	16	20	15	14	10
		Subfamily Orthocldiinae	1						
		Nanocladius		1	1				1
		Dicrotendipes	6	5	3	3	5	1	5
		Parachironomus			1				
		Polypedilum	3	1	2	1			5
		Tribelos	31	16	36	27	11	31	35
		Xenochironomus	1						5
		Tanytarsus	1		1	1		1	
Eulamellibranchia	Dreissenidae	Mytilopsis	25	50	11	12	17	20	12
Neuroptera	Sisyridae	Climacia	1						
Odonata	Corduliidae	Neurocordulia					1		
Trichoptera	Polycentropodidae	Cyrnellus	7	8	30	11	18	13	16

Macroinvertebrate raw data table for Station 14 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	121	122	123	124	125	126	127
Amphipoda	Corophiidae	Apocorophium	4	30	26	19	26	19	13
	Gammaridae	Gammarus	7	8	22	8	33	25	6
Diptera	Chironomidae	Chironomid pupae		1	2				
		Ablabesmyia	6	1	4	8	19	6	10
		Thienemanniella	6	4	10	6	34	14	5
		Nanocladius	10	7	12	6	19	19	7
		Cryptochironomus	2		4				
		Dicrotendipes	6	3	8	2	8	11	5
		Harnischia	2						
		Parachironomus	2						
		Polypedilum	17	8	12	10	23	33	7
		Stenochironomus							1
		Tribelos	43	29	34	64	46	56	33
		Stelechomyia		1					
		Pseudochironomus	2	1		2	4		2
		Rheotanytarsus	15	19	28	16	49	22	21
		Tanytarsus				2			1
	Empididae	Hemerodromia				1	1	2	1
	Simuliidae	Simulium		1		1	4		
Ephemeroptera	Baetidae	Baetidae sp.	1						
		Pseudocloeon		2				1	
	Caenidae	Caenis	2	2	2	4	7	4	2
	Heptageniidae	Heptageniidae sp.		2	2		4	1	
		Stenacron	2						
		Maccaffertium	39	32	32	19	25	19	18
	Leptohyphidae	Tricorythodes		2		5	3	2	2
Eulamellibranchia	Corbiculidae	Corbicula							1
Hydroida	Hydridae	Hydra	1						
Trichoptera	Hydropsychidae	Trichoptera sp.	3	4	4		15	4	2
		Cheumatopsyche		1					
		Hydropsyche	97	90	42	25	92	120	39
	Leptoceridae	Oecetis						1	
	Polycentropodidae	Cyrnellus	40	36	32	43	49	51	45
		Neureclipsis	3	4	5	4	13	6	3
Tubificida	Naididae (Naidinae)	Naididae sp.	6	2	4	8	12	9	4
	Naididae (Pristininae)	Pristinella					1	7	
	Naididae (Tubificinae)	Tubificidae sp.	1				1	1	

Macroinvertebrate raw data table for Station 14 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	122	124	125	126	128	129	130
Amphipoda	Corophiidae	Apocorophium					1		1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1						
	Chironomidae	Chironomidae sp.	1						
		Chironomid pupae	3	7	3	7	2	1	1
		Coelotanypus		2				1	1
		Ablabesmyia	19	14	8	10	17	12	13
		Nanocladius		1		1			
		Dicrotendipes	8	12	14	12	13	7	13
		Microchironomus	2						
		Parachironomus	1						
		Polypedilum				1			3
		Tribelos	43	62	41	46	39	33	40
		Stelechomyia					1		
		Tanytarsus	1	1				1	1
Odonata	Coenagrionidae	Argia						1	
Trichoptera	Polycentropodidae	Cyrnellus	10	9	4	7	9	1	8

Macroinvertebrate raw data table for Station 14 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	122	124	125	126	127	128	129
Decapoda	Palaemonidae	Macrobrachium					2		
	Panopeidae	Rhithropanopeus	7	2	4	3	4	3	8
	Portunidae	Callinectes		1					1
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1	1	
	Chironomidae	Chironomidae sp.						1	
		Chironomid pupae		1	2	1	1	1	3
		Coelotanypus		1	1		1	2	1
		Ablabesmyia	10	5	6	3	10	4	5
		Nanocladius	1		1		1	1	
		Dicrotendipes	5	8	8	4	11	9	1
		Polypedilum	7	6	4	7	4	3	2
		Tribelos	31	35	24	21	23	34	31
		Xenochironomus	1	1			1	8	5
		Tanytarsus	1	1	1		3	1	
Eulamellibranchia	Dreissenidae	Mytilopsis	6	13	26	18	51	12	9
Isopoda	Bopyridae	Bopyridae sp.					1		
Odonata	Coenagrionidae	Argia			1				
	Macromiidae	Macromia						1	
Trichoptera	Polycentropodidae	Cyrnellus	5	2	5	4	8	10	5
Tubificida	Naididae (Naidinae)	Naididae sp.	1			2			

Macroinvertebrate raw data table for Station 15 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	132	134	135	136	137	139	140
Amphipoda	Corophiidae	Apocorophium	2	2	4	11	1	10	1
	Gammaridae	Gammarus	3	3	3	8	2	6	5
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1			1		
	Chaoboridae	Chaoborus						1	
	Chironomidae	Chironomidae sp.			3	4	3	5	
		Chironomid pupae							2
		Ablabesmyia	16	8	13	14	13	5	4
		Thienemanniella	8	1	10	14	13		13
		Nanocladius	11	4	5	22	5	5	4
		Chironomus				4			
		Cryptochironomus	5	2					
		Dicrotendipes	11	4			5	10	7
		Harnischia		1		4			
		Polypedilum	11		3	7	5	2	
		Stenochironomus					3		
		Tribelos	84	52	100	116	67	113	70
		Pseudochironomus				4	3		
		Rheotanytarsus	3	4	10	22	21	7	7
		Tanytarsus			5	4			2
	Empididae	Hemerodromia			1				
Ephemeroptera	Caenidae	Caenis	2			2	2		
	Heptageniidae	Heptageniidae sp.	1		2		2	1	1
		Maccaffertium	9	13	9	7	9	9	5
	Leptohyphidae	Tricorythodes	2		1	1	3	3	
Eulamellibranchia	Corbiculidae	Corbicula						1	
Trichoptera	Hydropsychidae	Trichoptera sp.	2		2		4		1
		Hydropsyche	19	23	31	6	22	13	34
	Polycentropodidae	Cyrnellus	69	52	68	87	67	73	74
		Neureclipsis	2	6	3	1	6	4	1
Tubificida	Naididae (Naidinae)	Naididae sp.	7	2	7	16	3		1
	Naididae (Pristininae)	Pristinella			1	10	1		
	Naididae (Tubificinae)	Tubificidae sp.				1			

Macroinvertebrate raw data table for Station 15 during the summer of 2010.

Order	Family	Genus	Summer 2010 Sample No. 131	132	135	137	138	139	140
Diptera	Chironomidae	Chironomidae sp.						2	
		Chironomid pupae			2	4	2	10	2
		Coelotanypus		14	2				
		Ablabesmyia	8	27	20	19	21	20	25
		Cryptochironomus					2		
		Dicrotendipes	34	7	11	34	19	6	17
		Microchironomus				2			1
		Polypedilum		2		4	5	4	1
		Stictochironomus					2	4	
		Tribelos	62	82	49	44	77	60	46
		Rheotanytarsus			1				
		Tanytarsus				2	5		1
Trichoptera	Polycentropodidae	Cyrnellus	29	29	26	19	25	31	21

Macroinvertebrate raw data table for Station 15 during the fall of 2010.

Order	Family	Genus	Fall 2010 Sample No. 132	133	134	136	137	138	140
Amphipoda	Melitidae	Melita	2						
Decapoda	Palaemonidae	Macrobrachium	1		1	1			
	Panopeidae	Rhithropanopeus	3	1	3	1	2	1	2
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1		2		
	Chironomidae	Chironomidae sp.	1			2	2		
		Chironomid pupae	2	3	2	3	1		
		Coelotanypus			1		1	1	1
		Ablabesmyia	2	4	3	8	5	4	6
		Nanocladius	2	2	2		1	1	
		Dicrotendipes	7	4	12	6	15	3	2
		Microchironomus		1	1			1	
		Polypedilum	8	4	3	2	6		3
		Stictochironomus	2						
		Tribelos	32	59	40	34	32	6	30
		Xenochironomus		2	1	14	21		
		Tanytarsus	3		5	1	1		1
Eulamellibranchia	Dreissenidae	Mytilopsis	54	19	66	44	72	36	25
Neuroptera	Sisyridae	Climacia		2		3	2		
Odonata	Coenagrionidae	Argia							1
	Polycentropodidae	Cyrnellus	4	9	7	8	8	6	6
Tubificida	Naididae (Tubificinae)	Tubificidae sp.		1					

Macroinvertebrate raw data table for Station 16 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	151	152	153	155	156	157	159
Amphipoda	Corophiidae	Apocorophium	224	72	91	44	132	195	103
	Gammaridae	Gammarus	45	37	46	17	101	67	30
Coleoptera	Elmidae	Stenelmis	1						
Collembola	Entomobryidae	Entomobryidae sp.						1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.			2		1		
	Chironomidae	Chironomid pupae		3					1
		Coelotanypus		2	1	2		2	1
		Ablabesmyia	3	10		2	5		5
		Larsia					1		
		Thienemannimyia group				1			
		Thienemanniella		1	4	6			
		Nanocladius	1		2		1		2
		Chironomus			1				
		Cryptochironomus				1	1		
		Dicrotendipes	2	2	4	3	6	1	5
		Microtendipes					1		
		Polypedilum	3	2	2	8	8	2	14
		Stictochironomus		1		1			
		Tribelos	32	44	32	30	36	35	56
		Stempellina							1
		Cladotanytarsus							1
		Rheotanytarsus		1	3	10	1	2	3
	Empididae	Hemerodromia	1				1		
Ephemeroptera	Baetidae	Pseudocloeon					1		
	Caenidae	Caenis	1	4	5	2	11	4	5
	Heptageniidae	Heptageniidae sp.	1	1	3	3	4	3	17
		Stenacron		3	1			1	
		Maccaffertium	33	25	27	38	28	27	2
	Leptohyphidae	Tricorythodes	1	6		6	6	1	4
Eulamellibranchia	Corbiculidae	Corbicula		1				1	
Hoplonemertea	Tetrastemmatidae	Nematoda sp.		3	5				1
Hydroida	Hydridae	Hydra				2			
Lymnophila	Planorbidae	Menetus	1	1					
Trichoptera	Hydropsychidae	Trichoptera sp.				2			
		Cheumatopsyche			1	2			
		Hydropsyche		11		48	5		7
	Polycentropodidae	Cyrnellus	16	32	24	28	21	15	30
		Neureclipsis		4	3				4
Tubificida	Naididae (Naidinae)	Naididae sp.		3	1	5	2	1	8
	Naididae (Pristininae)	Pristinella		1				1	4
	Naididae (Tubificinae)	Tubificidae sp.	1	2	2	1		2	1

Macroinvertebrate raw data table for Station 16 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	152	153	154	155	157	158	160
Diptera	Ceratopogonidae	Ceratopogonidae sp.			2		2	1	
	Chironomidae	Chironomid pupae		1		1		2	2
		Coelotanypus		1	2	2	1	1	4
		Ablabesmyia	16	10	22	10	23	14	15
		Chironomus						1	
		Dicrotendipes	5	6	6	9	3	11	10
		Microchironomus		1					1
		Parachironomus							1
		Polypedilum		1	2	2	2		1
		Stictochironomus		1	1			1	1
		Tribelos	32	41	17	24	45	45	37
		Tanytarsus				1	2		2
Ephemeroptera	Ephemeridae	Hexagenia	1				1		
Odonata	Corduliidae	Neurocordulia							1
Trichoptera	Polycentropodidae	Cyrnellus	19	17	8	11	14	25	11
Tubificida	Naididae (Tubificinae)	Tubificidae sp.	2		3				

Macroinvertebrate raw data table for Station 16 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	151	153	154	156	157	158	159
Decapoda	Palaemonidae	Macrobrachium	1	1	1	1		1	
	Panopeidae	Rhithropanopeus	2	3	1	1	5	1	
Diptera	Chironomidae	Chironomidae sp.			1	1	1		
		Chironomid pupae			1	1	3		
		Coelotanypus					1		1
		Ablabesmyia	3		4	3	3	3	3
		Subfamily Orthocldiinae			2		1		
		Nanocladius	1	1	1	1	2		
		Dicrotendipes	2	1	4	2	9		1
		Polypedilum	3	5	6	4	6	2	
		Tribelos	13	7	15	16	18	13	
		Xenochironomus			51		12		
		Tanytarsus				1	1		8
Eulamellibranchia	Dreissenidae	Mytilopsis	16	14	66	6	35	8	32
Mesogastropoda	Hydrobiidae	Littoridinops			1			1	
Neuroptera	Sisyridae	Climacia			1				
Trichoptera	Polycentropodidae	Cyrnellus	2	2	1	6	4	1	4
Tubificida	Naididae (Naidinae)	Naididae sp.				1	1		

Macroinvertebrate raw data table for Station 17 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	161	162	163	164	165	169	170
Amphipoda	Corophiidae	Apocorophium	17	5	23	39	11	9	21
	Gammaridae	Gammarus	44	18	54	31	19	33	49
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1		1		
	Chironomidae	Chironomidae sp.	1					2	
		Chironomid pupae	2	1		1	1	3	
		Coelotanypus		1		2		2	1
		Procladius			1			2	
		Ablabesmyia	6	4	14	6	11	8	4
		Nilotanypus					1		
		Thienemanniella	7	9	5	7	5	7	3
		Nanocladius	1	2	6	8			2
		Parakiefferiella				1			
		Cryptochironomus		1					
		Dicrotendipes		1		3	2	1	1
		Glyptotendipes	1			1	1		
		Goeldichironomus	1						
		Harnischia					1		
		Polypedilum	12	9	16	17	6	2	14
		Stictochironomus					1		
		Tribelos	38	20	42	32	52	44	32
		Stempellina				1			
		Pseudochironomus			1	1			
		Cladotanytarsus				1			
		Rheotanytarsus	9	11	4	16	5	3	13
		Tanytarsus	1		1			2	
Ephemeroptera	Baetidae	Pseudocloeon	1						
	Caenidae	Caenis	9	4	6	9	6	4	18
	Ephemeridae	Hexagenia						1	
	Heptageniidae	Heptageniidae sp.	3	7	4	3	2	5	3
		Stenacron	1	1	1		1	1	
		Maccaffertium	52	51	25	33	20	36	40
	Leptohyphidae	Tricorythodes	4	6	4	9	3	2	6
Eulamellibranchia	Corbiculidae	Corbicula	1	2	1		4	2	
Hoplonemertea	Tetrastemmatidae	Nematoda sp.				1			
Hydroida	Hydridae	Hydra			2	1			
Lymnophila	Planorbidae	Menetus						1	
Odonata	Gomphidae	Gomphiidae sp.				1			
Trichoptera	Hydropsychidae	Trichoptera sp.	1	3	4	2			
		Cheumatopsyche	1	1					1
		Hydropsyche	17	22	27	26	1		18
	Leptoceridae	Ceraclea							1
	Polycentropodidae	Cyrnellus	34	11	12	43	19	27	19
		Neureclipsis		3	2	2	3	3	1
Tubificida	Naididae (Naidinae)	Naididae sp.	8	2	5		1	5	1
	Naididae (Pristininae)	Pristinella	1					1	
	Naididae (Tubificinae)	Tubificidae sp.	1		1				

Macroinvertebrate raw data table for Station 17 during the summer of 2010.

Order	Family	Genus	Summer 2010						
			Sample No.						
			161	162	164	165	167	168	169
Decapoda	Panopeidae	Rhithropanopeus					1		
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1			1	
	Chironomidae	Chironomid pupae	2	1	2	5	6		2
		Coelotanypus	1	2	2	1	1		1
		Procladius				1		1	
		Ablabesmyia	9	14	12	17	7	12	23
		Dicrotendipes	16	12	29	13	13	20	7
		Microchironomus		1		1	1	1	
		Polypedilum	1	1	2	3	2	2	5
		Stenochironomus			1				
		Tribelos	25	26	29	27	26	27	21
		Tanytarsus		1	1	1			1
Ephemeroptera	Ephemeridae	Hexagenia						1	
Odonata	Corduliidae	Neurocordulia			1				
Trichoptera	Polycentropodidae	Cyrnellus	11	18	10	16	16	12	17
Tubificida	Naididae (Tubificinae)	Tubificidae sp.	1						1

Macroinvertebrate raw data table for Station 17 during the fall of 2010.

Order	Family	Genus	Fall 2010						
			Sample No.						
			161	163	164	166	168	169	170
Decapoda	Panopeidae	Rhithropanopeus	4	2	6			5	2
Diptera	Chironomidae	Chironomidae sp.		1					
		Chironomid pupae				2	1		
		Ablabesmyia	1		1	1		1	1
		Nanocladius	1						
		Dicrotendipes	2	3	2	1	2	3	1
		Polypedilum	2	1	3	5	1	1	4
		Tribelos	5	10	5	16	9	6	4
		Xenochironomus		4	5				
		Tanytarsus				1			
Eulamellibranchia	Dreissenidae	Mytilopsis	26	31	9	38	10	12	4
Mesogastropoda	Hydrobiidae	Littoridinops				1	1		
Neuroptera	Sisyridae	Climacia		4	1				
Odonata	Coenagrionidae	Argia		1					
Trichoptera	Polycentropodidae	Cyrnellus				2	2	3	1

Macroinvertebrate raw data table for Station 18 during the spring of 2010.

			Spring 2010						
			Sample No.						
Order	Family	Genus	172	173	174	175	176	178	179
Amphipoda	Corophiidae	Apocorophium	38	62	47	45	37	58	44
	Gammaridae	Gammarus	121	46	132	76	137	278	126
Diptera	Ceratopogonidae	Ceratopogonidae sp.				1	1	1	
	Chironomidae	Chironomidae sp.				1	1		
		Chironomid pupae	2					2	2
		Coelotanypus	1	1	1	1		1	
		Procladius		1		2			
		Ablabesmyia	3	2		2		1	5
		Thienemanniella	1	1	3	1	1		4
		Nanocladius	2	1	1	1			6
		Chironomus		1				1	
		Cryptochironomus	1	1		1		4	
		Dicrotendipes	1	1	2			1	
		Glyptotendipes	1						
		Harnischia				2			
		Polypedilum	17	3	5	3	10	17	21
		Tribelos	17	26	7	12	15	12	20
		Stempellina				1			
		Stelechomyia			1				
		Pseudochironomus	1						
		Rheotanytarsus	3	5		1			6
		Tanytarsus		1	1				1
	Empididae	Hemerodromia						1	
Ephemeroptera	Caenidae	Caenis	6	3	7	5	12	29	20
	Heptageniidae	Heptageniidae sp.	3	3	2	2		4	1
		Stenacron	1		1	4	1		
		Maccaffertium	61	51	26	55	55	25	41
	Leptohyphidae	Tricorythodes	25	6	15	6	11	13	27
Eulamellibranchia	Corbiculidae	Corbicula					1		
Isopoda	Asellidae	Caecidotea		1				1	
Lymnophila	Ancylidae	Ferrissia			1		4	3	
	Planorbidae	Menetus						1	
Trichoptera	Hydropsychidae	Trichoptera sp.	5						1
		Cheumatopsyche	1				1	2	2
		Hydropsyche	53		6		1	4	35
		Potamyia	1						3
	Leptoceridae	Nectopsyche					1		1
	Polycentropodidae	Cyrnellus	20	22	13	12	9	19	23
		Neureclipsis	3	2	1	4			3
Tubificida	Naididae (Naidinae)	Naididae sp.	3		2		2	2	
	Naididae (Pristininae)	Pristinella					1		
	Naididae (Tubificinae)	Tubificidae sp.			1		1		

Macroinvertebrate raw data table for Station 18 during the summer of 2010.

			Summer 2010						
			Sample No.						
Order	Family	Genus	172	173	174	175	176	179	180
Decapoda	Portunidae	Callinectes							1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1	1		1	1	2	1
	Chironomidae	Chironomidae sp.				1		1	
		Chironomid pupae	1	5	1	2	2		2
		Coelotanypus	3	3	1	2	2	2	3
		Ablabesmyia	23	19	29	29	25	31	26
		Nanocladius	1				2		
		Dicrotendipes	11	14	9	25	29	10	7
		Polypedilum	4	2	4	6	11	1	1
		Stictochironomus	1						1
		Tribelos	40	15	29	30	32	39	28
		Stelechomyia						1	
		Cladotanytarsus	1						
		Tanytarsus	2						
Trichoptera	Polycentropodidae	Cyrnellus	20	23	19	37	27	20	24

Macroinvertebrate raw data table for Station 18 during the fall of 2010.

			Fall 2010						
			Sample No.						
Order	Family	Genus	172	173	175	176	178	179	180
Amphipoda	Amphilochidae	Hourstonia	2						
	Melitidae	Melita					1		
Decapoda	Palaemonidae	Macrobrachium				1		1	1
	Panopeidae	Rhithropanopeus	3	5	2	4	5	5	
Diptera	Chironomidae	Chironomid pupae	1	1				1	
		Ablabesmyia		2		1			
		Nanocladius		1		1		1	1
		Dicrotendipes							1
		Polypedilum	3	3	1	1	2	2	
		Tribelos	1	6	2	3	5	8	3
Eulamellibranchia	Dreissenidae	Mytilopsis	7	10	4	8	9	7	5
		Dreissena	1						
Trichoptera	Polycentropodidae	Cyrnellus			1		1		2

Macroinvertebrate raw data table for Station 1 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	1	2	3	5	6	8	9
Amphipoda	Corophiidae	Apocorophium		1	64		12	22	104
	Gammaridae	Gammarus	7	10		36	8	7	8
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		
	Chironomidae	Chironomid pupae			1		1		
		Ablabesmyia	4	11	14	9	3	13	10
		Nanocladius	4	7	8	11	6	10	4
		Chironomus						3	2
		Cryptochironomus							2
		Dicrotendipes	27	34	71	37	99	108	51
		Glyptotendipes	1	2	5	1		3	2
		Polypedilum	1		5	3	8	13	6
		Tribelos	12	36	30	4	20	17	25
		Rheotanytarsus		4	3		6		
		Tanytarsus	1			1			
Ephemeroptera	Heptageniidae	Maccaffertium	1	2		8	2	1	14
	Leptohyphidae	Tricorythodes			1		1		
Eulamellibranchia	Corbiculidae	Corbicula		1	1		3	5	1
Trichoptera	Hydropsychidae	Hydropsyche	7	6	42	14	40	4	11
	Polycentropodidae	Cyrnellus	63	60	50	70	62	58	44
	Trichoptera sp.	Trichoptera pupae	1	3	2	2	1	5	2

Macroinvertebrate raw data table for Station 1 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	1	2	3	5	6	8	9
Amphipoda	Corophiidae	Apocorophium			1				
	Gammaridae	Gammarus						1	
Diptera	Chironomidae	Chironomid pupae	2	3	1	1		2	1
		Coelotanypus	2			7			2
		Ablabesmyia	36	30	36	33	41	28	45
		Dicrotendipes	43	35	49	21	22	22	20
		Glyptotendipes	2	4					
		Polypedilum	5	6	8	2	6	1	
		Tribelos	32	22	34	23	29	18	31
		Pseudochironomus		2					
		Tanytarsus			2	2			
Odonata	Ceratopogonidae	Ceratopogonidae sp.		1					
Trichoptera	Polycentropodidae	Cyrnellus	64	41	50	34	59	35	38
	Trichoptera	Trichoptera pupae		1	2		1		

Macroinvertebrate raw data table for Station 1 during the fall of 2011.

Order	Family	Genus	Fall 2011 Sample No. 2	3	5	6	7	8	9
Amphipoda	Corophidae	Apocorophium		1	9	2	23		
Decapoda	Panopeidae	Rhithropanopeus	1	1		1		1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		
	Chironomidae	Chironomid pupae	1			1	1		1
		Coelotanypus	1		1	5	2	2	3
		Ablabesmyia	1	2	11	6	8	3	2
		Nanocladius	9	6	7	1	9		10
		Cryptochironomus		1					
		Dicrotendipes	6	5	6	8	5	9	10
		Glyptotendipes				3		1	
		Microchironomus		1					
		Tribelos	54	17	21	44	41	50	45
		Rheotanytarsus		1	6		1		5
		Tanytarsus	1	3	1	3		1	
Ephemeroptera	Caenidae	Caenis							1
	Heptageniidae	Caenis				4			
		Stenacron							1
		Maccaffertium		2	1	1		2	
	Leptohyphidae	Tricorythodes			2	1			
Odonata	Coenagridonidae	Argia					1	2	1
Pelecypoda	Dreisseniidae	Mytilopsis					1	2	
Trichoptera	Polycentropodidae	Cyrnellus	23	26	22	22	30	22	21
Tubificida	Naididae (Naidinae)	Nadidae sp.		1			1	1	

Macroinvertebrate raw data table for Station 2 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	2	3	4	6	7	9	10
Amphipoda	Corophiidae	Apocorophium	136	147	92	386	181	229	188
	Gammaridae	Gammarus	1	30	2	47	27	12	25
Diptera	Ceratopogonidae	Ceratopogonidae sp.	2		1	1	1	1	2
	Chironomidae	Chironomid pupae	2	1	1		1	1	1
		Coelotanypus	4	7	20	16	2		
		Procladius					2	4	3
		Ablabesmyia	16	9	26	21	15	29	27
		Nanocladius	2	9	6	2	8	8	6
		Chironomus	2			2			
		Cryptochironomus							3
		Dicrotendipes	50	43	68	58	41	79	43
		Glyptotendipes	4	5			4	33	12
		Harnischia	2					4	
		Polypedilum	14	14	10	16	12	17	24
		Tribelos	14	28	33	16	10	29	31
		Stelechomyia	2						
		Rheotanytarsus		2			6	4	3
		Tanytarsus					2		
Ephemeroptera	Caenidae	Caenis				1			1
	Leptohyphidae	Tricorythodes		1			1	1	1
Eulamellibranchia	Corbiculidae	Corbicula	2	2	1		2		
	Sphaeriidne	Stictochironomus			2	3		2	1
Odonata	Corduliidae	Neurocordulia					1		1
Trichoptera	Hydropsychidae	Hydropsyche	13	1	19	6	1	19	6
	Polycentropodidae	Cyrnellus	71	69	87	80	71	96	77
	Trichoptera sp.	Trichoptera pupae	5	1	4	2	1	7	3
Tubificida	Naididae	Naididae sp.				1			

Macroinvertebrate raw data table for Station 2 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	3	4	5	7	8	9	10
Amphipoda	Corophiidae	Apocorophium	1				2		
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1	3	5	4	6	1	5
	Chironomidae	Chironomid pupae	1			1	2		
		Coelotanypus	7	10	4	5	7	21	10
		Procladius	1						
		Ablabesmyia	20	22	46	47	63	37	23
		Nanocladius			2				
		Dicrotendipes	6	7	11	31	22	13	23
		Glyptotendipes		3	2	2		2	1
		Polypedilum	6	24	17	14	11	6	8
		Tribelos	12	19	9	7	4	17	11
		Rheotanytarsus				2			
		Tanytarsus			2	5	2		5
Ephemeroptera	Ephemeridae	Hexagenia						1	
Trichoptera	Hydropsychidae	Hydropsyche					2	2	1
	Polycentropodidae	Cyrnellus	60	49	53	88	82	81	50
	Trichoptera	Trichoptera pupae		1	1		2		1
Tubificida	Naididae (Naidinae)	Naididae sp.	2		1				

Macroinvertebrate raw data table for Station 2 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	3	4	5	6	7	8	10
Amphipoda	Corophidae	Apocorophium	12	21	1	2		1	4
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1					1
	Chironomidae	Chironomid pupae					1	3	2
		Coelotanypus	19	14	9	2	12	5	8
		Ablabesmyia	9	4	7	12	10	8	14
		Nanocladius	4	15	3	5	10	4	6
		Dicrotendipes	6	5	6	7	12	7	10
		Glyptotendipes	2	6	1	3	1		3
		Polypedilum	6	3	1		1	3	2
		Stictochironomus		4					
		Tribelos	11	8	29	12	22	12	11
		Rheotanytarsus	2	1	2	2	3	1	5
		Tanytarsus	4	3		1	1		1
Ephemeroptera	Caenidae	Caenis							1
	Ephemeridae	Hexagenia	6	2	3	5	1	3	
	Heptageniidae	Maccaffertium		2	21	3	7	10	5
	Leptohyphidae	Tricorythodes	1						
Odonata	Coenagridonidae	Argia	2			1			
Trichoptera	Polycentropodidae	Cyrnellus	53	59	54	42	63	54	48
	Trichoptera	Trichoptera pupae	1	1	1	1			
Tubificida	Naididae (Naidinae)	Naididae sp.	2	7	7		1	1	1

Macroinvertebrate raw data table for Station 3 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	1	4	6	7	8	9	10
Amphipoda	Corophiidae	Apocorophium	78	144	103	51	59	1	27
	Gammaridae	Gammarus	6	6	9	6	4		
Diptera	Ceratopogonidae	Ceratopogonidae sp.	6	1	1			5	2
	Chironomidae	Chironomid pupae				1	1		
		Coelotanypus	2	2	2			3	3
		Procladius		3	2	2	2	1	
		Ablabesmyia	17	31	21	23	14	8	26
		Nanocladius	8	5	2	7	2	1	3
		Chironomus	2						3
		Dicrotendipes	40	24	41	57	23	12	72
		Glyptotendipes	6	2			7	2	
		Harnischia	4	2	4	2	2	3	6
		Microchironomus				2			
		Paralauterborniella				2			
		Polypedilum	11	9	13		9	3	6
		Tribelos	13	9	21	19	55	14	36
		Rheotanytarsus	2					1	6
		Tanytarsus				2		1	
Ephemeroptera	Caenidae	Caenis		1					1
	Ephemeridae	Hexagenia				1		1	
	Heptageniidae	Maccaffertium	1			1	2		1
	Leptohyphidae	Tricorythodes			1				
Eulamellibranchia	Corbiculidae	Corbicula	6		1	4			
	Sphaeriidne	Stictochironomus			2			1	1
Trichoptera	Hydropsychidae	Cheumatopsyche				1			
		Hydropsyche	1	1	1	19	4	2	18
	Polycentropodidae	Cyrnellus	80	63	74	78	73	66	89
	Trichoptera sp.	Trichoptera pupae	4		5	5	1	2	1
Tubificida	Naididae	Naididae sp.		1					

Macroinvertebrate raw data table for Station 3 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	1	4	5	6	7	9	10
Amphipoda	Corophiidae	Apocorophium			1	1		1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.				1	4	2	1
	Chironomidae	Chironomid pupae	2	2	1		1	1	
		Coelotanypus	4	2	6	2	3		5
		Procladius			1				
		Ablabesmyia	38	41	34	39	32	47	27
		Dicrotendipes	11	8	5	8	14	42	5
		Glyptotendipes			1				1
		Polypedilum	4	4	9	16	5	22	4
		Tribelos	34	43	21	35	11	47	20
		Tanytarsus	2		1	2	3		1
Ephemeroptera	Leptohyphidae	Tricorythodes						1	
Neuroptera	Sisyridae	Climacia			3			1	
Odonata	Coenagrionidae	Argia	1						
Trichoptera	Polycentropodidae	Cyrnellus	67	52	46	39	48	75	54
	Trichoptera	Trichoptera pupae		1	1	1		1	

Macroinvertebrate raw data table for Station 3 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	2	4	5	6	8	9	10
Amphipoda	Corophidae	Apocorophium	1	2	1		2		4
Coleoptera	Elmidae	Dubiraphia							1
Decapoda	Panopeidae	Rhithropanopeus		1	1	1	1		
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		
	Chironomidae	Chironomid pupae	2	1	3			2	1
		Coelotanypus	2		3		6	3	2
		Ablabesmyia	5	9	3	7	3		2
		Nanocladius	1	6		4	1	1	2
		Cryptochironomus		1					
		Dicrotendipes	5	7	7	11	8	11	10
		Glyptotendipes	2	3	4				
		Polypedilum		1	1				1
		Stictochironomus	1						
		Tribelos	24	31	51	38	38	48	20
		Rheotanytarsus	1			1		1	2
		Tanytarsus	3	4		5		4	1
Ephemeroptera	Caenidae	Caenis						1	
	Ephemeridae	Hexagenia			1	3	1	1	1
	Heptageniidae	Maccaffertium	1	3	6	3	1	1	3
	Leptohyphidae	Tricorythodes	1						1
Nematoda	Nematoda sp.	Nematoda sp.		5					
Odonata	Coenagridonidae	Argia	1		3	2		2	8
Pelecypoda	Dreisseniidae	Mytilopsis		1	4		2		1
Trichoptera	Hydropsychidae	Hydropsyche					1		1
	Polycentropodidae	Cyrnellus	17	20	8	10	20	22	9
Tubificida	Naididae (Naidinae)	Naididae sp.		2	2				1

Macroinvertebrate raw data table for Station 4 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	11	13	15	16	17	19	20
Amphipoda	Corophiidae	Apocorophium	113	136	62	7	65	79	210
	Gammaridae	Gammarus					1	6	5
Diptera	Ceratopogonidae	Ceratopogonidae sp.		2	4	3	1		
	Chironomidae	Chironomid pupae		1		2	1	1	1
		Procladius						2	2
		Ablabesmyia	14	33	25	25	22	24	15
		Nanocladius	4	12	3	4		2	
		Cryptochironomus						2	2
		Dicrotendipes	21	57	59	88	32	39	51
		Glyptotendipes	3	9	10		3	6	12
		Harnischia		6				2	5
		Parachironomus		3					
		Polypedilum	6	3	5	7	16	8	15
		Tribelos	19	24	20	53	59	10	15
		Pseudochironomus			5		3		
		Cladotanytarsus						2	
		Rheotanytarsus	1					2	
		Tanytarsus	1	3					
Ephemeroptera	Ephemeridae	Hexagenia			1				1
	Heptageniidae	Maccaffertium		3			1	6	11
Eulamellibranchia	Corbiculidae	Corbicula		2		1		4	5
	Sphaeriidne	Stictochironomus			3				
Trichoptera	Hydropsychidae	Hydropsyche			1				
	Polycentropodidae	Cyrnellus	91	155	127	137	103	112	62
	Trichoptera sp.	Trichoptera pupae	1	2	2	2	4	1	1

Macroinvertebrate raw data table for Station 4 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	11	12	15	16	17	19	20
Amphipoda	Corophiidae	Apocorophium	1				2	1	1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1	2	2		2		
	Chironomidae	Chironomid pupae	4	3	3		2		2
		Coelotanypus			3	7			
		Ablabesmyia	46	51	47	48	48	45	40
		Dicrotendipes	12	27	11	9	7	14	8
		Glyptotendipes							2
		Microchironomus				2			
		Polypedilum		2			2	2	4
		Tribelos	96	31	78	45	60	37	50
		Pseudochironomus					2		
		Tanytarsus				2		4	
Trichoptera	Polycentropodidae	Cyrnellus	69	62	53	60	43	54	41

Macroinvertebrate raw data table for Station 4 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	13	14	15	16	17	18	19
Amphipoda	Corophidae	Apocorophium						2	
Decapoda	Panopeidae	Rhithropanopeus		1	1	1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.			2				
	Chironomidae	Chironomid pupae		1					
		Coelotanypus			2	1	3	3	3
		Ablabesmyia	1	2	2	3	2	2	1
		Nanocladius	1	1	1	3			3
		Cryptochironomus							1
		Dicrotendipes	7	1		12	3	6	8
		Glyptotendipes	1	1					
		Polypedilum	1	5	3	1		2	
		Stictochironomus		1			1		1
		Tribelos	55	12	32	32	52	60	34
		Pseudochironomus							1
		Rheotanytarsus		2	1	1			
		Tanytarsus	3	2	3			2	3
Ephemeroptera	Caenidae	Caenis						2	
	Ephemeridae	Hexagenia					1		
	Heptageniidae	Maccaffertium	6		1	1	2		3
	Leptohyphidae	Tricorythodes	1					1	1
Odonata	Coenagridonidae	Argia						3	
Pelecypoda	Dreisseniidae	Mytilopsis	1		1	1	2	4	1
Trichoptera	Polycentropodidae	Cyrnellus	21	5	1	13	27	14	6
Tubificida	Naididae (Naidinae)	Naididae sp.		1	2				

Macroinvertebrate raw data table for Station 5 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	21	22	23	24	28	29	30
Amphipoda	Corophiidae	Apocorophium	229	291	58	95	252	253	173
	Gammaridae	Gammarus	41	14	8	5	40	21	9
Decapoda	Panopeidae	Rhithropanopeus			1				
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1			1		1	
	Chironomidae	Chironomid pupae					2	1	
		Coelotanypus		4		2		1	
		Procladius	1	2	1	3	2	4	2
		Ablabesmyia	5	11	8	2	7	6	2
		Cricotopus/Orthocladius						3	
		Nanocladius	1		4	5			9
		Axarus					2		
		Chironomus		2				1	
		Cryptochironomus	2	6		2	4		3
		Cryptotendipes			1				
		Dicrotendipes	20	6	33	31	21	31	30
		Glyptotendipes				2		1	
		Harnischia		4	1		2	1	9
		Microchironomus			1	5		3	5
		Polypedilum	3	4	1	11	4	7	2
		Stictochironomus				2			
		Tribelos	11	52	20	22	61	10	22
		Pseudochironomus					2		
		Rheotanytarsus				2			
		Tanytarsus	1	4		2		1	2
Ephemeroptera	Heptageniidae	Maccaffertium	8	7	4	11	5	9	13
Eulamellibranchia	Corbiculidae	Corbicula		2				1	3
Trichoptera	Polycentropodidae	Cyrnellus	14	22	24	31	31	21	26
	Trichoptera sp.	Trichoptera pupae	1	3	1	1		1	1

Macroinvertebrate raw data table for Station 5 during the summer of 2011.

			Summer 2011						
			SampleNum						
Order	Family	Genus	23	24	26	27	28	29	30
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1		1		1
	Chironomidae	Chironomid pupae	1	2	2		1	1	
		Coelotanypus					2		
		Ablabesmyia	15	24	25	17	13	32	22
		Axarus	1						
		Chironomus						2	
		Cryptochironomus			1				3
		Dicrotendipes	21	12	23	30	42	16	14
		Microchironomus	1	6		3	8		1
		Polypedilum	7	6	4		4	8	6
		Tribelos	20	48	35	37	25	43	28
		Rheotanytarsus							1
		Tanytarsus	1				2		3
Ephemeroptera	Ephemeridae	Hexagenia				1			
Odonata	Coenagrionidae	Argia					1		
Trichoptera	Polycentropodidae	Cyrnellus	26	25	32	29	42	26	44
	Trichoptera	Trichoptera pupae					1		

Macroinvertebrate raw data table for Station 5 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	21	22	23	26	28	29	30
Amphipoda	Corophidae	Apocorophium			1			1	4
Decapoda	Panopeidae	Rhithropanopeus	2	5	4	2	2	5	4
Diptera	Chironomidae	Chironomid pupae						2	
		Coelotanypus				1	1		
		Ablabesmyia						3	3
		Nanocladius	4	3	2	1	6	7	5
		Cryptochironomus							1
		Dicrotendipes	3	2	2	1		6	4
		Glyptotendipes		1					
		Polypedilum		2	3				
		Tribelos	20	9	2	9	7	8	13
		Rheotanytarsus							1
		Tanytarsus	2	1			2	1	3
Ephemeroptera	Caenidae	Caenis	1	1	1				1
	Heptageniidae	Maccaffertium			1				
Nematoda	Nematoda sp.	Nematoda sp.		2					
Odonata	Coenagridonidae	Argia					1		
Pelecypoda	Dreisseniidae	Mytilopsis	1		3	5	1	3	1
Trichoptera	Polycentropodidae	Cyrnellus	17	4	4	3	3	5	1

Macroinvertebrate raw data table for Station 6 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	32	33	34	35	36	38	40
Amphipoda	Corophiidae	Apocorophium	5	11	3	4	20	13	44
	Gammaridae	Gammarus	1		20	3	17		6
Decapoda	Panopeidae	Rhithropanopeus	1			1		1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.	7		2	1			
	Chironomidae	Chironomid pupae	1		1	3			5
		Coelotanypus			2		4		
		Procladius			2			2	4
		Ablabesmyia	6	18	10	9	12	9	9
		Labrundinia						2	
		Nanocladius	11	2	10	12	4	9	13
		Axarus		2					
		Chironomus			2	3			
		Cryptochironomus		2					
		Dicrotendipes	56	39	66	92	61	44	54
		Glyptotendipes	3		2				4
		Harnischia		2			8		4
		Microchironomus	3						2
		Polypedilum	8	4	2	3		5	4
		Tribelos	48	30	17	30	8	30	9
		Pseudochironomus							2
		Rheotanytarsus	3		5		4	2	2
		Tanytarsus	3					2	
Ephemeroptera	Heptageniidae	Maccaffertium	10	2	14	9	13	9	4
	Leptohyphidae	Tricorythodes			1				
Eulamellibranchia	Sphaeriidne	Stictochironomus						1	
Trichoptera	Hydropsychidae	Hydropsyche			1		5		1
	Polycentropodidae	Cyrnellus	24	36	25	21	33	15	49
	Trichoptera sp.	Trichoptera pupae	1						

Macroinvertebrate raw data table for Station 6 during the summer of 2011.

Order	Family	Genus	Summer 2011						
			Sample No.						
			33	34	35	36	38	39	40
Amphipoda	Corophiidae	Apocorophium	1		1		2		1
Decapoda	Panopeidae	Rhithropanopeus					1	1	
Diptera	Chironomidae	Chironomid pupae	1	1		2	2		4
		Ablabesmyia	23	11	17	6	21	22	27
		Dicrotendipes	23	13	8	25	13	15	8
		Glyptotendipes	2						
		Microchironomus	2				1		
		Polypedilum		3	13		6	7	2
		Tribelos	31	44	55	43	48	35	39
		Tanytarsus			2		6	2	3
Trichoptera	Polycentropodidae	Cyrnellus	67	38	21	36	29	29	39
	Trichoptera	Trichoptera pupae			1				

Macroinvertebrate raw data table for Station 6 during the fall of 2011.

Order	Family	Genus	Fall 2011						
			Sample No.						
			33	35	36	37	38	39	40
Amphipoda	Corophidae	Apocorophium		1		1			
Decapoda	Panopeidae	Rhithropanopeus	2	2	2	3	4		3
Diptera	Chironomidae	Chironomid pupae					1		
		Ablabesmyia	3	1	1	3	2	5	2
		Cricotopus/Orthocladius							1
		Nanocladius	4	4	3	7	2	6	2
		Cryptochironomus						1	1
		Dicrotendipes	3	4	4	3	1	9	3
		Glyptotendipes				1			
		Microchironomus						1	
		Polypedilum	1		1				
		Stictochironomus						1	
		Tribelos	11	26	15	30	15	27	17
		Rheotanytarsus				4		2	
		Tanytarsus	2	1	6	5	2	6	3
Ephemeroptera	Heptageniidae	Maccaffertium		1		1	1		1
	Leptohyphidae	Tricorythodes		1					
Pelecypoda	Dreisseniidae	Mytilopsis		1		4		2	2
Trichoptera	Polycentropodidae	Cyrnellus	14	7	7	15	4	15	5

Macroinvertebrate raw data table for Station 7 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	41	42	44	46	47	48	50
Amphipoda	Corophiidae	Apocorophium	2	2	4	4	6		6
	Gammaridae	Gammarus	2	25	10	13	6	10	16
Decapoda	Panopeidae	Rhithropanopeus		1		1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.						2	
	Chironomidae	Chironomid pupae				1		1	
		Coelotanypus				3			
		Procladius	3	3					
		Ablabesmyia	11	16	23	21	16	22	9
		Nanocladius	1	5	3	14	3	12	
		Cryptochironomus						3	
		Dicrotendipes	21	46	51	76	83	47	38
		Glyptotendipes	1	2	3				4
		Harnischia	1	2					
		Microchironomus		2					5
		Polypedilum			5		3		2
		Tribelos	22	10	43	52	54	71	33
		Tanytarsus	1						
Ephemeroptera	Heptageniidae	Maccaffertium	2	11	3	9	6		
Eulamellibranchia	Sphaeriidne	Stictochironomus			6	2		1	2
Trichoptera	Hydropsychidae	Hydropsyche	2	1	1	2		5	
	Polycentropodidae	Cyrnellus	40	31	52	46	27	56	46
	Trichoptera sp.	Trichoptera pupae	1		3	3		5	5

Macroinvertebrate raw data table for Station 7 during the summer of 2011.

Order	Family	Genus	Summer 2011						
			Sample No.						
			41	42	43	46	47	48	50
Decapoda	Panopeidae	Rhithropanopeus	1	1			1		
Diptera	Chironomidae	Chironomid pupae		1	2			1	2
		Coelotanypus		1				2	
		Ablabesmyia	23	24	25	11	23	26	25
		Cryptochironomus				2			
		Dicrotendipes	29	14	60	36	18	19	34
		Glyptotendipes	1	1			2		
		Microchironomus				2			
		Polypedilum	2		7	9		2	
		Tribelos	31	23	30	29	34	37	70
		Tanytarsus	4		2	2			
Ephemeroptera	Caenidae	Caenis		1	1		1		
Trichoptera	Polycentropodidae	Cyrnellus	72	50	61	36	63	69	94
	Trichoptera	Trichoptera pupae			1			2	

Macroinvertebrate raw data table for Station 7 during the fall of 2011.

Order	Family	Genus	Fall 2011						
			Sample No.						
			41	42	43	44	45	49	50
Amphipoda	Amphilochidae	Hourstonia				1			
	Corophidae	Apocorophium		1	1				
Decapoda	Palaemonidae	Palaemenetes		1					
	Panopeidae	Rhithropanopeus		2	1	1			2
Diptera	Ceratopogonidae	Ceratopogonidae sp.						1	
	Chironomidae	Chironomid pupae	1		2	1	1	1	
		Ablabesmyia	4	1	1	2	1	1	4
		Nanocladius	7	6	1		4	6	12
		Cryptochironomus				2			
		Dicrotendipes		5	4	5	1	4	3
		Glyptotendipes					2		
		Parachironomus							1
		Polypedilum						1	1
		Tribelos	26	46	48	16	17	35	21
		Rheotanytarsus		1	1	1			
		Tanytarsus	3			1	4	3	2
Ephemeroptera	Heptageniidae	Maccaffertium				1	1		2
	Leptohyphidae	Tricorythodes	1						
Pelecypoda	Dreisseniidae	Mytilopsis	1	1		1		1	
Trichoptera	Hydropsychidae	Hydropsyche			1				
	Polycentropodidae	Cyrnellus	8	6	16	2	6	8	2
	Trichoptera	Trichoptera pupae							1

Macroinvertebrate raw data table for Station 8 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	51	52	53	54	55	56	58
Amphipoda	Corophiidae	Apocorophium	18	1	11	17	3	16	18
	Gammaridae	Gammarus	4	2	4	5	5	4	4
Diptera	Ceratopogonidae	Ceratopogonidae sp.						2	
	Chironomidae	Chironomid pupae		1	2			3	2
		Coelotanypus	4		1	1	2	4	2
		Procladius	4	2	4			2	
		Ablabesmyia	7	8	3	7	12	6	16
		Nanocladius	7	2		2	2	8	2
		Chironomus			2				
		Dicrotendipes	32	33	32	29	31	35	33
		Glyptotendipes				1	2		2
		Microchironomus	2		1				2
		Polypedilum	4	2		2			2
		Tribelos	33	51	25	25	38	39	24
		Rheotanytarsus			2	1		4	
		Tanytarsus				2			
Ephemeroptera	Caenidae	Caenis				1			
	Ephemeridae	Hexagenia	1						
	Heptageniidae	Maccaffertium			4	2	3	6	1
	Leptohyphidae	Maccaffertium	1	4					
		Tricorythodes						1	
Eulamellibranchia	Corbiculidae	Corbicula					1		
	Sphaeriidne	Stictochironomus						1	
Trichoptera	Hydropsychidae	Hydropsyche						2	
	Polycentropodidae	Cyrnellus	31	29	23	23	36	25	36
	Trichoptera sp.	Trichoptera pupae		4		3	1	1	1

Macroinvertebrate raw data table for Station 8 during the summer of 2011.

Order	Family	Genus	Summer 2011						
			Sample No.						
			52	54	55	56	57	59	60
Amphipoda	Corophiidae	Apocorophium	1		1			1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.				1	2	4	1
	Chironomidae	Chironomid pupae	1	1					
		Coelotanypus	8	6	2		7	9	
		Ablabesmyia	18	21	29	26	28	23	24
		Dicrotendipes	10	22	2	25	17	8	28
		Glyptotendipes						1	2
		Microchironomus						1	4
		Polypedilum	2	3	2	2	1	4	6
		Tribelos	26	16	11	20	16	11	33
		Tanytarsus		3	1				4
Nematoda	Nematoda	Nematoda sp.						1	
Neuroptera	Sisyridae	Climacia		1			2		
Trichoptera	Polycentropodidae	Cyrnellus	44	45	44	51	46	34	53
	Trichoptera	Trichoptera pupae							1
Tubificida	Naididae (Naidinae)	Naididae sp.		1					1

Macroinvertebrate raw data table for Station 8 during the fall of 2011.

Order	Family	Genus	Fall 2011						
			Sample No.						
			52	53	54	56	57	59	60
Amphipoda	Amphilochidae	Hourstonia				3			
	Corophidae	Apocorophium	1		1	4		15	
Decapoda	Panopeidae	Rhithropanopeus	3	5	4	3	1	4	3
Diptera	Chironomidae	Chironomid pupae		2					2
		Coelotanypus			1				
		Ablabesmyia		2	3	2	2	1	2
		Nanocladius	2		2	5	3	5	1
		Cryptochironomus		2			1		
		Dicrotendipes	2	4	2	4	6	1	2
		Glyptotendipes	1						
		Parachironomus							2
		Paralauterborniella			1				
		Tribelos	12	30	23	19	12	13	20
		Rheotanytarsus					1		1
		Tanytarsus	1	1		1	1		
Ephemeroptera	Caenidae	Caenis			1	1			
	Heptageniidae	Maccaffertium					1		1
	Leptohyphidae	Tricorythodes		1		1			
Odonata	Coenagridonidae	Argia					1		
Pelecypoda	Dreisseniidae	Mytilopsis	4	3	2		2	2	3
Trichoptera	Polycentropodidae	Cyrnellus	3	3	3	3	11	2	2
Tubificida	Tubificidae	Tubificidae sp.							1

Macroinvertebrate raw data table for Station 9 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	63	64	65	66	67	69	70
Amphipoda	Corophiidae	Apocorophium				1			
	Gammaridae	Gammarus						1	
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1			1		4	
	Chironomidae	Chironomid pupae		1			1		1
		Coelotanypus				2	2		
		Ablabesmyia	46	29	26	32	31	51	38
		Dicrotendipes	25	11	21	16	31	12	14
		Glyptotendipes			2				
		Microchironomus				2			
		Polypedilum			8	4		6	8
		Tribelos	34	55	42	31	34	32	77
		Tanytarsus				4			
Trichoptera	Polycentropodidae	Cyrnellus	52	37	34	62	36	39	36
	Trichoptera	Trichoptera pupae		1				1	
Tubificida	Naididae (Naidinae)	Naididae sp.	1						1

Macroinvertebrate raw data table for Station 9 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	61	63	64	65	67	68	70
Amphipoda	Amphilochidae	Hourstonia					1		
	Corophidae	Apocorophium	1		1	1	1	1	1
Decapoda	Panopeidae	Rhithropanopeus	3	3	2	3	1	2	1
Diptera	Chironomidae	Chironomid pupae				1			
		Ablabesmyia	2	1	3	1	3		4
		Nanocladius	2	6	2	2		6	1
		Dicrotendipes	1	2	2		1	1	1
		Polypedilum		1	1		1	1	
		Tribelos	11	12	19	16	16	17	12
		Rheotanytarsus		1					
		Tanytarsus	3		1	1	1		1
Ephemeroptera	Caenidae	Caenis	1	1	1				
	Heptageniidae	Maccaffertium			1				
	Leptohyphidae	Tricorythodes				1			
Odonata	Coenagridonidae	Argia			1				
Trichoptera	Polycentropodidae	Cyrnellus	2	4		1		2	2
Tubificida	Naididae (Naidinae)	Naididae sp.	1						

Macroinvertebrate raw data table for Station 10 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	71	73	74	76	78	79	80
Amphipoda	Corophiidae	Apocorophium	3	8	2			1	15
	Gammaridae	Gammarus	3	4	2	2	5	7	2
Diptera	Chironomidae	Chironomid pupae							1
		Coelotanypus	1			2			5
		Ablabesmyia	15	16	17	8	18	17	18
		Nanocladius		3	2		4	2	5
		Dicrotendipes	21	13	10	9	29	12	12
		Glyptotendipes						1	
		Microchironomus			1				
		Tribelos	36	29	32	26	41	10	36
		Tanytarsus	2					1	
Ephemeroptera	Heptageniidae	Maccaffertium	11	15	6	12	12	21	19
Eulamellibranchia	Corbiculidae	Corbicula							1
Trichoptera	Hydropsychidae	Hydropsyche	6	1		6		2	1
	Polycentropodidae	Cyrnellus	26	22	27	29	26	35	48
	Trichoptera sp.	Trichoptera pupae		1		2	3		

Macroinvertebrate raw data table for Station 10 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	71	72	73	76	77	78	80
Amphipoda	Corophiidae	Apocorophium	1						1
	Gammaridae	Gammarus					1		
Diptera	Chironomidae	Chironomid pupae	2	1	3	2	1	4	1
		Coelotanypus				4	9		
		Ablabesmyia	29	23	26	21	44	18	25
		Dicrotendipes	15	22	39	9	15	18	27
		Glyptotendipes	2		3				
		Polypedilum			3	2	3		
		Tribelos	50	67	68	71	89	91	72
		Tanytarsus			3				
Nematoda	Nematoda	Nematoda sp.					1		
Trichoptera	Polycentropodidae	Cyrnellus	67	38	40	39	46	36	48
	Trichoptera	Trichoptera pupae							1
Tubificida	Naididae (Naidinae)	Naididae sp.						1	2

Macroinvertebrate raw data table for Station 10 during the fall of 2011.

Order	Family	Genus	Fall 2011						
			Sample No.						
			71	73	74	76	77	78	80
Amphipoda	Amphilochidae	Hourstonia	2	2	1				
	Corophidae	Apocorophium		1					
Decapoda	Palaemonidae	Macrobrachium			1			1	
	Panopeidae	Rhithropanopeus	1	2		2			2
Diptera	Chironomidae	Ablabesmyia	1	2	2		2	3	
		Nanocladius	3	5		4	4	2	13
		Dicrotendipes	1			6	5	1	1
		Tribelos	18	32	20	14	30	25	37
		Stelechomyia				1			
		Rheotanytarsus					2		1
		Tanytarsus		1					1
Ephemeroptera	Caenidae	Caenis					1	1	
Pelecypoda	Dreisseniidae	Mytilopsis			2				
Trichoptera	Polycentropodidae	Cyrnellus	5	9	6	6	10	18	9

Macroinvertebrate raw data table for Station 11 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	81	82	83	84	85	87	89
Amphipoda	Corophiidae	Apocorophium	1	27	80	5	8	1	13
	Gammaridae	Gammarus		3	1		3	2	1
Decapoda	Panopeidae	Rhithropanopeus	1	1		2	1		1
Diptera	Ceratopogonidae	Ceratopogonidae sp.							1
	Chironomidae	Chironomid pupae			1				
		Coelotanypus		1	2				
		Procladius					1		1
		Ablabesmyia	8	20	14	4	6	11	17
		Nanocladius	4	7	2	4	1	9	7
		Axarus							1
		Chironomus				1			
		Cryptochironomus		1					1
		Dicrotendipes	15	10	12	9	5	2	5
		Parachironomus						1	1
		Polypedilum	3				1	1	1
		Tribelos	14	26	54	8	13	29	21
		Rheotanytarsus	2		2			2	1
		Tanytarsus			2				
Ephemeroptera	Caenidae	Caenis			1			1	2
	Heptageniidae	Maccaffertium	15	24	16	16	14	22	13
	Leptohyphidae	Tricorythodes			1				1
Eulamellibranchia	Sphaeriidne	Stictochironomus			1				
Nematoda	Nematoda sp.	Nematoda sp.				1			
Plecoptera	Perlidae	801010	1						
Trichoptera	Hydropsychidae	Hydropsyche	2	2		2		8	2
	Polycentropodidae	Cyrnellus	19	22	20	12	15	41	12
	Trichoptera sp.	Trichoptera pupae					1	4	
Tubificida	Naididae	Naididae sp.	1						

Macroinvertebrate raw data table for Station 11 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	81	83	84	86	87	88	90
Amphipoda	Corophiidae	Apocorophium					1	2	
	Gammaridae	Gammarus	1	1					
Decapoda	Panopeidae	Rhithropanopeus						1	
Diptera	Chironomidae	Chironomid pupae				2			2
		Coelotanypus				1			
		Ablabesmyia	17	27	24	24	23	47	17
		Dicrotendipes	4	6	12	10	22	2	5
		Polypedilum	1		2		2		
		Tribelos	38	65	46	18	50	46	23
		Tanytarsus			2		2		
Ephemeroptera	Heptageniidae	Maccaffertium				1			
Trichoptera	Polycentropodidae	Cyrnellus	59	87	58	41	58	31	70
	Trichoptera	Trichoptera pupae		1	1				
Tubificida	Naididae (Naidinae)	Naididae sp.	1	3	2	1	3		1

Macroinvertebrate raw data table for Station 11 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	81	82	84	85	87	88	90
Amphipoda	Amphilochidae	Hourstonia	1	1	1	2		1	
	Corophidae	Apocorophium					1	1	
Decapoda	Palaemonidae	Macrobrachium					1		
	Panopeidae	Rhithropanopeus	7	4	4	7	6	7	5
Diptera	Chironomidae	Chironomid pupae	1						
		Ablabesmyia			1		3	1	1
		Nanocladius	5	5	3	3	2		3
		Dicrotendipes	2	2	1	1			1
		Glyptotendipes		1					
		Parachironomus		2					
		Tribelos	11	21	7	8	6	1	7
		Rheotanytarsus		2					1
		Tanytarsus		1		2			1
Ephemeroptera	Heptageniidae	Maccaffertium		1					
Pelecypoda	Dreisseniidae	Mytilopsis			1	1	6	1	3
Trichoptera	Hydropsychidae	Hydropsyche							1
	Polycentropodidae	Cyrnellus	2	11	9	5	7	1	1

Macroinvertebrate raw data table for Station 12 during the spring of 2011.

			Spring 2011					
			Sample No.					
Order	Family	Genus	91	94	97	98	99	100
Amphipoda	Corophiidae	Apocorophium	4	6	3	12	9	27
	Gammaridae	Gammarus	1	1	7	1	7	2
Decapoda	Panopeidae	Rhithropanopeus		1				1
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1			1	
	Chironomidae	Chironomid pupae	1		1			
		Coelotanypus				1		
		Procladius	2	6				1
		Ablabesmyia	15	17	4	9	17	25
		Nanocladius		2		4		4
		Cryptochironomus	1	2		4		
		Dicrotendipes	32	7	25	48	44	8
		Glyptotendipes			1			1
		Microchironomus	1	1				
		Parachironomus				2		
		Polypedilum		2	1			1
		Tribelos	18	16	17	26	33	15
		Pseudochironomus			1			
		Rheotanytarsus			1			
		Tanytarsus			1			
Ephemeroptera	Heptageniidae	Maccaffertium	14	1	14	17	14	6
	Leptohyphidae	Tricorythodes				1	1	
Eulamellibranchia	Corbiculidae	Corbicula				1		
Nematoda	Nematoda sp.	Nematoda sp.		1	1			1
Odonata	Corduliidae	Neurocordulia		1				
Trichoptera	Hydropsychidae	Hydropsyche			2			
	Polycentropodidae	Cyrnellus	4	7	9	12	18	3
Tubificida	Naididae	Naididae sp.						1
		Pristinella		1				

Macroinvertebrate raw data table for Station 12 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	91	93	95	96	97	98	99
Amphipoda	Corophiidae	Apocorophium			1				
Decapoda	Panopeidae	Rhithropanopeus			2	1	2	1	1
Diptera	Ceratopogonidae	Ceratopogonidae sp.				2	4	4	
	Chironomidae	Chironomid pupae	1	5		1	1	2	
		Coelotanypus				1	3		
		Ablabesmyia	29	24	39	25	22	22	42
		Nanocladius			1				
		Dicrotendipes	4	8	9	15	14	15	16
		Microchironomus				2	2		2
		Polypedilum				5	3	5	
		Tribelos	38	49	39	33	41	41	51
		Pseudochironomus				2			
Nematoda	Nematoda	Nematoda sp.		1					
Trichoptera	Polycentropodidae	Cyrnellus	13	25	13	17	32	43	33
Tubificida	Naididae (Naidinae)	Naididae sp.	2	1	1	1	3	1	

Macroinvertebrate raw data table for Station 12 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	91	93	95	96	97	98	99
Amphipoda	Amphilochidae	Hourstonia	2	2	2				5
	Corophidae	Apocorophium	2				1		
Decapoda	Palaemonidae	Macrobrachium				1		1	
	Panopeidae	Rhithropanopeus	1	6	5	4	7	2	5
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1						
	Chironomidae	Chironomid pupae	1						
		Ablabesmyia		4	2	1		1	6
		Nanocladius	2	2	4		4	6	9
		Parakiefferiella					1		
		Cryptochironomus						1	2
		Dicrotendipes	1	1		3	3	2	1
		Paralauterborniella	1						
		Polypedilum		1		1		1	
		Tribelos	9	4	5	10	3	27	21
		Rheotanytarsus	2					3	2
		Tanytarsus		5		2	1	2	1
Ephemeroptera	Heptageniidae	Maccaffertium			1			1	
Pelecypoda	Dreisseniidae	Mytilopsis	7		1	1	3	7	10
Trichoptera	Hydropsychidae	Hydropsyche		1					2
	Polycentropodidae	Cyrnellus	6	3			2	7	7
Tubificida	Naididae (Naidinae)	Naididae sp.				1		1	

Macroinvertebrate raw data table for Station 13 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	101	102	104	105	106	109	110
Amphipoda	Corophiidae	Apocorophium	37	2	96	3	5	62	4
	Gammaridae	Gammarus	8	7	11	3		3	9
Decapoda	Panopeidae	Rhithropanopeus			1				
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1						
	Chironomidae	Chironomid pupae		2	1				
		Coelotanypus					1	1	
		Ablabesmyia	6	12	6	17	6	10	6
		Nanocladius	1	5	2	9	7	3	
		Chironomus	1						
		Cryptochironomus			1				
		Dicrotendipes	20	12	21	39	15	22	27
		Glyptotendipes	2					1	
		Microchironomus					1		
		Parachironomus				4			
		Polypedilum	1	1	2	4	1	3	
		Tribelos	14	35	12	32	16	13	11
		Rheotanytarsus			1				
		Tanytarsus	1	1	1	2			
Ephemeroptera	Caenidae	Caenis				1			1
	Heptageniidae	Maccaffertium	10	8	4	5	4	5	20
	Leptohyphidae	Tricorythodes			1				
Eulamellibranchia	Sphaeriidne	Stictochironomus		1					
Trichoptera	Hydropsychidae	Hydropsyche						1	
	Polycentropodidae	Cyrnellus	20	9	12	11	11	10	16
Tubificida	Naididae	Naididae sp.					1		

Macroinvertebrate raw data table for Station 13 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	101	102	105	106	107	108	109
Amphipoda	Corophiidae	Apocorophium		1	1				
Decapoda	Panopeidae	Rhithropanopeus			1	1			1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	3		1	2	1		
	Chironomidae	Chironomid pupae	3	3	2	1	2	3	
		Coelotanypus		2					
		Ablabesmyia	35	26	45	16	40	36	25
		Dicrotendipes	9	10	6	7	7	11	
		Microchironomus	2	2		2	3		
		Polypedilum	4	3		1		2	5
		Tribelos	37	42	54	20	14	39	32
		Tanytarsus	1		2		1		
Ephemeroptera	Ephemeridae	Hexagenia		1					
Neuroptera	Sisyridae	Climacia		2		2			
Trichoptera	Polycentropodidae	Cyrnellus	42	43	25	18	41	35	33
	Trichoptera	Trichoptera pupae	1						

Macroinvertebrate raw data table for Station 13 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	101	102	103	104	106	109	110
Amphipoda	Amphilochidae	Hourstonia					1		
Decapoda	Palaemonidae	Macrobrachium	1	1	1	1		1	
	Panopeidae	Rhithropanopeus	1	3		2	3	2	1
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		
	Chironomidae	Chironomid pupae				1			
		Ablabesmyia				1	1	1	
		Nanocladius	5	7	5		1		5
		Dicrotendipes	1	2			2		1
		Parachironomus					2		
		Polypedilum	1		1	1	1		1
		Tribelos	15	18	7	16	10	18	24
		Rheotanytarsus	1	1					
		Tanytarsus	1		2	1		1	
Ephemeroptera	Caenidae	Caenis		1	1		1		
	Heptageniidae	Maccaffertium	1				1		
Nematoda	Nematoda sp.	Nematoda sp.	2						
Pelecypoda	Dreisseniidae	Mytilopsis	2	9	3			4	1
Trichoptera	Polycentropodidae	Cyrnellus	1	4	4	3	2	2	6
Tubificida	Naididae (Naidinae)	Naididae sp.		1					3

Macroinvertebrate raw data table for Station 14 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	121	123	124	125	127	129	130
Amphipoda	Corophiidae	Apocorophium	7	11	6	39	42	17	54
	Gammaridae	Gammarus	13	25	23	11	21	24	13
Diptera	Chironomidae	Chironomid pupae							1
		Coelotanypus			3	2		1	5
		Procladius						1	
		Ablabesmyia	19	21	15	14	15	14	26
		Nanocladius	3	5		4	2	2	
		Chironomus							2
		Cryptochironomus	3						
		Dicrotendipes	26	37	21	34	35	28	18
		Glyptotendipes		8				1	2
		Polypedilum				7	5	2	
		Tribelos	26	58	45	28	24	11	33
		Rheotanytarsus							2
		Tanytarsus		3					
Ephemeroptera	Caenidae	Caenis		1	1		1		
	Heptageniidae	Maccaffertium	23	10	5	7	5	5	4
	Leptohyphidae	Tricorythodes	2				3	1	1
Eulamellibranchia	Sphaeriidne	Stictochironomus					2	1	
Trichoptera	Hydropsychidae	Hydropsyche	10	23	1		8	3	6
	Polycentropodidae	Cyrnellus	33	50	21	46	74	20	59
		Neureclipsis					1	2	
	Trichoptera sp.	Trichoptera pupae							4

Macroinvertebrate raw data table for Station 14 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	121	122	123	124	126	128	129
Decapoda	Panopeidae	Rhithropanopeus					1		1
Diptera	Ceratopogonidae	Ceratopogonidae sp.	2	1	1		1		3
	Chironomidae	Chironomid pupae	1	2	1	2	1	2	1
		Coelotanypus				2		3	
		Ablabesmyia	45	22	31	31	44	28	27
		Dicrotendipes	23	10	10	6	27	12	17
		Polypedilum	2		10	2		3	3
		Tribelos	31	31	45	40	34	20	30
		Tanytarsus	2		2			1	2
Ephemeroptera	Caenidae	Caenis	1						
Nematoda	Nematoda	Nematoda sp.				1			1
Trichoptera	Hydropsychidae	Hydropsyche					1		
	Polycentropodidae	Cyrnellus	26	54	51	43	33	26	31
	Trichoptera	Trichoptera pupae					1		

Macroinvertebrate raw data table for Station 14 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	121	122	123	124	125	128	130
Amphipoda	Amphilochidae	Hourstonia	1		2	2	1		
	Corophidae	Apocorophium				7			
Decapoda	Palaemonidae	Macrobrachium	1		2	3		1	
	Panopeidae	Rhithropanopeus	1	1	1	2	1	1	2
Diptera	Chironomidae	Chironomid pupae				1			
		Ablabesmyia							1
		Nanocladius	4	2	1			2	1
		Dicrotendipes	3	2	1		1	1	
		Glyptotendipes			1				
		Polypedilum	1						2
		Tribelos	15	14	13	4	11	6	9
		Stelechomyia			1				
		Rheotanytarsus		1	3	2	1	1	1
		Tanytarsus	2	2	1		3		2
Ephemeroptera	Caenidae	Caenis			1	1			1
	Leptohyphidae	Tricorythodes							1
Nematoda	Nematoda sp.	Nematoda sp.			1				
Pelecypoda	Dreisseniidae	Mytilopsis					1		
Trichoptera	Polycentropodidae	Cyrnellus	3	5	4	2		7	1
Tubificida	Naididae (Naidinae)	Naididae sp.			1	1		1	

Macroinvertebrate raw data table for Station 15 during the spring of 2011.

			Spring 2011						
			Sample No.						
Order	Family	Genus	132	135	136	137	138	139	140
Amphipoda	Corophiidae	Apocorophium	1	13	5	1	1	18	9
	Gammaridae	Gammarus	2	18	3	9	1	9	3
Diptera	Ceratopogonidae	Ceratopogonidae sp.					1		1
	Chironomidae	Chironomid pupae	1			2		2	
		Coelotanypus				2			
		Procladius	3					4	
		Ablabesmyia	48	22	21	28	16	16	22
		Nanocladius	5				1	2	4
		Cryptochironomus				4			
		Dicrotendipes	13	41	27	34	31	29	41
		Glyptotendipes		6					
		Microchironomus			2				
		Polypedilum	8	4	3	4	1		2
		Tribelos	55	20	32	32	16	51	32
		Rheotanytarsus			2				
		Tanytarsus			2	2			
Ephemeroptera	Caenidae	Caenis							1
	Heptageniidae	Maccaffertium	1	4	4		2	1	3
	Leptohyphidae	Tricorythodes		1				1	
Gordea	Gordiidae	Gordius	1						
Trichoptera	Hydropsychidae	Hydropsyche				1			1
	Polycentropodidae	Cyrnellus	26	35	19	32	33	31	20
	Trichoptera sp.	Trichoptera pupae				1			

Macroinvertebrate raw data table for Station 15 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	131	132	133	134	135	137	140
Decapoda	Palaemonidae	Macrobrachium						1	
	Panopeidae	Rhithropanopeus		1		1			1
Diptera	Ceratopogonidae	Ceratopogonidae sp.			3		2		
	Chironomidae	Chironomid pupae	4			1			
		Coelotanypus	5			1		1	2
		Ablabesmyia	35	24	25	25	23	24	39
		Cladopelma					2		
		Cryptochironomus						4	
		Dicrotendipes	23	9	10	14	19	15	4
		Polypedilum	2		5	4	6	11	2
		Tribelos	52	33	40	28	26	37	26
Neuroptera	Sisyridae	Climacia	1		3				
Trichoptera	Hydropsychidae	Hydropsyche					1		
	Polycentropodidae	Cyrnellus	45	18	40	22	20	28	17
	Trichoptera	Trichoptera pupae		1					
Tubificida	Naididae (Naidinae)	Naididae sp.				1			

Macroinvertebrate raw data table for Station 15 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	131	132	133	135	136	137	138
Amphipoda	Amphilochidae	Hourstonia		2	2		2	1	
	Corophidae	Apocorophium	2						
Decapoda	Panopeidae	Rhithropanopeus	3	5	4	4	5	6	5
Diptera	Ceratopogonidae	Ceratopogonidae sp.		2	1				
	Chironomidae	Chironomid pupae	1					1	
		Ablabesmyia	1			1	1	1	1
		Corynoneura			1				
		Nanocladius	3	5	7	3	5	5	
		Cryptochironomus					1		
		Dicrotendipes	1	3	2	2	1		3
		Parachironomus			1	1			
		Polypedilum			1				1
		Stenochironomus				1			
		Tribelos	12	10	20	16	18	9	17
		Rheotanytarsus		3	1				
		Tanytarsus	1	2	2	3	2		2
Ephemeroptera	Caenidae	Caenis							1
	Leptohyphidae	Tricorythodes	1						
Nematoda	Nematoda sp.	Nematoda sp.				1			
Odonata	Coenagridonidae	Argia			1				
Pelecypoda	Dreisseniidae	Mytilopsis	3					2	
Trichoptera	Hydropsychidae	Hydropsyche		1					
	Polycentropodidae	Cyrnellus	3	3	5	3	2	2	
Tubificida	Naididae (Naidinae)	Naididae sp.				3			

Macroinvertebrate raw data table for Station 17 during the spring of 2011.

			Spring 2011					
			Sample No.					
Order	Family	Genus	162	163	165	166	169	170
Amphipoda	Corophiidae	Apocorophium	1	7	3	13	22	30
	Gammaridae	Gammarus	8	5		3	13	15
Decapoda	Panopeidae	Rhithropanopeus	2	1	1	1		1
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1			
	Chironomidae	Chironomid pupae			1	1		
		Coelotanypus			2		2	
		Ablabesmyia	8	6	15	6	15	7
		Nanocladius		6	4		5	6
		Cryptochironomus		1				
		Dicrotendipes	8	14	20	20	36	10
		Harnischia		1	1			
		Microchironomus		2	1		2	1
		Paralauterborniella						1
		Polypedilum		3	1		3	1
		Tribelos	25	12	17	37	22	20
		Rheotanytarsus		1				
Ephemeroptera	Heptageniidae	Maccaffertium	8	20	12	14	15	19
Trichoptera	Hydropsychidae	Hydropsyche	1	1			1	
	Polycentropodidae	Cyrnellus	5	13	5	2	10	7
	Trichoptera sp.	Trichoptera pupae			1			

Macroinvertebrate raw data table for Station 17 during the summer of 2011.

			Summer 2011						
			Sample No.						
Order	Family	Genus	163	164	165	167	168	169	170
Amphipoda	Corophiidae	Apocorophium					1		
	Gammaridae	Gammarus	1						
Diptera	Ceratopogonidae	Ceratopogonidae sp.			1				
	Chironomidae	Chironomid pupae	2		2	2	2	1	1
		Coelotanypus	1			1		2	3
		Procladius							1
		Ablabesmyia	28	25	40	31	31	36	13
		Dicrotendipes	18	2	15	6	19	22	
		Polypedilum	4	2	8	7	15	11	20
		Stenochironomus							1
		Tribelos	22	24	63	23	23	39	14
		Tanytarsus	1	2		1	6	2	1
Ephemeroptera	Caenidae	Caenis	1				1		
Trichoptera	Polycentropodidae	Cyrnellus	19	9	30	17	19	9	
	Trichoptera	Trichoptera pupae			1		1		
Tubificida	Naididae (Naidinae)	Naididae sp.		1			1	3	17

Macroinvertebrate raw data table for Station 17 during the fall of 2011.

			Fall 2011						
			Sample No.						
Order	Family	Genus	164	165	166	167	168	169	170
Amphipoda	Amphilochidae	Hourstonia	2	5			1		3
Decapoda	Panopeidae	Rhithropanopeus	5	4	4		6		7
Diptera	Ceratopogonidae	Ceratopogonidae sp.				2			
	Chironomidae	Chironomid pupae	2						
		Coelotanypus			1			1	
		Ablabesmyia			1				
		Nanocladius	1		2				6
		Dicrotendipes	1						
		Polypedilum	1	2					
		Tribelos	7	3	1		3		6
		Tanytarsus	3				1		
Ephemeroptera	Caenidae	Caenis	1		1				
Nematoda	Nematoda sp.	Nematoda sp.		1				1	
Pelecypoda	Dreisseniidae	Mytilopsis			1				
Trichoptera	Polycentropodidae	Cyrnellus	1		1				
Tubificida	Naididae (Naidinae)	Naididae sp.		1		1			

Macroinvertebrate raw data table for Station 18 during the summer of 2011.

Order	Family	Genus	Summer 2011						
			Sample No.						
			171	173	174	177	178	179	180
Amphipoda	Gammaridae	Gammarus	3	2	1			1	
Decapoda	Panopeidae	Rhithropanopeus			1	1			
Diptera	Ceratopogonidae	Ceratopogonidae sp.	1	1	5				
	Chironomidae	Chironomid pupae	1	2	2		2		2
		Coelotanypus							3
		Procladius							2
		Ablabesmyia	29	45	35	35	36	16	30
		Cryptotendipes	2						
		Dicrotendipes	16	30	19	19	47	9	10
		Harnischia			2				
		Microchironomus			2				
		Polypedilum	6		8	2	3		7
		Tribelos	24	39	35	23	52	38	33
		Tanytarsus	2		2	2			2
Ephemeroptera	Caenidae	Caenis				2		1	
	Heptageniidae	Maccaffertium					1		1
Trichoptera	Polycentropodidae	Cyrnellus	28	19	13	12	7	10	11
Tubificida	Naididae (Naidinae)	Naididae sp.		1	1		2		

Macroinvertebrate raw data table for Station 18 during the fall of 2011.

Order	Family	Genus	Fall 2011						
			Sample No.						
			172	173	175	176	178	179	180
Amphipoda	Amphilochidae	Hourstonia	2	6	12	9	8	6	5
	Corophidae	Apocorophium	1						2
Decapoda	Palaemonidae	Macrobrachium	1						
	Panopeidae	Rhithropanopeus	7	4	4	4	7	4	3
Diptera	Ceratopogonidae	Ceratopogonidae sp.		1					
	Chironomidae	Coelotanypus				1			
		Ablabesmyia							1
		Nanocladius			2	2	2		1
		Dicrotendipes		1	3		2		
		Parachironomus					1		
		Polypedilum	1			1		2	
		Tribelos	13	3	7	8	12	5	14
Ephemeroptera	Caenidae	Caenis				1			
Pelecypoda	Dreissenidae	Mytilopsis	2	2			8		3
Polychaeta	Polychaeta	Polychaeta sp.						1	
Trichoptera	Polycentropodidae	Cyrnellus	4						

CPUE data for the spring 2010 season.

Family	Species	Sample Location					
		Upstream		Thermal Mixing Zone		Downstream	
		Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank
Lepisosteidae, Gars	Spotted gar	2.0	6.0	4.0	4.0	4.0	3.9
Amiidae, Bowfin	Bowfin	0.0	0.0	0.0	0.0	0.0	1.0
Anguillidae, Eels	American eel	0.0	0.0	0.0	0.0	0.0	0.0
Clupeidae, Shad and Herrings	Gizzard shad	0.0	2.0	2.0	1.0	1.0	11.6
	Threadfin shad	0.0	2.0	0.0	0.0	0.0	1.0
	Gulf menhaden	0.0	1.0	2.0	0.0	1.0	1.0
Engraulidae, Anchovies	Bay anchovy	0.0	1.0	0.0	0.0	0.0	1.0
Cyprinidae, Carps and Minnows	Silverside shiner	7.0	7.0	1.0	4.0	13.0	0.0
	Emerald shiner	0.0	5.0	0.0	0.0	1.0	0.0
	Silver chub	0.0	1.0	0.0	0.0	0.0	0.0
	Blacktail shiner	1.0	0.0	0.0	0.0	0.0	0.0
	Bullhead minnow	0.0	0.0	0.0	0.0	0.0	0.0
	Fluvial shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Pugnose minnow	0.0	0.0	0.0	0.0	0.0	0.0
Catostomidae, Suckers	Quillback	4.0	3.0	0.0	0.0	7.0	3.9
	Highfin carpsucker	0.0	1.0	0.0	0.0	0.0	0.0
	Blacktail redhorse	1.0	0.0	0.0	0.0	0.0	0.0
	Smallmouth buffalo	0.0	0.0	0.0	0.0	11.0	1.0
Ictaluridae, Bullhead Catfish	Blue catfish	1.0	2.0	4.0	0.0	0.0	0.0
	Channel catfish	36.0	59.0	12.0	21.0	18.0	21.3
	Flathead catfish	1.0	0.0	0.0	0.0	0.0	0.0
Belonidae, Needlefish	Atlantic needlefish	1.0	2.0	0.0	1.0	0.0	0.0
Fundulidae, Topminnows	Blackspotted topminnow	0.0	0.0	0.0	0.0	0.0	0.0
Poeciliidae, Livebearers	Mosquitofish	0.0	1.0	0.0	0.0	0.0	0.0
Atherinidae, Silversides	Brook silverside	1.0	5.0	1.0	1.0	3.0	0.0
	Inland silverside	0.0	0.0	1.0	0.0	0.0	0.0
Moronidae, Striped Basses	Yellow bass	0.0	0.0	0.0	0.0	0.0	0.0
	White bass	0.0	0.0	0.0	0.0	0.0	0.0
	Striped bass	0.0	0.0	0.0	0.0	0.0	0.0
Centrarchidae, Sunfishes	Bluegill sunfish	35.0	6.0	2.0	5.0	29.0	16.5
	Spotted bass	0.0	0.0	0.0	0.0	0.0	0.0
	Black crappie	5.0	1.0	0.0	0.0	5.0	6.8
	White crappie	0.0	0.0	0.0	0.0	0.0	0.0
	Redear sunfish	0.0	0.0	0.0	0.0	0.0	0.0
	Largemouth bass	5.0	0.0	0.0	2.0	6.0	2.9
	Green sunfish	0.0	0.0	0.0	0.0	0.0	1.0
	Redspotted sunfish	0.0	0.0	0.0	0.0	0.0	0.0
Sciaenidae, Drums	Freshwater drum	3.0	2.0	4.0	5.0	13.0	0.0
Mugilidae, Mullets	Striped mullet	1.0	1.0	1.0	0.0	2.0	4.8
Soleidae, Soles	Hogchoker	0.0	1.0	0.0	0.0	0.0	0.0
Gerreidae, Mojarras	Spotfin mojarra	0.0	0.0	0.0	0.0	0.0	0.0
Gobiidae, Gobies	Highfin goby	0.0	0.0	0.0	0.0	0.0	0.0

CPUE data for the summer 2010 season.

		Sample Location					
		Upstream		Thermal Mixing Zone		Downstream	
Family	Species	Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank
Lepisosteidae, Gars	Spotted gar	2.0	5.0	1.0	0.0	1.0	1.0
Amiidae, Bowfin	Bowfin	0.0	0.0	0.0	1.0	0.0	0.0
Anguillidae, Eels	American eel	0.0	1.0	0.0	0.0	0.0	0.0
Clupeidae, Shad and Herrings	Gizzard shad	11.0	17.0	2.0	1.0	0.0	0.0
	Threadfin shad	0.0	0.0	0.0	0.0	0.0	0.0
	Gulf menhaden	1.0	161.0	0.0	14.0	296.0	0.0
Engraulidae, Anchovies	Bay anchovy	1.0	3.0	0.0	0.0	0.0	0.0
Cyprinidae, Carps and Minnows	Silverside shiner	109.0	42.0	11.0	2.0	38.0	40.0
	Emerald shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Silver chub	1.0	1.0	0.0	0.0	0.0	0.0
	Blacktail shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Bullhead minnow	1.0	0.0	0.0	0.0	0.0	0.0
	Fluvial shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Pugnose minnow	0.0	0.0	0.0	0.0	0.0	0.0
Catostomidae, Suckers	Quillback	0.0	0.0	0.0	0.0	0.0	0.0
	Highfin carpsucker	0.0	0.0	0.0	0.0	0.0	0.0
	Blacktail redhorse	0.0	0.0	0.0	0.0	0.0	0.0
	Smallmouth buffalo	1.0	0.0	0.0	0.0	0.0	0.0
Ictaluridae, Bullhead Catfish	Blue catfish	1.0	0.0	10.0	0.0	0.0	0.0
	Channel catfish	13.0	13.0	18.0	28.0	2.0	7.0
	Flathead catfish	0.0	0.0	0.0	0.0	0.0	0.0
Belonidae, Needlefish	Atlantic needlefish	2.0	3.0	0.0	0.0	3.0	0.0
Fundulidae, Topminnows	Blackspotted topminnow	0.0	0.0	0.0	0.0	0.0	0.0
Poeciliidae, Livebearers	Mosquitofish	0.0	0.0	0.0	0.0	0.0	0.0
Atherinidae, Silversides	Brook silverside	1.0	0.0	0.0	0.0	0.0	0.0
	Inland silverside	0.0	0.0	0.0	0.0	0.0	0.0
Moronidae, Striped Basses	Yellow bass	0.0	0.0	0.0	0.0	0.0	1.0
	White bass	1.0	1.0	2.0	0.0	0.0	0.0
	Striped bass	0.0	0.0	0.0	8.0	0.0	0.0
Centrarchidae, Sunfishes	Bluegill sunfish	23.0	5.0	4.0	12.0	14.0	12.0
	Spotted bass	1.0	0.0	0.0	0.0	0.0	0.0
	Black crappie	4.0	5.0	0.0	4.0	0.0	0.0
	White crappie	0.0	0.0	0.0	0.0	0.0	1.0
	Redear sunfish	0.0	0.0	0.0	0.0	0.0	0.0
	Largemouth bass	14.0	8.0	0.0	4.0	7.0	8.0
	Green sunfish	0.0	0.0	0.0	0.0	0.0	0.0
	Redspotted sunfish	0.0	0.0	0.0	0.0	0.0	2.0
Sciaenidae, Drums	Freshwater drum	0.0	0.0	0.0	0.0	0.0	0.0
Mugilidae, Mullets	Striped mullet	8.0	1.0	0.0	2.0	1.0	1.0
Soleidae, Soles	Hogchoker	0.0	0.0	0.0	0.0	0.0	0.0
Gerreidae, Mojarras	Spotfin mojarra	0.0	0.0	0.0	0.0	0.0	0.0
Gobiidae, Gobies	Highfin goby	0.0	0.0	0.0	0.0	0.0	0.0

CPUE data for the fall 2010 season.

		Sample Location					
		Upstream		Thermal Mixing Zone		Downstream	
Family	Species	Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank
Lepisosteidae, Gars	Spotted gar	0.0	2.0	1.0	2.0	13.0	3.0
Amiidae, Bowfin	Bowfin	0.0	0.0	0.0	5.0	0.0	0.0
Anguillidae, Eels	American eel	0.0	0.0	0.0	0.0	0.0	0.0
Clupeidae, Shad and Herrings	Gizzard shad	2.0	12.0	73.0	21.0	13.0	23.0
	Threadfin shad	0.0	0.0	0.0	0.0	0.0	0.0
	Gulf menhaden	29.0	347.0	164.0	10.0	15.0	217.0
Engraulidae,	Bay anchovy	2.0	15.0	0.0	0.0	1.0	2.0
Cyprinidae, Carps and Minnows	Silverside shiner	120.0	94.0	17.0	14.0	30.0	16.0
	Emerald shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Silver chub	2.0	8.0	1.0	0.0	0.0	2.0
	Blacktail shiner	0.0	0.0	0.0	0.0	0.0	0.0
	Bullhead minnow	0.0	0.0	0.0	0.0	0.0	0.0
	Fluvial shiner	0.0	1.0	0.0	0.0	0.0	0.0
	Pugnose minnow	6.0	0.0	0.0	0.0	1.0	0.0
Catostomidae, Suckers	Quillback	0.0	0.0	0.0	0.0	0.0	0.0
	Highfin carpsucker	0.0	0.0	0.0	0.0	0.0	0.0
	Blacktail redhorse	0.0	0.0	0.0	1.0	0.0	0.0
	Smallmouth buffalo	1.0	0.0	1.0	1.0	0.0	0.0
Ictaluridae, Bullhead Catfish	Blue catfish	1.0	0.0	0.0	0.0	0.0	0.0
	Channel catfish	22.0	18.0	6.0	1.0	2.0	5.0
	Flathead catfish	1.0	1.0	0.0	1.0	0.0	0.0
Belonidae, Needlefish	Atlantic needlefish	0.0	0.0	2.0	0.0	1.0	1.0
Fundulidae,	Blackspotted	0.0	0.0	0.0	1.0	0.0	0.0
Poeciliidae,	Mosquitofish	0.0	0.0	0.0	0.0	0.0	0.0
Atherinidae, Silversides	Brook silverside	0.0	0.0	0.0	0.0	3.0	1.0
	Inland silverside	0.0	0.0	0.0	0.0	0.0	0.0
Moronidae, Striped Basses	Yellow bass	0.0	0.0	0.0	0.0	0.0	0.0
	White bass	0.0	1.0	0.0	0.0	0.0	0.0
	Striped bass	1.0	1.0	2.0	1.0	0.0	1.0
Centrarchidae, Sunfishes	Bluegill sunfish	35.0	9.0	7.0	15.0	16.0	2.0
	Spotted bass	5.0	0.0	0.0	0.0	1.0	0.0
	Black crappie	0.0	1.0	3.0	1.0	3.0	0.0
	White crappie	0.0	0.0	0.0	0.0	0.0	0.0
	Redear sunfish	0.0	2.0	0.0	0.0	0.0	0.0
	Largemouth bass	4.0	5.0	6.0	18.0	8.0	7.0
	Green sunfish	1.0	0.0	0.0	0.0	0.0	0.0
	Redspotted sunfish	0.0	0.0	0.0	0.0	0.0	0.0
Sciaenidae, Drums	Freshwater drum	0.0	0.0	0.0	0.0	0.0	0.0
Mugilidae, Mullets	Striped mullet	1.0	2.0	24.0	1.0	5.0	5.0
Soleidae, Soles	Hogchoker	0.0	1.0	0.0	1.0	0.0	0.0
Gerreidae, Mojarras	Spotfin mojarra	0.0	0.0	2.0	1.0	1.0	3.0
Gobiidae, Gobies	Highfin goby	0.0	0.0	0.0	0.0	0.0	1.0

7.2. Appendix B Individual Macroinvertebrate Station Results

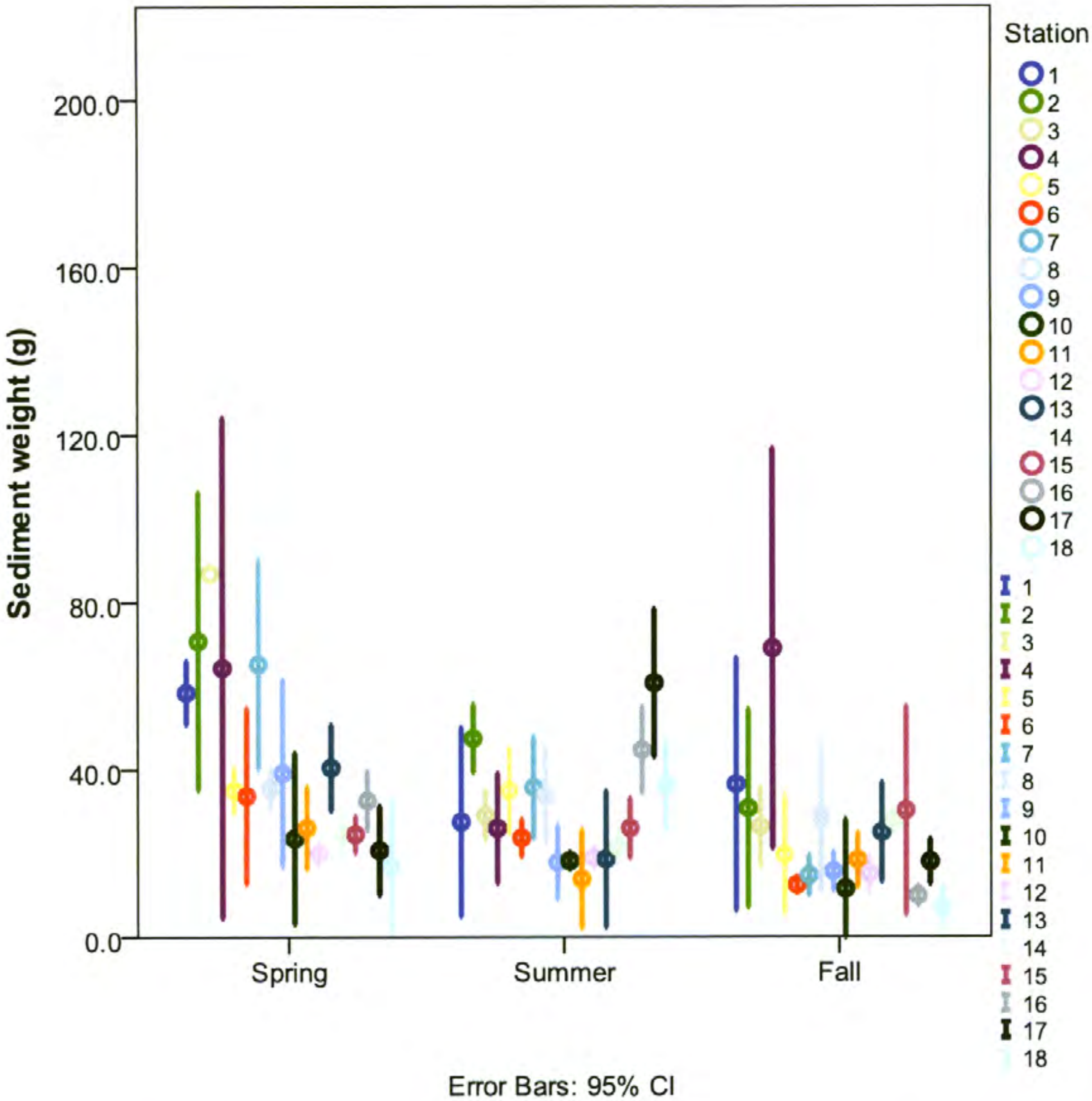


Figure B1. Error bar plot (95% CI) of the Hester-Dendy plate sediment weights (dry) seasonally and by station for 2010. Each bar represents the individual plate samplers (N=3), except for Station 3 in the spring (N=1).

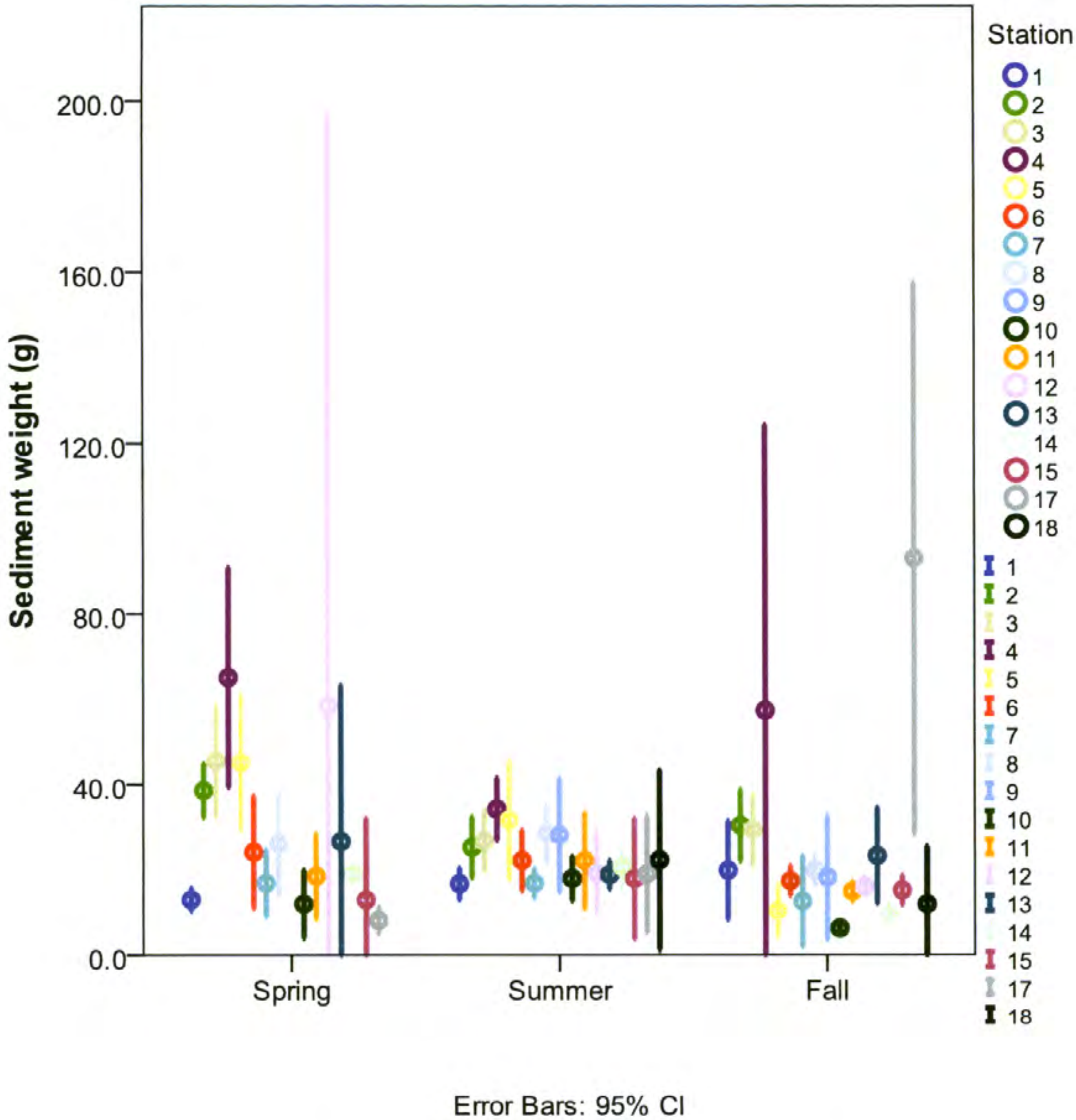


Figure B2. Error bar plot (95% CI) of the Hester-Dendy plate sediment weights (dry) seasonally and by station for 2011. Each bar represents the individual plate samplers (N=3), except for Stations 9 and 18 in the spring (N=0). All plates were lost for Station 16 for all seasons.

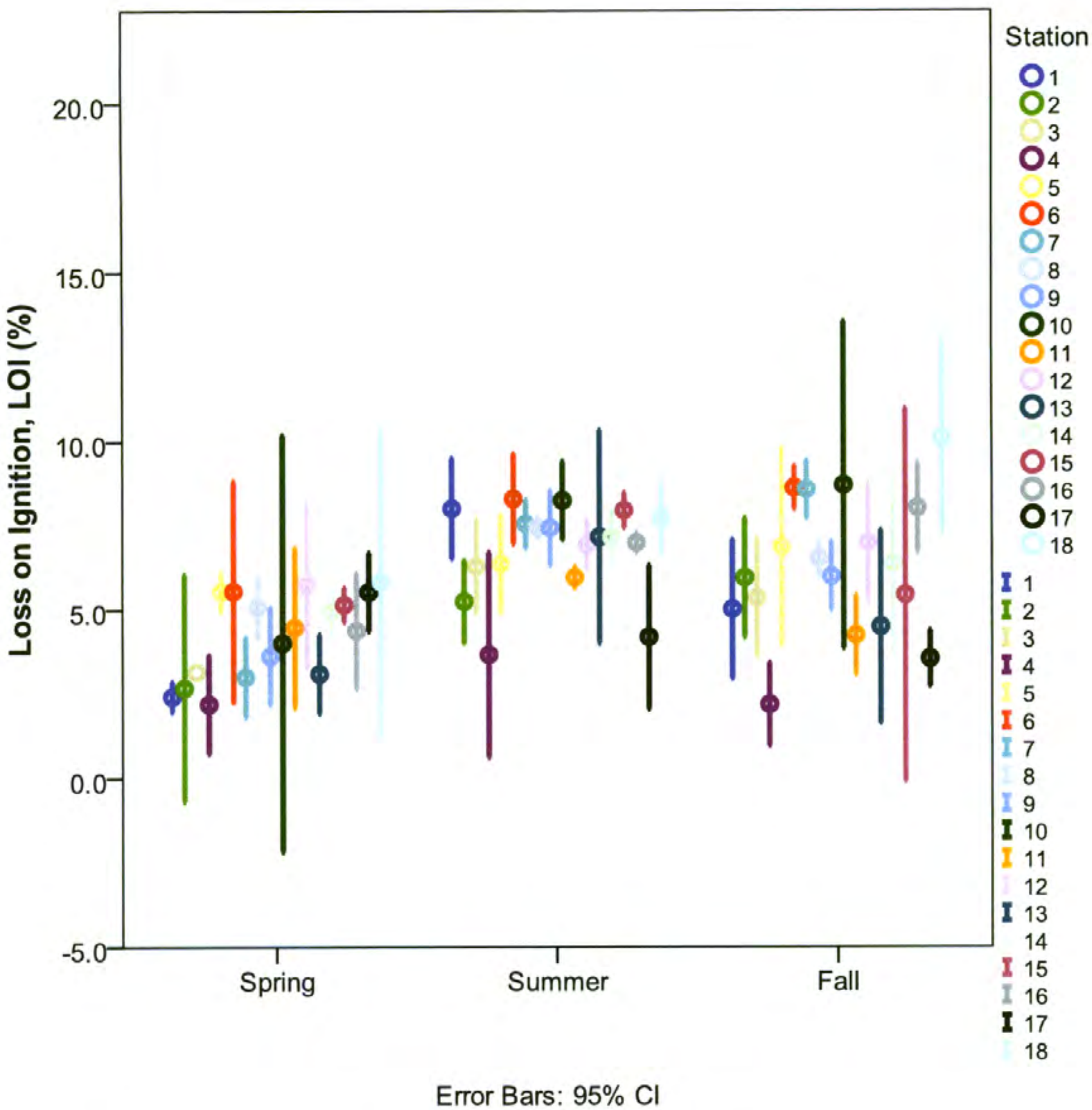


Figure B3. Error bar plot (95% CI) of the Hester-Dendy plate sediment loss on ignition (LOI) seasonally and by station for 2010. Each bar represents the individual plate samplers (N=3), except for Station 3 in the spring (N=1).

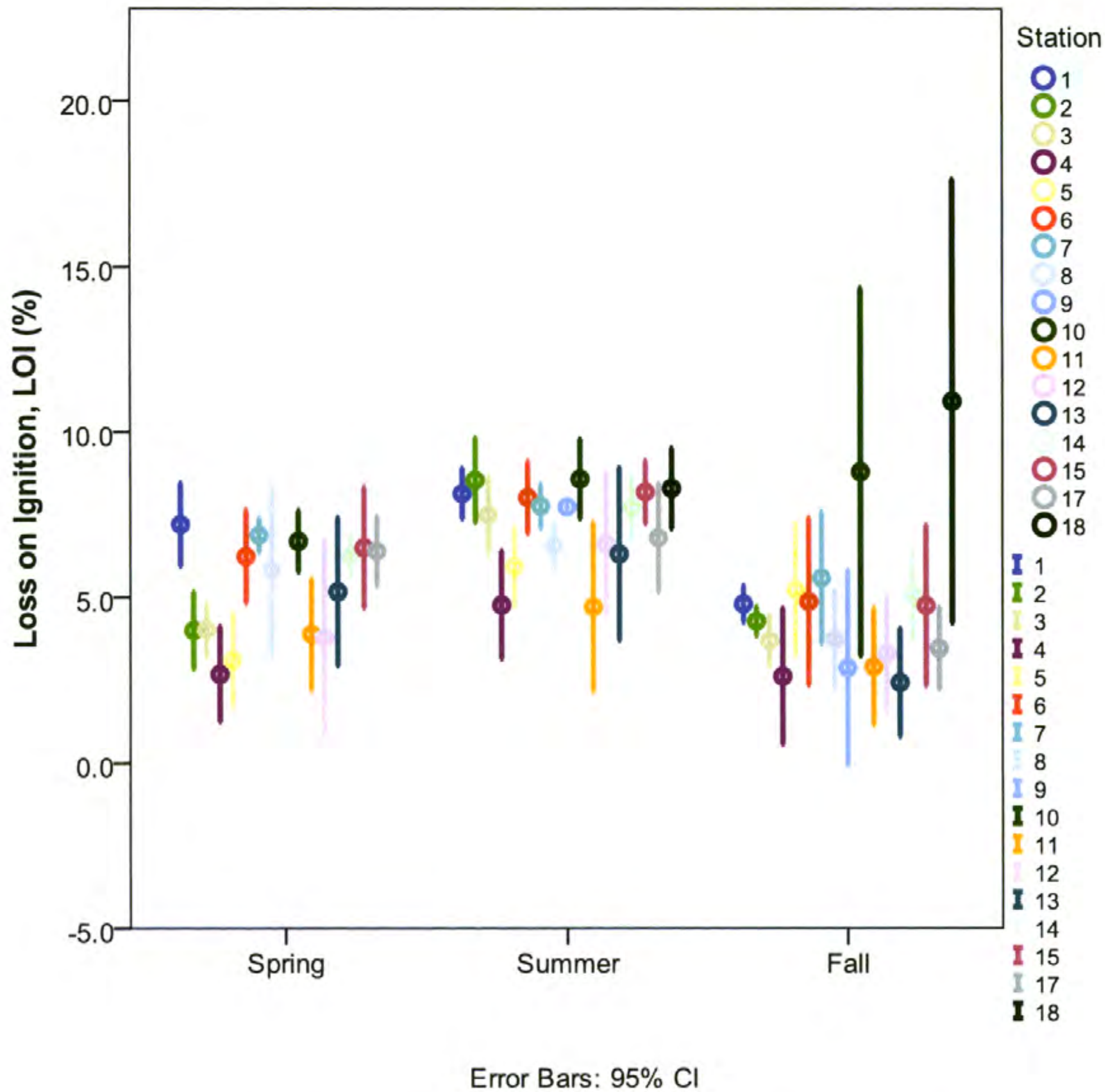


Figure B4. Error bar plot (95% CI) of the Hester-Dendy plate sediment loss on ignition (LOI) seasonally and by station for 2011. Each bar represents the individual plate samplers (N=3), except for Stations 9 and 18 in the spring (N=0). All plates were lost for Station 16 for all seasons.

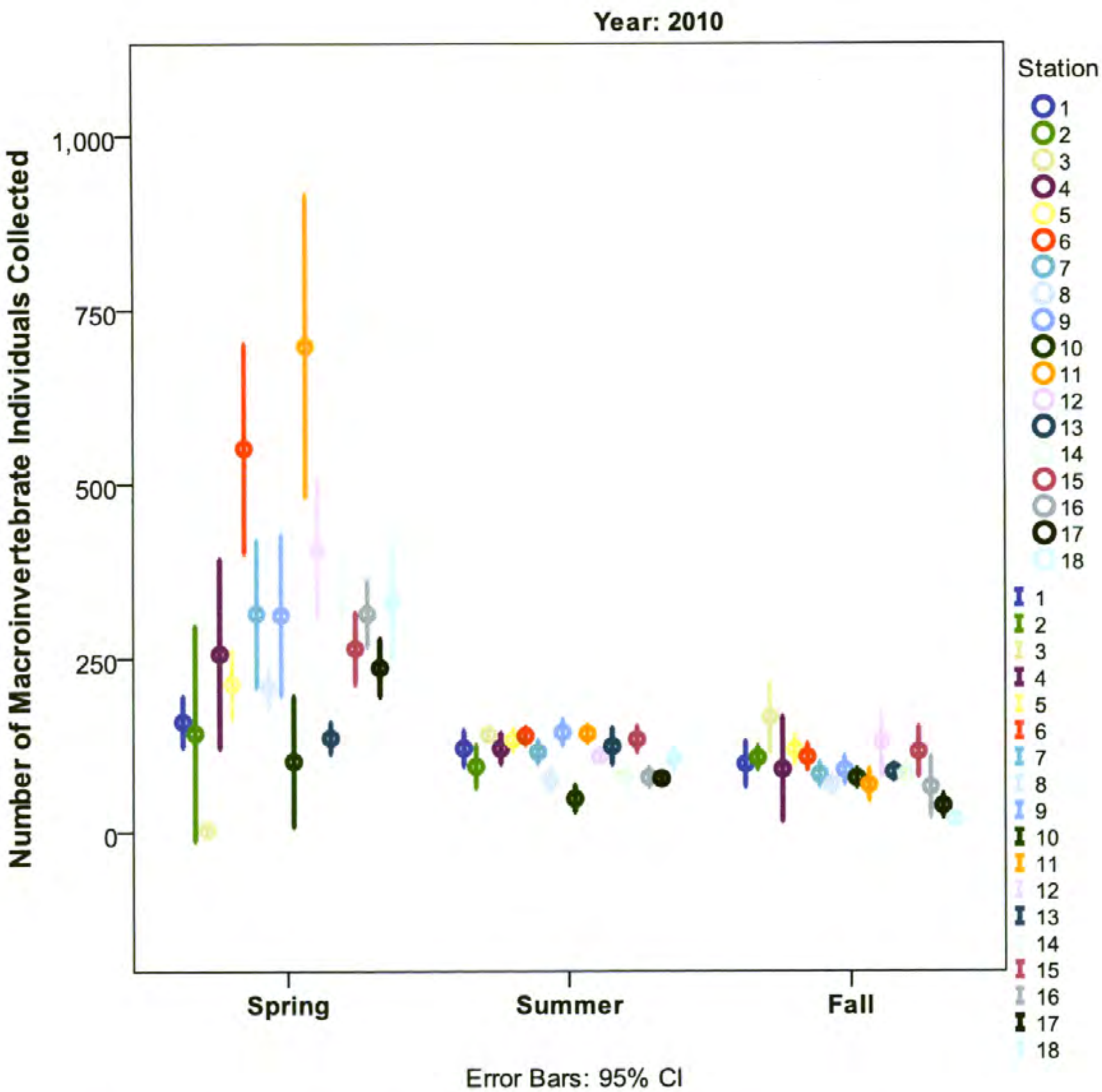
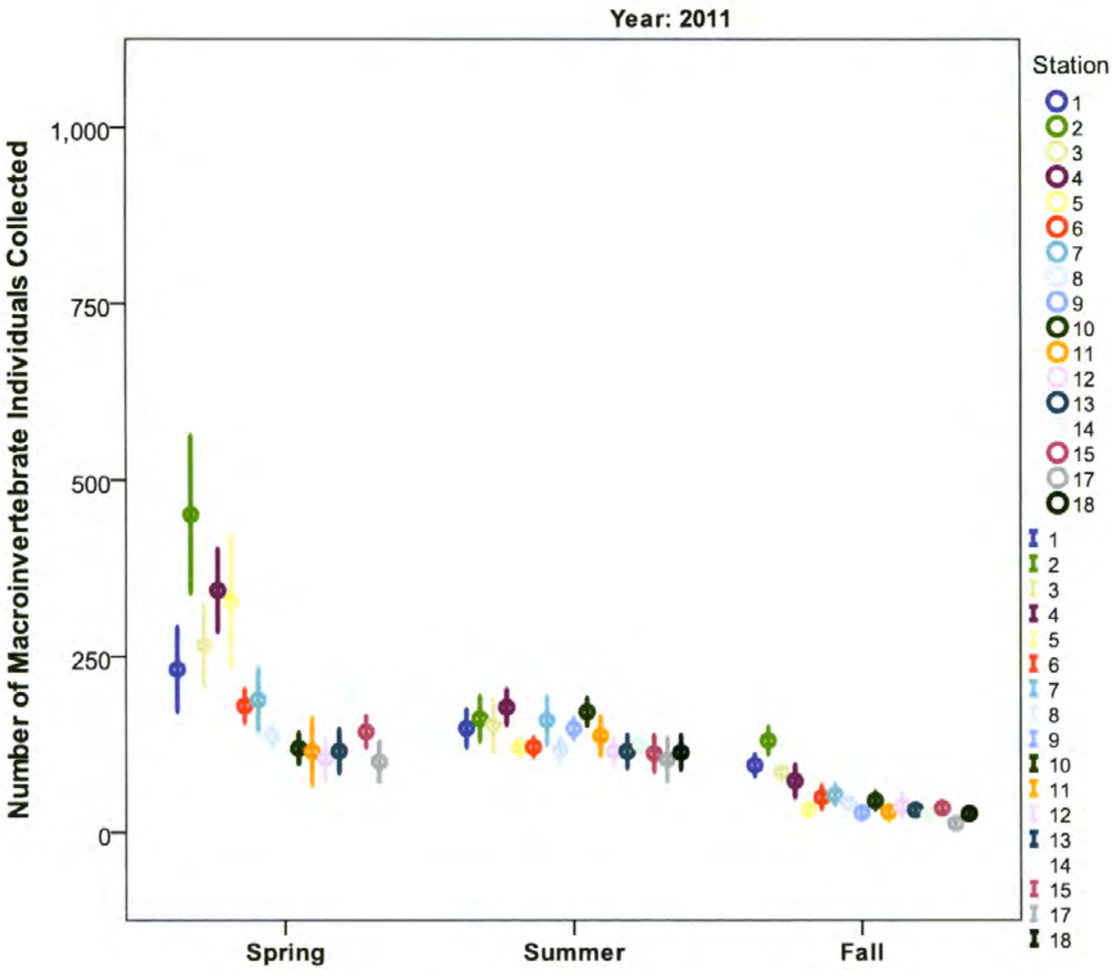


Figure B5. Error bar plot (95% CI) of the number of macroinvertebrate organisms collected per plate seasonally and by station for the 2010 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).



Error Bars: 95% CI

Figure B6. Error bar plot (95% CI) of the number of macroinvertebrate organisms collected per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

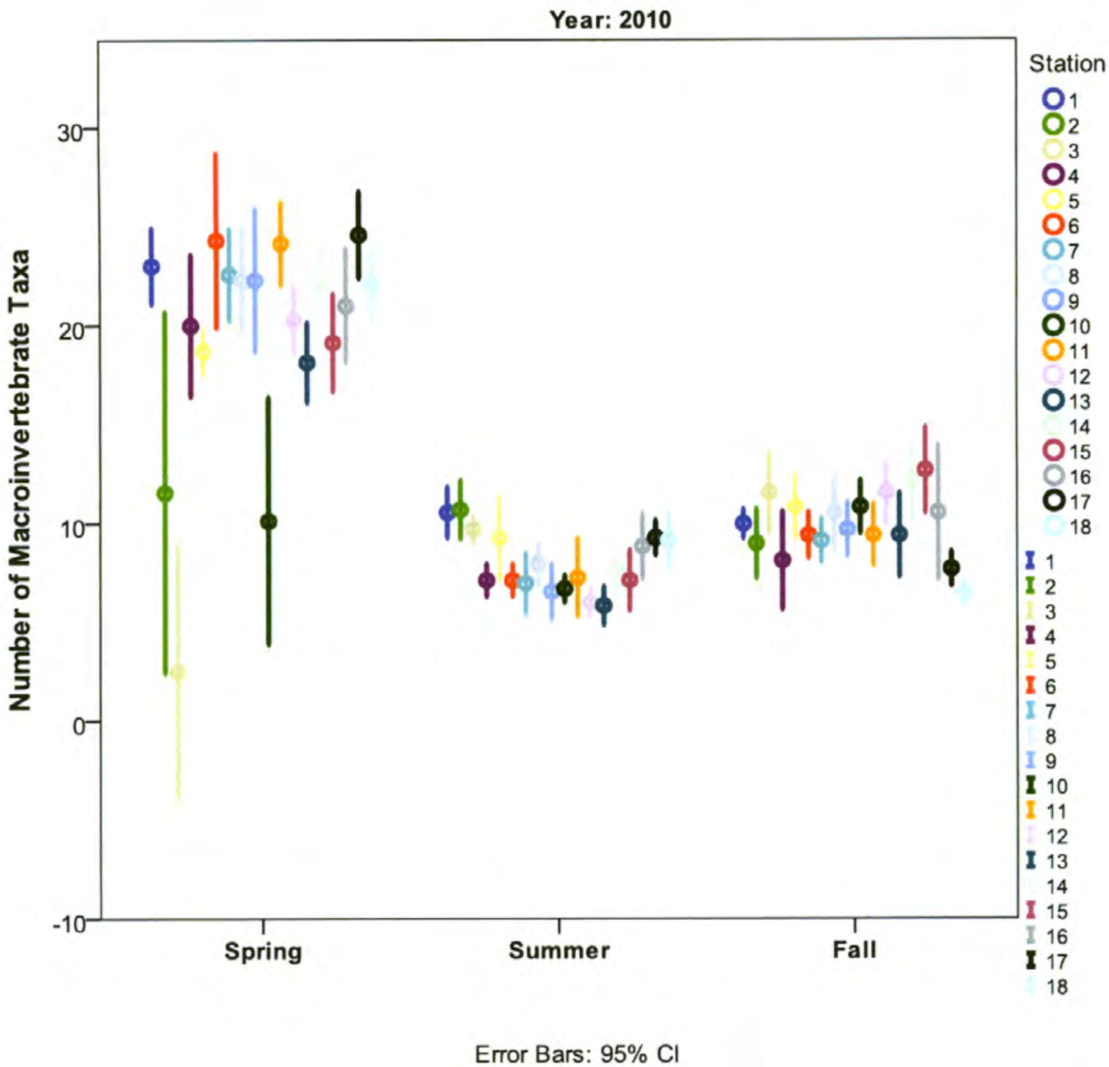


Figure B7. Error bar plot (95% CI) of the number of macroinvertebrate taxa collected per plate seasonally and by station for the 2010 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).

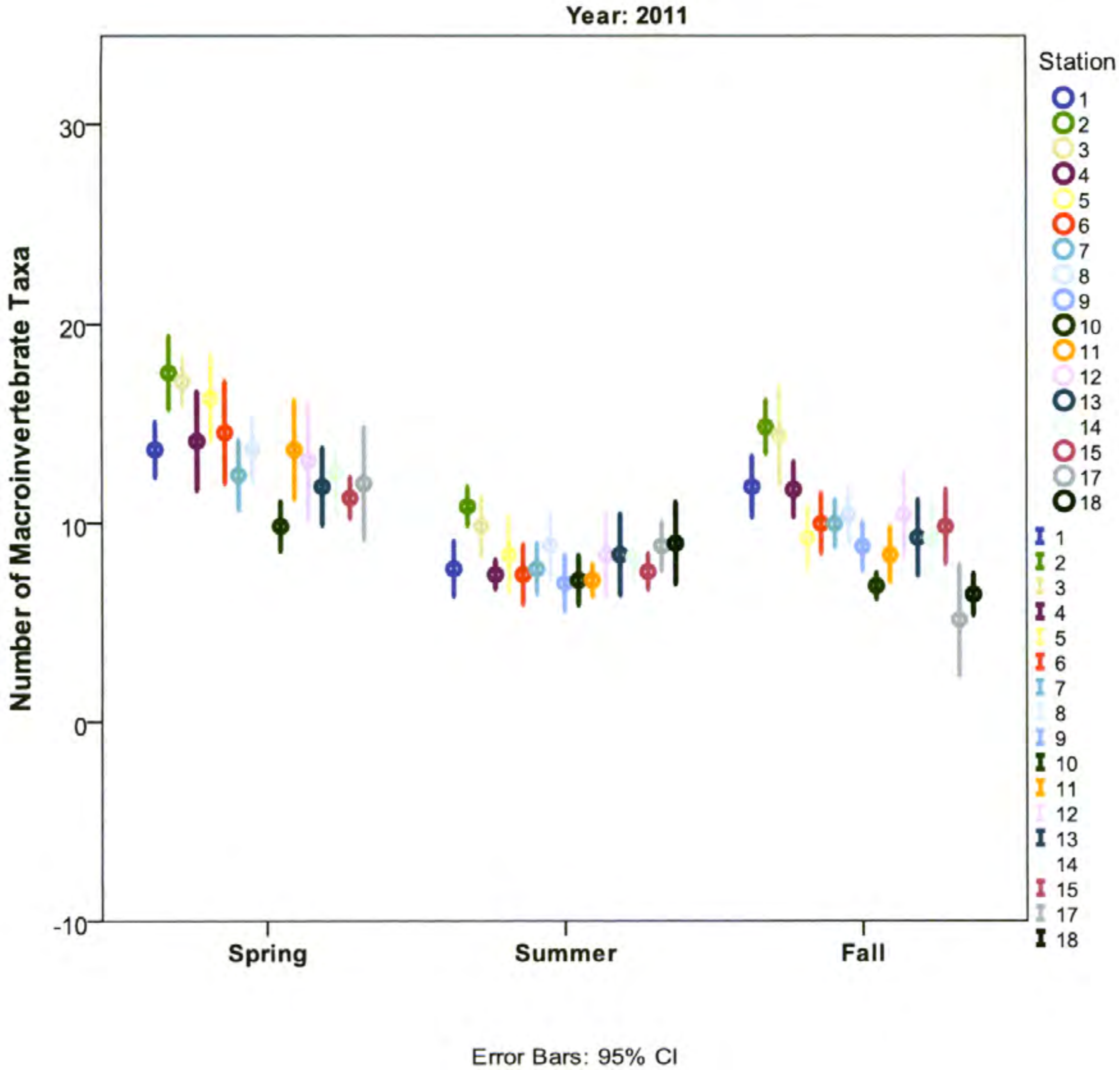


Figure B8. Error bar plot (95% CI) of the number of macroinvertebrate taxa collected per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

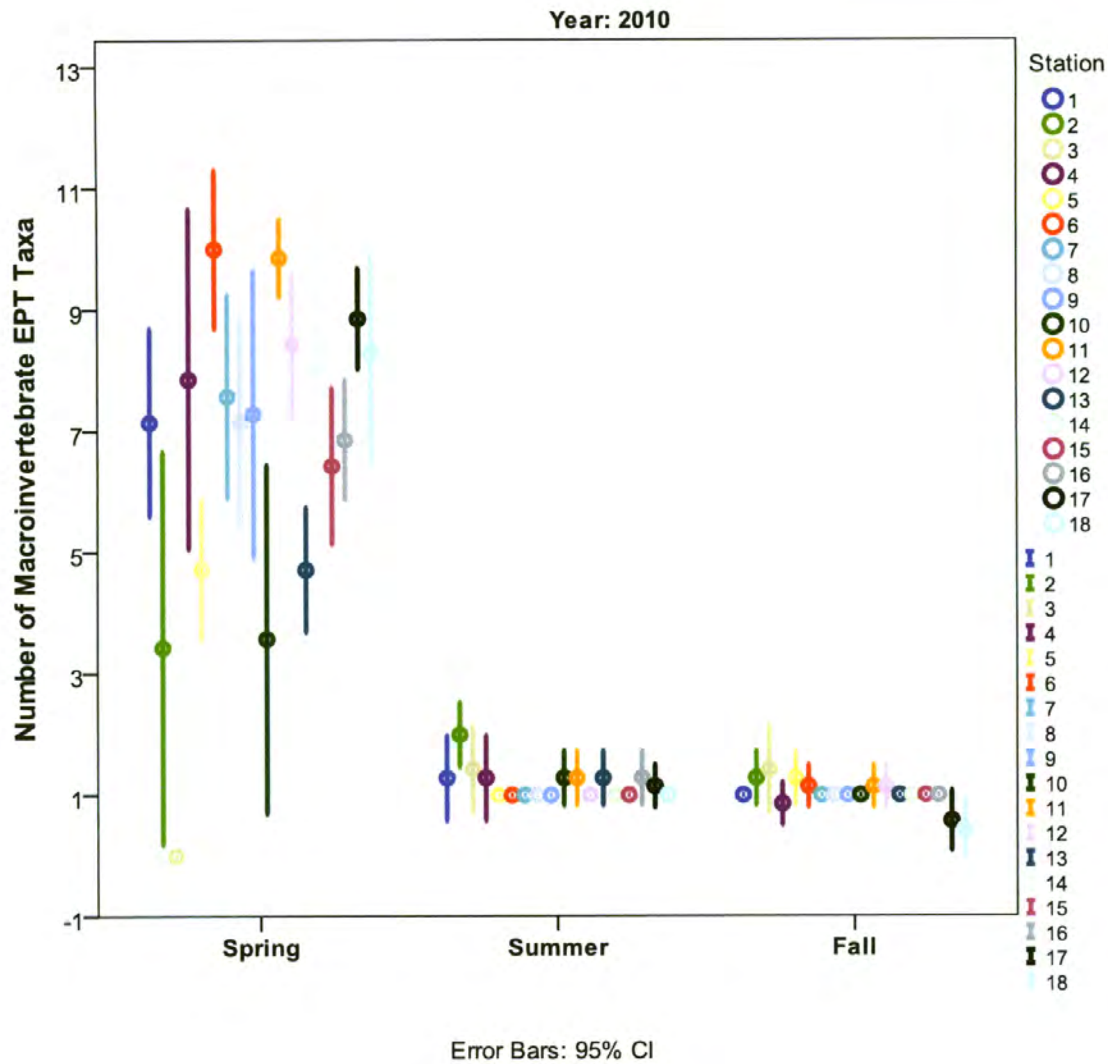


Figure B9. Error bar plot (95% CI) of the number of macroinvertebrate EPT taxa collected per plate seasonally and by station for the 2010 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).

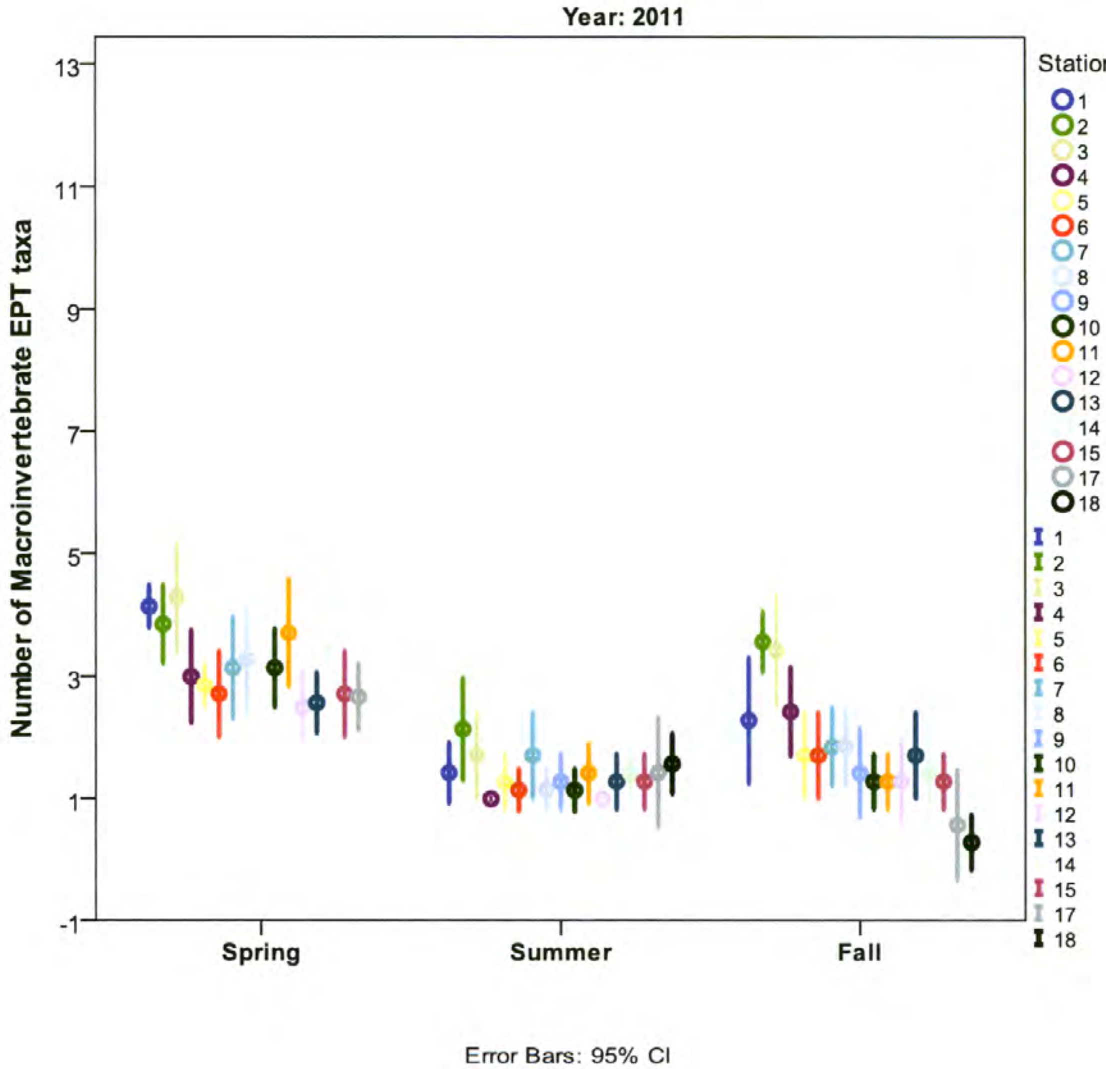


Figure B10. Error bar plot (95% CI) of the number of macroinvertebrate EPT taxa collected per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

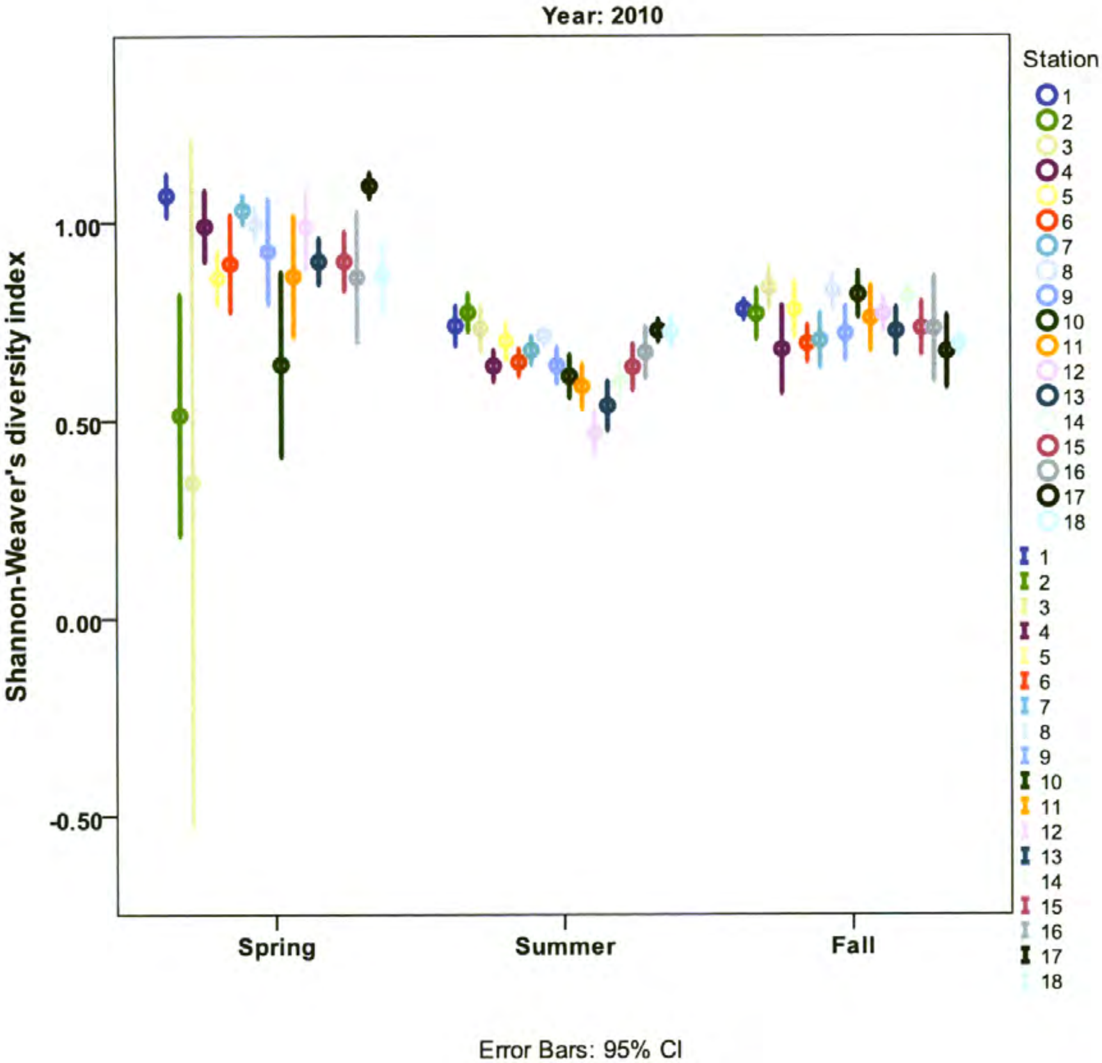


Figure B11. Error bar plot (95% CI) of the Shannon-Weaver diversity index per plate seasonally and by station for the 2010 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).

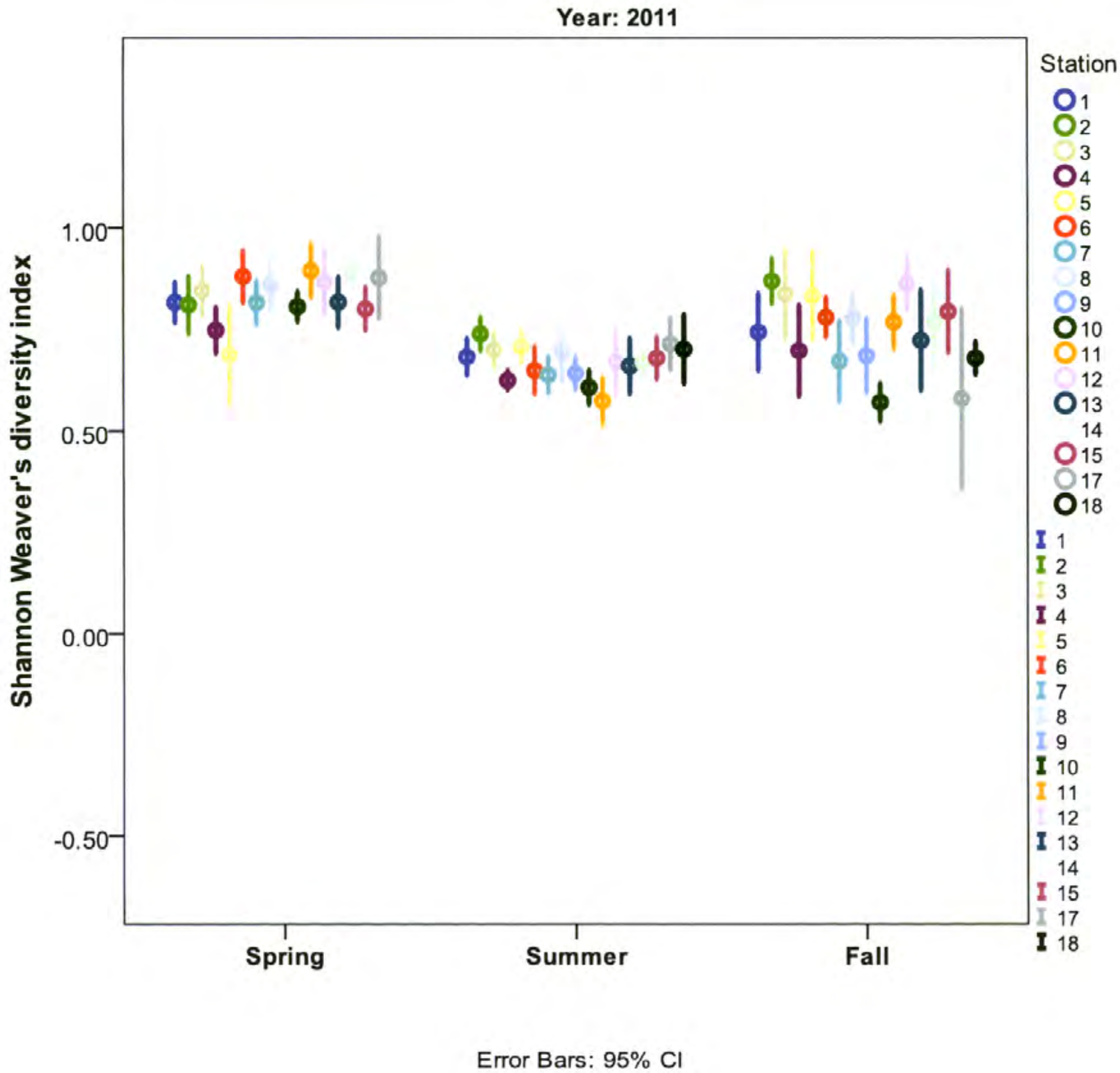


Figure B12. Error bar plot (95% CI) of the Shannon-Weaver diversity index per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

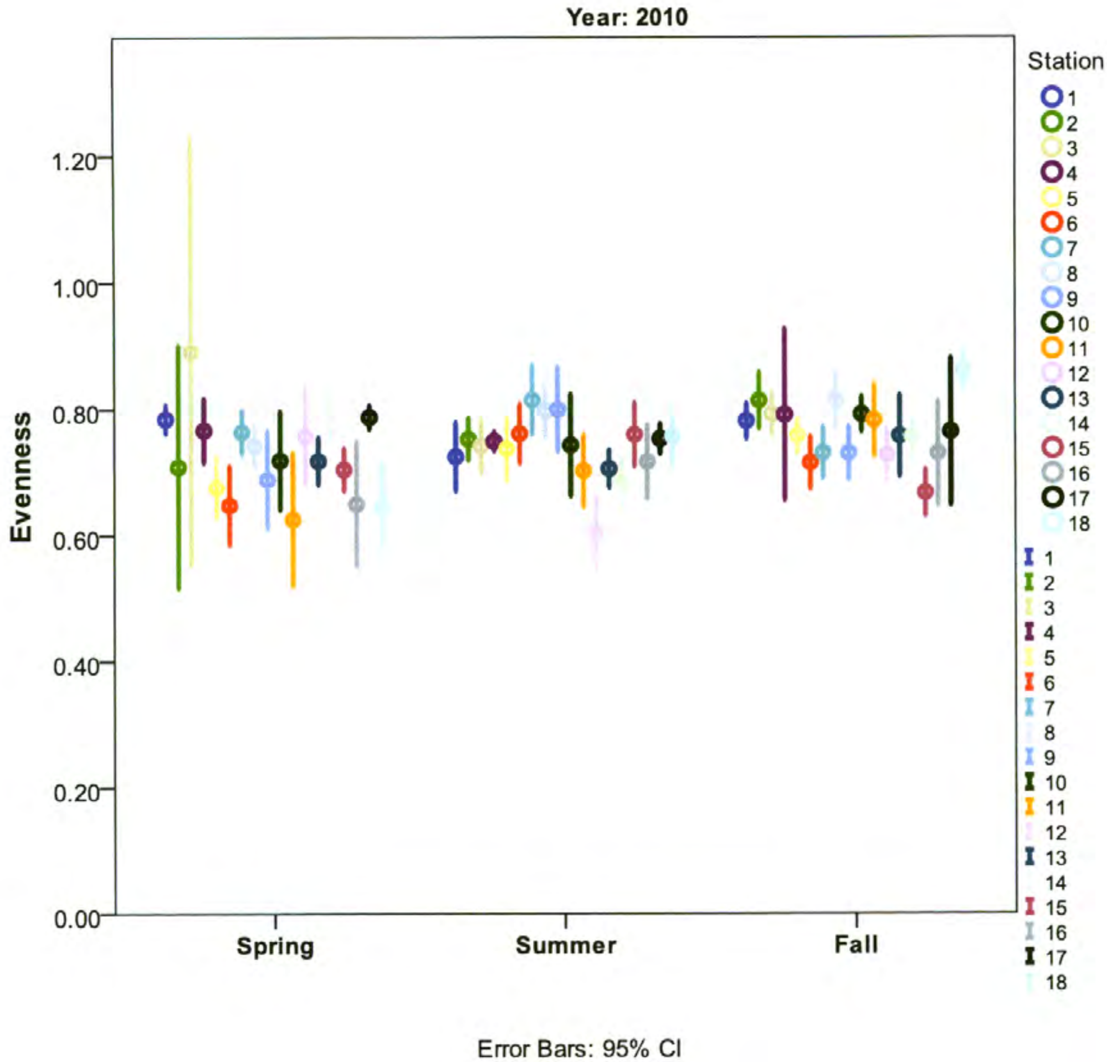


Figure B13. Error bar plot (95% CI) of Evenness per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).

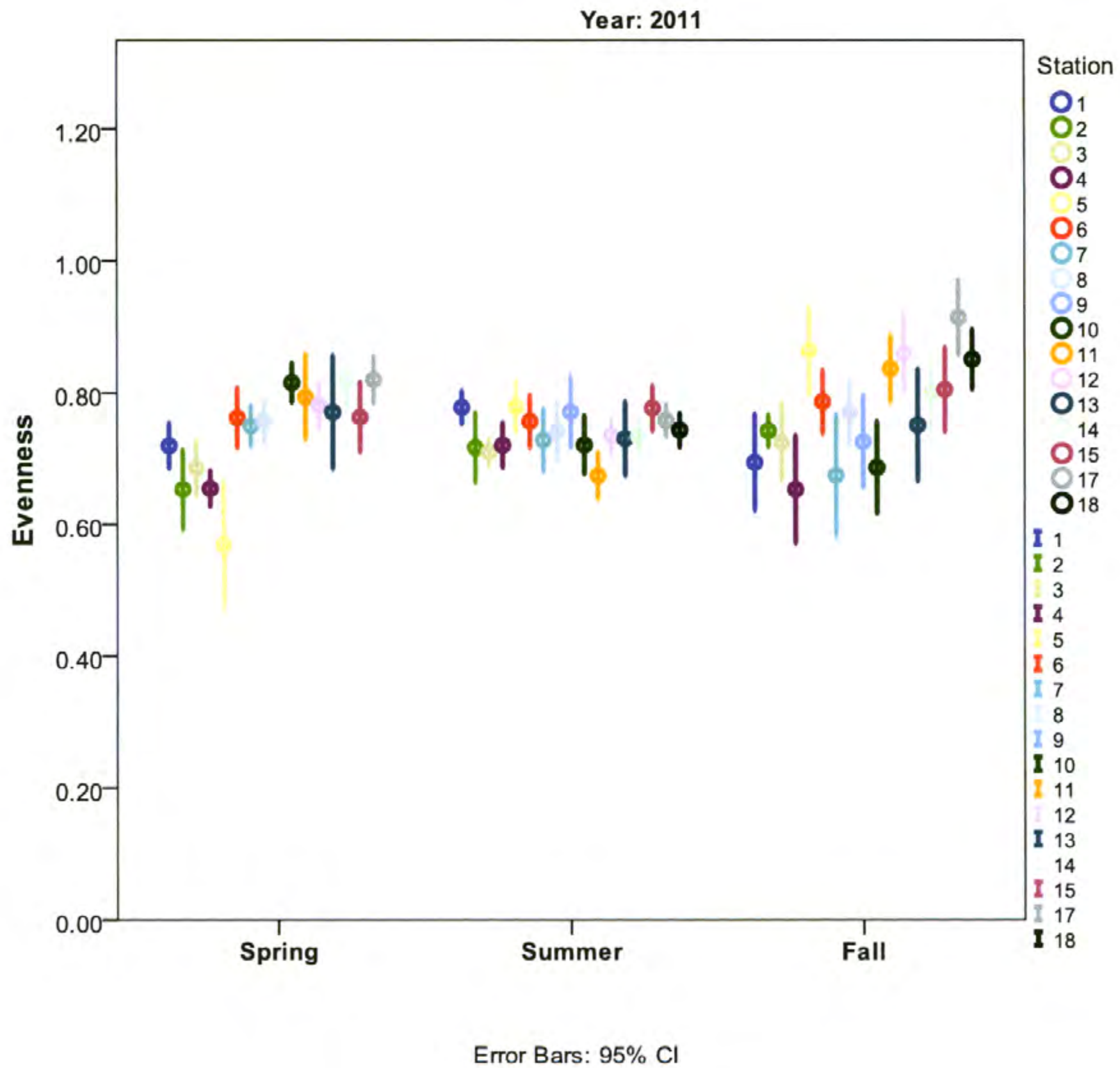


Figure B14. Error bar plot (95% CI) of Evenness per plate seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

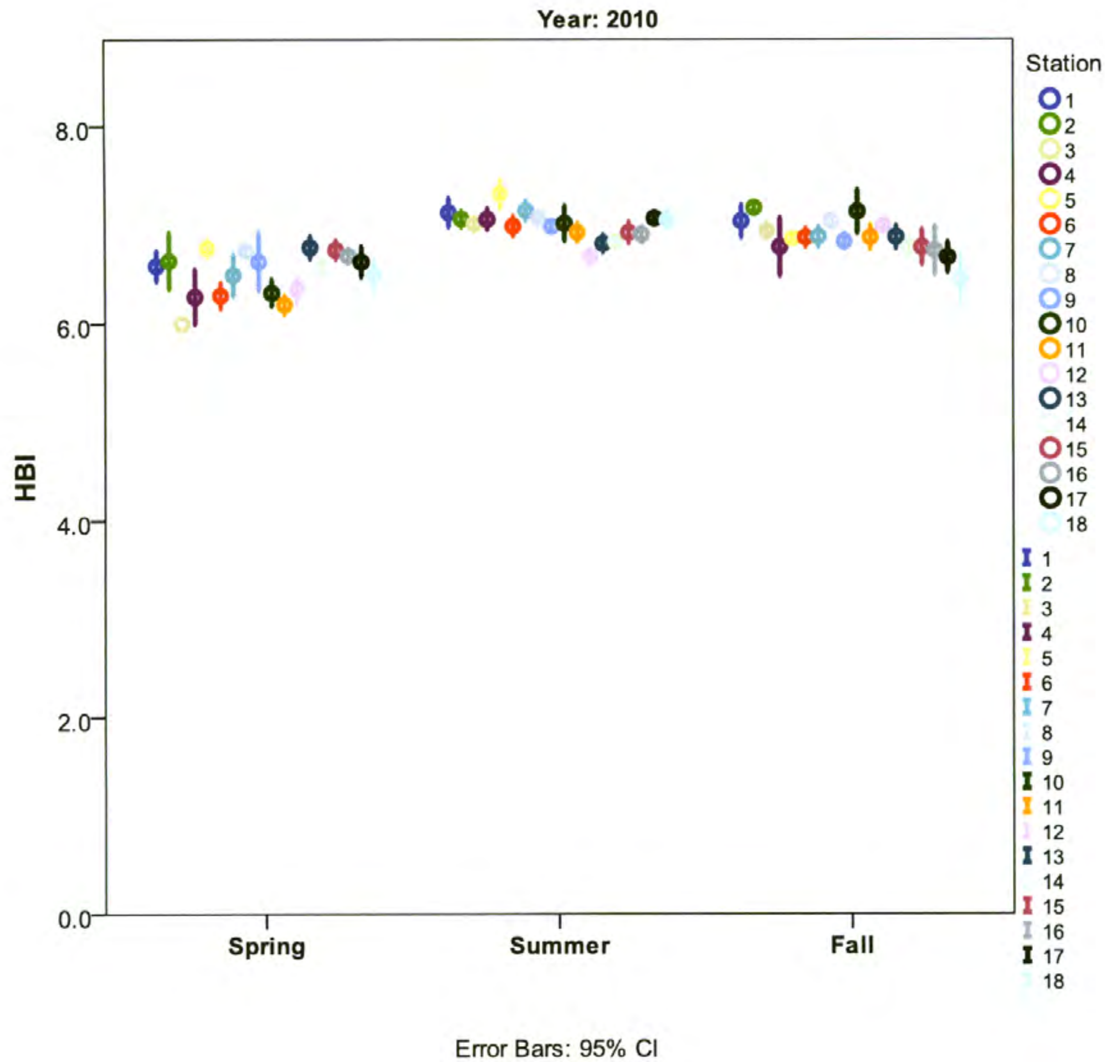


Figure B15. Error bar plot (95% CI) of the HBI seasonally and by station for the 2010 sampling. Each bar represents the individual plate samplers (N=7, except for Station 3 during the spring deployment, when N=2).

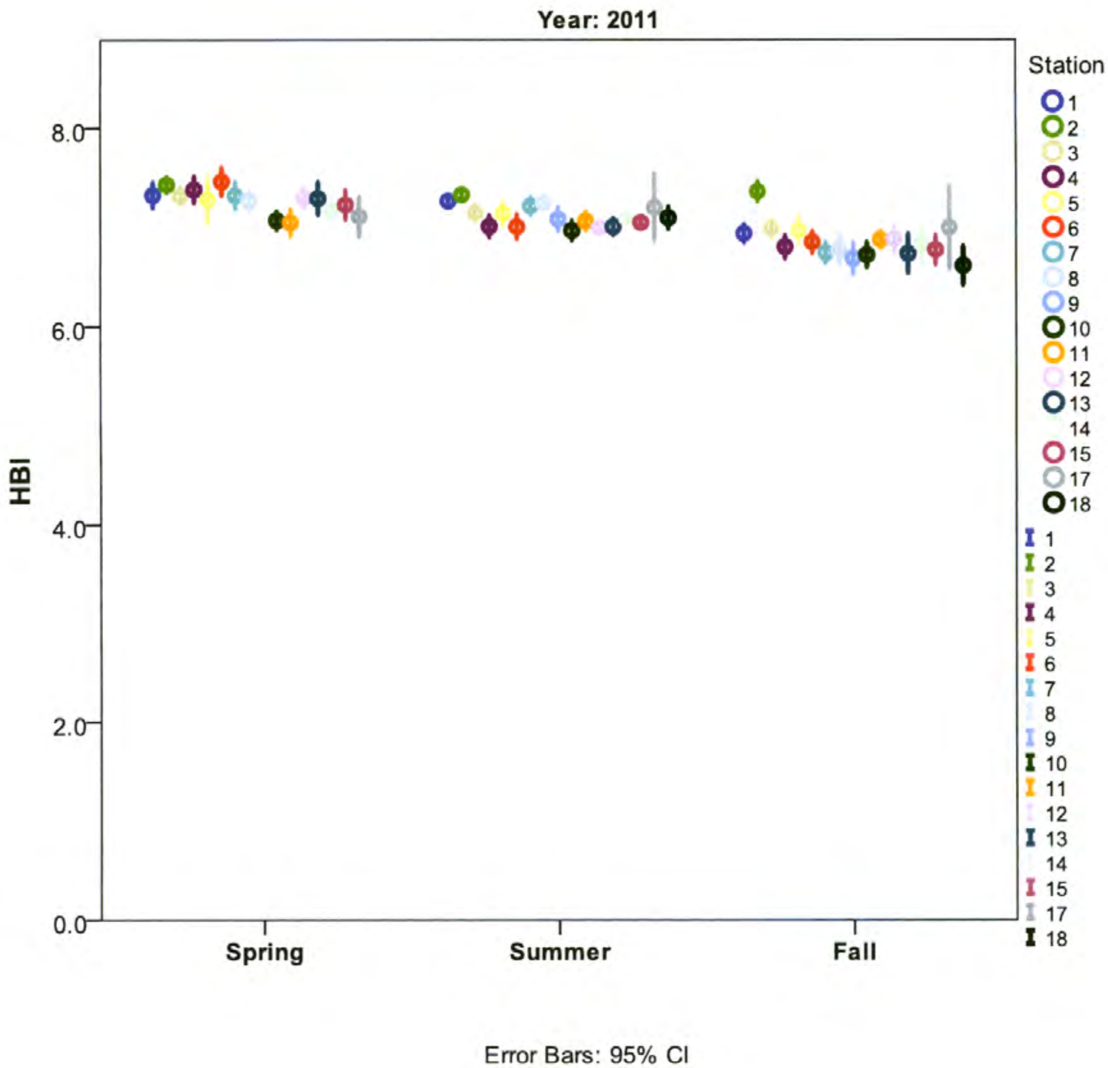


Figure B16. Error bar plot (95% CI) of the HBI seasonally and by station for the 2011 sampling. Each bar represents the individual plate samplers (N=7, except during the spring, when N=6 for stations 12 and 17). All plates at stations 9 and 18 were damaged or lost during the spring deployment, and all plates were lost for all three deployments at Station 16.

Table B1. **Summary of macroinvertebrate data for the three deployment periods in 2010.**

Deployment	Location	# of Plates Retrieved	Average # of Organisms per plate	Average Density (# of organisms per m²) per plate	Average # of Taxa per plate	Average # of EPT Taxa per plate
Spring	Station 1	7	160	2,457	23.0	7.1
	Station 2	7	143	2,200	11.6	3.4
	Station 3	2	4	62	2.5	0.0
	Station 4	7	257	3,956	20.0	7.9
	Station 5	7	214	3,288	18.7	4.7
	Station 6	7	552	8,490	24.3	10.0
	Station 7	7	315	4,844	22.6	7.6
	Station 8	7	209	3,209	22.3	7.1
	Station 9	7	313	4,811	22.3	7.3
	Station 10	7	103	1,578	10.1	3.6
	Station 11	7	699	10,754	24.1	9.9
	Station 12	7	407	6,257	20.3	8.4
	Station 13	7	136	2,097	18.1	4.7
	Station 14	7	328	5,042	22.1	8.0
	Station 15	7	265	4,070	19.1	6.4
	Station 16	7	314	4,833	21.0	6.9
	Station 17	7	237	3,646	24.6	8.9
	Station 18	7	331	5,099	22.0	8.3
Summer	Station 1	7	121	1,868	10.6	1.3
	Station 2	7	95	1,466	10.7	2.0
	Station 3	7	142	2,178	9.7	1.4
	Station 4	7	121	1,864	7.1	1.3
	Station 5	7	134	2,064	9.3	1.0
	Station 6	7	139	2,143	7.1	1.0
	Station 7	7	116	1,787	7.0	1.0
	Station 8	7	75	1,160	8.0	1.0
	Station 9	7	144	2,222	6.6	1.0
	Station 10	7	49	756	6.7	1.3
	Station 11	7	143	2,193	7.3	1.3
	Station 12	7	111	1,701	6.0	1.0
	Station 13	7	125	1,916	5.9	1.3
	Station 14	7	82	1,255	7.7	1.0
	Station 15	7	135	2,070	7.1	1.0
	Station 16	7	80	1,224	8.9	1.3
	Station 17	7	78	1,198	9.3	1.1
	Station 18	7	107	1,642	9.1	1.0
Fall	Station 1	7	99	1,525	10.0	1.0
	Station 2	7	108	1,662	9.0	1.3
	Station 3	7	166	2,556	11.6	1.4
	Station 4	7	91	1,407	8.1	0.9
	Station 5	7	120	1,840	10.9	1.3
	Station 6	7	109	1,679	9.4	1.1
	Station 7	7	84	1,290	9.1	1.0
	Station 8	7	68	1,053	10.6	1.0
	Station 9	7	91	1,396	9.7	1.0
	Station 10	7	79	1,211	10.9	1.0
	Station 11	7	69	1,059	9.4	1.1
	Station 12	7	130	2,007	11.6	1.1
	Station 13	7	88	1,347	9.4	1.0
	Station 14	7	83	1,277	12.1	1.0
	Station 15	7	117	1,793	12.7	1.0
	Station 16	7	65	1,007	10.6	1.0
	Station 17	7	39	596	7.7	0.6
	Station 18	7	19	299	6.4	0.4

Table B2. Summary of macroinvertebrate data for the three deployment periods in 2011.

Deployment	Location	# of Plates Retrieved	Average # of Organisms per plate	Average Density (# of organisms per m²) per plate	Average # of Taxa per plate	Average # of EPT Taxa per plate
Spring	Station 1	7	232	3,576	13.7	4.1
	Station 2	7	452	6,952	17.6	3.9
	Station 3	7	266	4,095	17.1	4.3
	Station 4	7	345	5,303	14.1	3.0
	Station 5	7	328	5,046	16.3	2.9
	Station 6	7	181	2,778	14.6	2.7
	Station 7	7	189	2,914	12.4	3.1
	Station 8	7	137	2,114	13.7	3.3
	Station 9	0	N/A†	N/A†	N/A†	N/A†
	Station 10	7	120	1,848	9.9	3.1
	Station 11	7	115	1,776	13.7	3.7
	Station 12	6	105	1,621	13.2	2.5
	Station 13	7	116	1,791	11.9	2.6
	Station 14	7	193	2,969	12.6	4.3
	Station 15	7	144	2,211	11.3	2.7
	Station 16	0	N/A†	N/A†	N/A†	N/A†
	Station 17	6	101	1,551	12.0	2.7
	Station 18	0	N/A†	N/A†	N/A†	N/A†
Summer	Station 1	7	148	2,284	7.7	1.4
	Station 2	7	163	2,501	10.9	2.1
	Station 3	7	153	2,349	9.9	1.7
	Station 4	7	179	2,747	7.4	1.0
	Station 5	7	121	1,866	8.4	1.3
	Station 6	7	122	1,875	7.4	1.1
	Station 7	7	160	2,462	7.7	1.7
	Station 8	7	117	1,800	8.9	1.1
	Station 9	7	148	2,279	7.0	1.3
	Station 10	7	172	2,646	7.1	1.1
	Station 11	7	138	2,119	7.1	1.4
	Station 12	7	117	1,793	8.4	1.0
	Station 13	7	116	1,780	8.4	1.3
	Station 14	7	126	1,945	8.3	1.4
	Station 15	7	112	1,730	7.6	1.3
	Station 16	0	N/A†	N/A†	N/A†	N/A†
	Station 17	7	104	1,593	8.9	1.4
	Station 18	7	114	1,756	9.0	1.6
Fall	Station 1	7	96	1,479	11.9	2.3
	Station 2	7	131	2,018	14.9	3.6
	Station 3	7	86	1,319	14.4	3.4
	Station 4	7	73	1,130	11.7	2.4
	Station 5	7	33	505	9.3	1.7
	Station 6	7	50	774	10.0	1.7
	Station 7	7	54	835	10.0	1.9
	Station 8	7	42	651	10.4	1.9
	Station 9	7	28	433	8.9	1.4
	Station 10	7	46	701	6.9	1.3
	Station 11	7	29	451	8.4	1.3
	Station 12	7	38	585	10.4	1.3
	Station 13	7	32	497	9.3	1.7
	Station 14	7	25	387	9.3	1.4
	Station 15	7	35	543	9.9	1.3
	Station 16	0	N/A†	N/A†	N/A†	N/A†
	Station 17	7	13	198	5.1	0.6
	Station 18	7	27	415	6.4	0.3

†No data were collected for this station due to vandalism of samplers.

Table B3. The average Shannon-Weaver diversity index (SWDI), evenness, and Hilsenhoff Biotic Index (HBI) values during the three deployment periods.

Deployment	Station	SWDI	Evenness	HBI
Spring	1	1.07	0.78	6.59
	2	0.51	0.71	6.64
	3	0.34	0.89	6.00
	4	0.99	0.77	6.28
	5	0.86	0.68	6.77
	6	0.90	0.65	6.29
	7	1.03	0.76	6.49
	8	1.00	0.74	6.74
	9	0.93	0.69	6.63
	10	0.64	0.72	6.32
	11	0.86	0.63	6.20
	12	0.99	0.76	6.35
	13	0.90	0.72	6.78
	14	1.07	0.80	6.57
	15	0.90	0.70	6.75
	16	0.86	0.65	6.69
	17	1.09	0.79	6.63
	18	0.87	0.65	6.49
Summer	1	0.74	0.72	7.13
	2	0.77	0.75	7.06
	3	0.73	0.74	7.01
	4	0.64	0.75	7.06
	5	0.70	0.74	7.32
	6	0.65	0.76	6.99
	7	0.68	0.82	7.15
	8	0.71	0.80	7.07
	9	0.64	0.80	6.99
	10	0.61	0.74	7.02
	11	0.59	0.70	6.93
	12	0.47	0.60	6.68
	13	0.54	0.71	6.81
	14	0.60	0.68	6.84
	15	0.63	0.76	6.93
	16	0.67	0.72	6.91
	17	0.73	0.75	7.07
	18	0.72	0.76	7.05
Fall	1	0.78	0.78	7.04
	2	0.77	0.81	7.18
	3	0.84	0.79	6.94
	4	0.68	0.79	6.78
	5	0.78	0.76	6.86
	6	0.69	0.72	6.87
	7	0.70	0.73	6.88
	8	0.83	0.81	7.04
	9	0.72	0.73	6.83
	10	0.82	0.79	7.14
	11	0.76	0.78	6.87
	12	0.77	0.73	6.99
	13	0.73	0.76	6.88
	14	0.81	0.76	6.77
	15	0.73	0.67	6.78
	16	0.73	0.73	6.74
	17	0.67	0.76	6.67
	18	0.69	0.86	6.45

Table B4. The average Shannon-Weaver diversity index (SWDI), evenness, and Hilsenhoff Biotic Index (HBI) values during the three deployment periods.

Deployment	Station	SWDI	Evenness	HBI
Spring	1	0.82	0.72	7.33
	2	0.81	0.65	7.43
	3	0.85	0.69	7.32
	4	0.75	0.65	7.38
	5	0.69	0.57	7.28
	6	0.88	0.76	7.47
	7	0.82	0.75	7.32
	8	0.86	0.76	7.28
	9	N/A†	N/A†	N/A†
	10	0.81	0.82	7.07
	11	0.90	0.79	7.05
	12	0.87	0.78	7.31
	13	0.82	0.77	7.30
	14	0.89	0.82	7.17
	15	0.80	0.76	7.23
	16	N/A†	N/A†	N/A†
	17	0.88	0.82	7.11
	18	N/A†	N/A†	N/A†
Summer	1	0.68	0.78	7.27
	2	0.74	0.72	7.33
	3	0.70	0.71	7.15
	4	0.63	0.72	7.01
	5	0.71	0.78	7.14
	6	0.65	0.76	7.01
	7	0.64	0.73	7.22
	8	0.69	0.74	7.25
	9	0.64	0.77	7.08
	10	0.61	0.72	6.97
	11	0.57	0.67	7.07
	12	0.67	0.74	7.00
	13	0.66	0.73	7.01
	14	0.67	0.73	7.10
	15	0.68	0.78	7.05
	16	N/A†	N/A†	N/A†
	17	0.72	0.76	7.21
	18	0.70	0.74	7.10
Fall	1	0.74	0.69	6.94
	2	0.87	0.74	7.36
	3	0.84	0.72	6.99
	4	0.70	0.65	6.81
	5	0.83	0.86	6.97
	6	0.78	0.79	6.85
	7	0.67	0.67	6.74
	8	0.78	0.77	6.78
	9	0.69	0.73	6.69
	10	0.57	0.69	6.72
	11	0.77	0.84	6.88
	12	0.86	0.86	6.89
	13	0.72	0.75	6.74
	14	0.77	0.80	6.84
	15	0.79	0.80	6.77
	16	N/A†	N/A†	N/A†
	17	0.58	0.91	7.00
	18	0.68	0.85	6.62

†No data were collected for this station due to vandalism of samplers.

Table B5. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2010 study during the spring season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	6.4	15.7	0.0	4.0	2.9	2.1	10.9	1.7	4.5	4.9	5.0	4.8	2.8	6.0	1.7	39.2	7.5	14.3
Gammarus	7.5	46.5	0.0	1.4	0.2	2.6	19.5	2.3	24.8	20.3	3.9	2.2	2.2	4.8	1.6	15.6	14.9	39.5
Rhithropanopeus	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ablabesmyia	4.1	1.2	0.0	2.9	5.7	1.6	1.4	4.9	1.4	1.4	1.3	3.1	9.7	2.4	3.9	1.1	3.2	0.6
Dicrotendipes	1.2	0.2	0.0	1.8	2.8	0.9	0.5	6.2	0.5	0.3	0.5	0.9	7.5	1.9	2.0	1.0	0.5	0.2
Polypedilum	2.6	5.9	12.5	6.7	4.7	5.7	5.4	4.2	2.9	6.3	5.2	6.4	1.3	4.8	1.5	1.8	4.6	3.3
Tribelos	23.3	6.0	0.0	16.6	22.5	7.3	9.0	21.4	8.1	31.3	5.8	9.7	38.9	13.3	32.5	12.1	15.7	4.7
Rheotanytarsus	4.6	1.5	12.5	6.4	2.4	4.6	2.7	1.5	2.4	1.7	4.3	6.3	0.5	7.4	4.0	0.9	3.7	0.6
Maccaffertium	16.1	1.0	0.0	8.3	0.5	5.1	10.8	1.8	10.2	16.4	6.0	7.9	6.3	8.0	3.3	8.2	15.5	13.5
Hydropsyche	1.8	4.8	0.0	25.4	5.9	47.4	12.5	12.5	17.9	5.6	52.4	34.3	0.0	22.0	8.0	3.2	6.7	4.3
Cyrnellus	9.9	2.4	0.0	6.9	38.8	9.1	9.0	26.9	4.7	2.8	4.6	10.3	15.2	12.9	26.5	7.5	9.9	5.1
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	77.4	85.1	25.0	80.4	86.5	86.5	81.6	83.6	77.3	90.9	88.9	85.7	84.5	83.4	85.0	90.6	82.2	86.1

Table B6. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2010 study during the summer season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	1.2	0.9	0.8	0.2	0.2	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0
Gammarus	1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhithropanopeus	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Ablabesmyia	28.0	31.2	18.5	29.6	23.5	22.9	28.0	24.1	22.7	14.5	12.8	9.8	13.9	16.3	14.9	19.7	17.2	24.4
Dicrotendipes	19.4	11.7	19.3	17.5	33.5	21.8	22.1	14.8	13.6	23.3	11.1	6.6	14.4	13.8	13.6	9.0	20.2	14.1
Polypedilum	3.2	3.4	2.6	0.5	1.7	3.8	2.7	1.3	1.9	0.0	0.4	0.1	0.1	0.7	1.7	1.4	2.9	3.9
Tribelos	31.0	28.3	37.8	32.3	24.5	39.5	25.5	29.2	37.0	47.7	43.6	64.9	57.7	53.2	44.6	43.3	33.2	28.5
Rheotanytarsus	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Maccaffertium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydropsyche	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyrnellus	7.8	9.1	11.2	15.6	7.2	6.9	17.3	21.6	21.8	6.1	29.5	15.9	9.9	8.4	19.1	18.9	18.3	22.8
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	91.5	85.0	90.7	95.6	90.8	95.0	95.8	91.3	97.0	91.9	98.1	97.3	96.1	92.8	93.9	92.3	92.1	93.6

Table B7. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2010 study during the fall season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	0.3	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Gammarus	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhithropanopeus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	2.1	0.3	0.7	5.3	1.6	2.8	7.0	17.6
Ablabesmyia	28.7	31.7	16.8	18.1	16.5	13.1	23.3	17.4	22.4	9.6	12.0	6.4	15.8	7.4	3.9	4.1	1.8	2.2
Dicrotendipes	12.5	14.4	15.0	3.0	10.2	9.2	9.4	10.8	4.3	8.0	11.1	10.6	4.6	7.9	6.0	4.1	5.2	0.7
Polypedilum	4.9	7.0	7.7	2.3	4.8	1.7	2.2	2.6	3.0	0.2	0.2	1.2	2.0	5.7	3.2	5.7	6.3	8.8
Tribelos	28.8	17.5	32.5	45.3	39.1	43.8	42.6	26.7	37.6	24.9	35.3	24.3	30.5	34.3	28.6	17.9	20.3	20.6
Rheotanytarsus	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Maccaffertium	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydropsyche	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyrnellus	9.8	15.6	10.0	18.9	14.9	20.7	11.2	17.2	18.4	16.2	10.3	13.3	16.8	6.7	5.9	4.4	3.0	2.9
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.1	0.2	9.8	4.7	26.9	19.5	35.9	24.0	23.2	38.7	38.6	48.0	36.8
Total	85.0	86.5	83.4	87.7	85.5	88.7	89.1	84.9	90.6	86.8	91.2	92.2	94.3	90.5	87.9	77.7	91.5	89.7

Table B8. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2011 study during the spring season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	12.5	43.0	24.9	27.8	58.8	7.9	1.8	8.7	N/A†	3.4	16.7	9.7	25.6	13.0	4.8	N/A†	12.6	N/A†
Gammarus	4.7	4.6	1.7	0.5	6.0	3.7	6.2	2.9	N/A†	3.0	1.2	3.0	5.0	9.6	4.5	N/A†	7.3	N/A†
Rhithropanopeus	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	N/A†	0.0	0.7	0.3	0.1	0.0	0.0	N/A†	1.0	N/A†
Ablabesmyia	3.9	4.5	7.5	6.5	1.8	5.8	8.9	6.1	N/A†	13.0	9.9	13.8	7.7	9.2	17.2	N/A†	9.4	N/A†
Dicrotendipes	26.2	12.1	14.4	14.4	7.5	32.6	27.3	23.4	N/A†	12.6	7.2	25.9	19.1	14.7	21.5	N/A†	17.9	N/A†
Polypedilum	2.2	3.4	2.7	2.5	1.4	2.1	0.8	1.0	N/A†	0.0	0.7	0.6	1.5	1.0	2.2	N/A†	1.3	N/A†
Tribelos	8.9	5.1	9.0	8.3	8.6	13.6	21.5	24.4	N/A†	25.0	20.4	19.8	16.3	16.7	23.7	N/A†	22.0	N/A†
Rheotanytarsus	0.8	0.5	0.5	0.1	0.1	1.3	0.0	0.7	N/A†	0.0	0.9	0.2	0.1	0.1	0.2	N/A†	0.2	N/A†
Maccaffertium	1.7	0.0	0.3	0.9	2.5	4.8	2.3	2.2	N/A†	11.4	14.9	10.4	6.9	4.4	1.5	N/A†	14.5	N/A†
Hydropsyche	7.6	2.1	2.5	0.0	0.0	0.6	0.8	0.2	N/A†	1.9	2.0	0.3	0.1	3.8	0.2	N/A†	0.5	N/A†
Cymellus	25.0	17.4	28.1	32.6	7.4	16.1	22.5	21.1	N/A†	25.3	17.5	8.4	10.9	22.4	19.5	N/A†	6.9	N/A†
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A†	0.0	0.0	0.0	0.0	0.0	0.0	N/A†	0.0	N/A†
Total	93.5	92.5	91.5	93.7	94.1	88.6	92.2	90.8	N/A†	95.6	92.1	92.4	93.5	95.0	95.1	N/A†	93.6	N/A†

† No data were collected due to lost samples.

Table B9. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2011 study during the summer season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	0.1	0.3	0.3	0.4	0.0	0.6	0.0	0.4	0.1	0.2	0.3	0.1	0.2	0.0	0.0	N/A†	0.2	0.0
Gammarus	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	N/A†	0.2	0.8
Rhithropanopeus	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.1	0.9	0.4	0.2	0.4	N/A†	0.0	0.2
Ablabesmyia	24.0	22.7	24.1	26.0	17.4	14.9	14.0	20.6	24.4	15.4	18.6	24.9	27.5	25.8	24.8	N/A†	29.2	27.5
Dicrotendipes	20.4	9.9	8.7	7.0	18.6	12.3	18.8	13.7	12.5	12.0	6.3	9.9	6.2	11.9	11.9	N/A†	12.5	17.2
Polypedilum	2.7	7.6	6.0	0.8	4.1	3.6	1.8	2.4	2.5	0.7	0.5	1.6	1.9	2.3	3.8	N/A†	7.2	5.3
Tribelos	18.2	6.9	19.7	31.8	27.8	34.6	22.7	16.2	29.4	42.2	29.7	35.8	29.4	26.1	30.7	N/A†	29.7	29.7
Rheotanytarsus	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A†	0.0	0.0
Maccaffertium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	N/A†	0.0	0.2
Hydropsyche	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	N/A†	0.0	0.0
Cymellus	30.9	40.7	35.6	30.6	26.4	30.4	39.7	38.7	28.5	26.1	41.9	21.6	29.3	29.8	24.1	N/A†	15.7	11.5
Mytilopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A†	0.0	0.0
Total	96.3	88.7	94.5	96.6	94.5	96.6	97.2	92.1	97.6	96.7	97.7	94.7	94.8	96.2	95.9	N/A†	94.6	92.4

† No data were collected due to lost samples.

Table B10. Relative abundance (%) of dominant macroinvertebrate taxa collected in the 2011 study during the fall season.

	Station																	
Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Apocorophium	5.2	4.5	1.7	0.4	2.6	0.6	0.5	7.1	3.0	0.3	1.0	1.1	0.0	4.0	0.8	N/A†	0.0	1.4
Gammarus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A†	0.0	0.0
Rhithropanopeus	0.6	0.0	0.7	0.6	10.4	4.5	1.6	7.8	7.6	2.2	19.5	11.3	5.3	5.1	13.0	N/A†	27.9	19.0
Ablabesmyia	4.9	7.0	4.8	2.5	2.6	4.8	3.7	4.1	7.1	3.1	2.9	5.3	1.3	0.6	2.0	N/A†	1.5	0.5
Dicrotendipes	7.3	5.8	9.8	7.2	7.8	7.7	5.8	7.1	4.1	4.4	3.4	4.1	2.7	4.5	4.9	N/A†	1.5	2.8
Polypedilum	0.0	1.7	0.5	2.3	2.2	0.6	0.5	0.0	2.0	0.0	0.0	1.1	2.2	1.7	0.8	N/A†	4.4	1.9
Tribelos	40.4	11.4	41.7	53.9	29.6	40.1	55.0	43.6	52.3	55.2	29.8	29.7	47.8	40.9	41.3	N/A†	20.6	32.2
Rheotanytarsus	1.9	1.7	0.8	0.8	0.4	1.7	0.8	0.7	0.5	0.9	1.5	2.6	0.9	5.1	1.6	N/A†	0.0	0.0
Maccaffertium	0.9	5.2	3.0	2.5	0.4	1.1	1.1	0.7	0.5	0.0	0.5	0.8	0.9	0.0	0.0	N/A†	0.0	0.0
Hydropsyche	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.5	1.1	0.0	0.0	0.4	N/A†	0.0	0.0
Cymellus	24.7	40.6	17.7	16.9	16.1	19.0	12.6	9.1	5.6	19.7	17.6	9.4	9.7	12.5	7.3	N/A†	2.9	1.9
Mytilopsis	0.4	0.0	1.3	1.9	6.1	2.6	1.1	5.4	0.0	0.6	5.9	10.9	8.4	0.6	2.0	N/A†	1.5	7.1
Total	86.3	78.0	82.3	89.1	78.3	82.7	82.9	85.5	82.7	86.5	82.4	77.4	79.2	75.0	74.1	N/A†	60.3	66.8

† No data were collected due to lost samples.

7.3. Appendix C Biothermal Modeling Results (Multivariate Statistics)

Generalized Additive Model ANOVA Results

Analysis for dependent variable N.taxa

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	0.8838	0.4137
	as.factor(Year)	1	0.1622	0.6873
	RiverMile	1	30.5987	<0.0001
	as.factor(Season):RiverMile	2	11.9602	<0.0001
smoothed terms	s(SpCondµScm.mean)	8.01	14.1079	<0.0001
	s(CLOID.mean)	1	1.4005	0.2370
	s(PSEDWT.mean)	8.85	14.2471	<0.0001
	s(t1)	2.61	81.1942	<0.0001
	s(t2)	1	2.5674	0.1095
	s(t3)	1.92	8.8244	0.0002

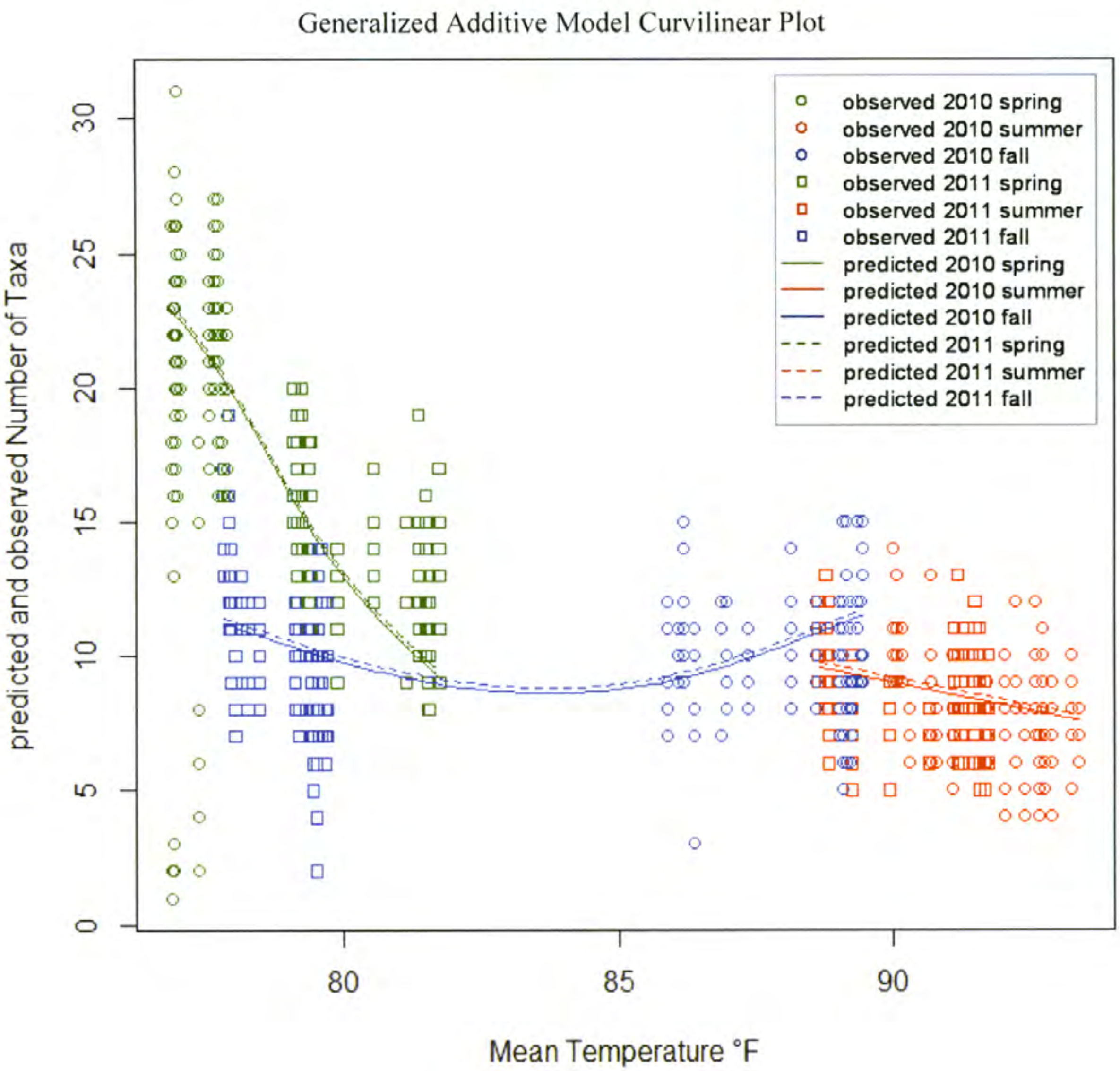
Parametric Coefficients Table

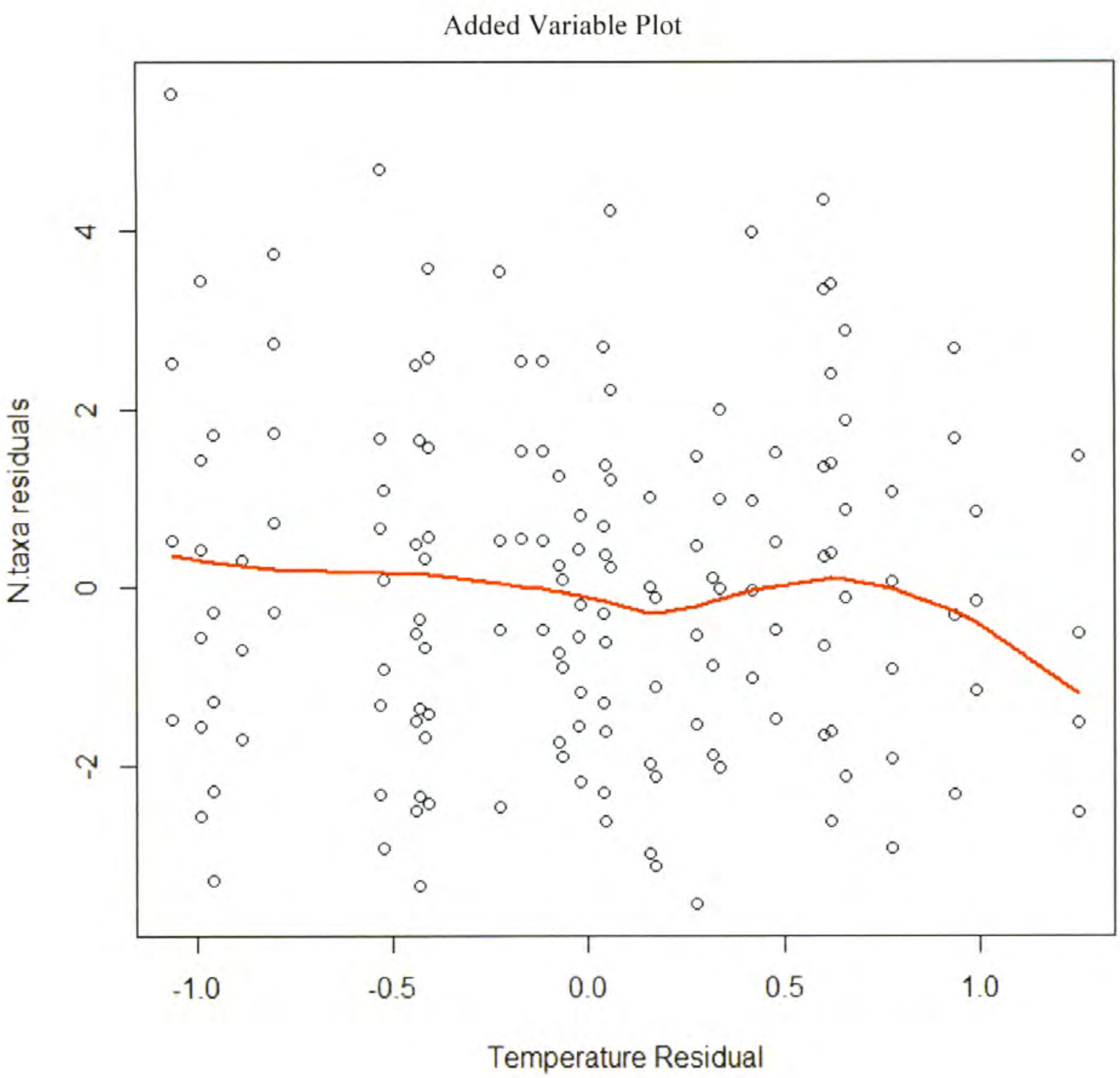
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	10.85	4.4079	2.4611	0.0141
as.factor(Season)2	2.17	6.5326	0.3323	0.7398
as.factor(Season)3	-0.35	6.457	-0.0543	0.9567
as.factor(Year)2011	0.2	0.4908	0.4027	0.6873
RiverMile	-0.38	0.0689	-5.5316	<0.0001
as.factor(Season)2:RiverMile	0.37	0.1125	3.2735	0.0011
as.factor(Season)3:RiverMile	0.72	0.153	4.6742	<0.0001

Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	8.01	8.58	14.1079	<0.0001
s(CLOID.mean)	1	1	1.4005	0.2370
s(PSEDWT.mean)	8.85	8.99	14.2471	<0.0001
s(t1)	2.61	2.98	81.1942	<0.0001
s(t2)	1	1	2.5674	0.1095
s(t3)	1.92	1.99	8.8244	0.0002

r-square (adjusted) = 0.7805
GCV score = 6.535
sample size = 714


Generalized Additive Model Curvilinear Plot
observed 2010 spring
observed 2010 summer
observed 2010 fall
observed 2011 spring
observed 2011 summer
observed 2011 fall
predicted 2010 spring
predicted 2010 summer
predicted 2010 fall
predicted 2011 spring
predicted 2011 summer
predicted 2011 fall
predicted and observed Number of Taxa
0
5
10
15
20
25
30
80
85
90
Mean Temperature °F


Added Variable Plot
N.taxa residuals
Temperature Residual
-1.0
-0.5
0.0
0.5
1.0
-2
0
2
4

Analysis for dependent variable log.N.taxa

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	1.5647	0.2099
	as.factor(Year)	1	0.153	0.6958
	RiverMile	1	32.0673	<0.0001
	as.factor(Season):RiverMile	2	11.1209	<0.0001
smoothed terms	s(SpCondµScm.mean)	7.92	12.2403	<0.0001
	s(CLOID.mean)	1	1.9239	0.1659
	s(PSEDWT.mean)	8.9	18.6744	<0.0001
	s(t1)	1	114.1486	<0.0001
	s(t2)	1.08	4.5288	0.0291
	s(t3)	1.92	8.388	0.0003

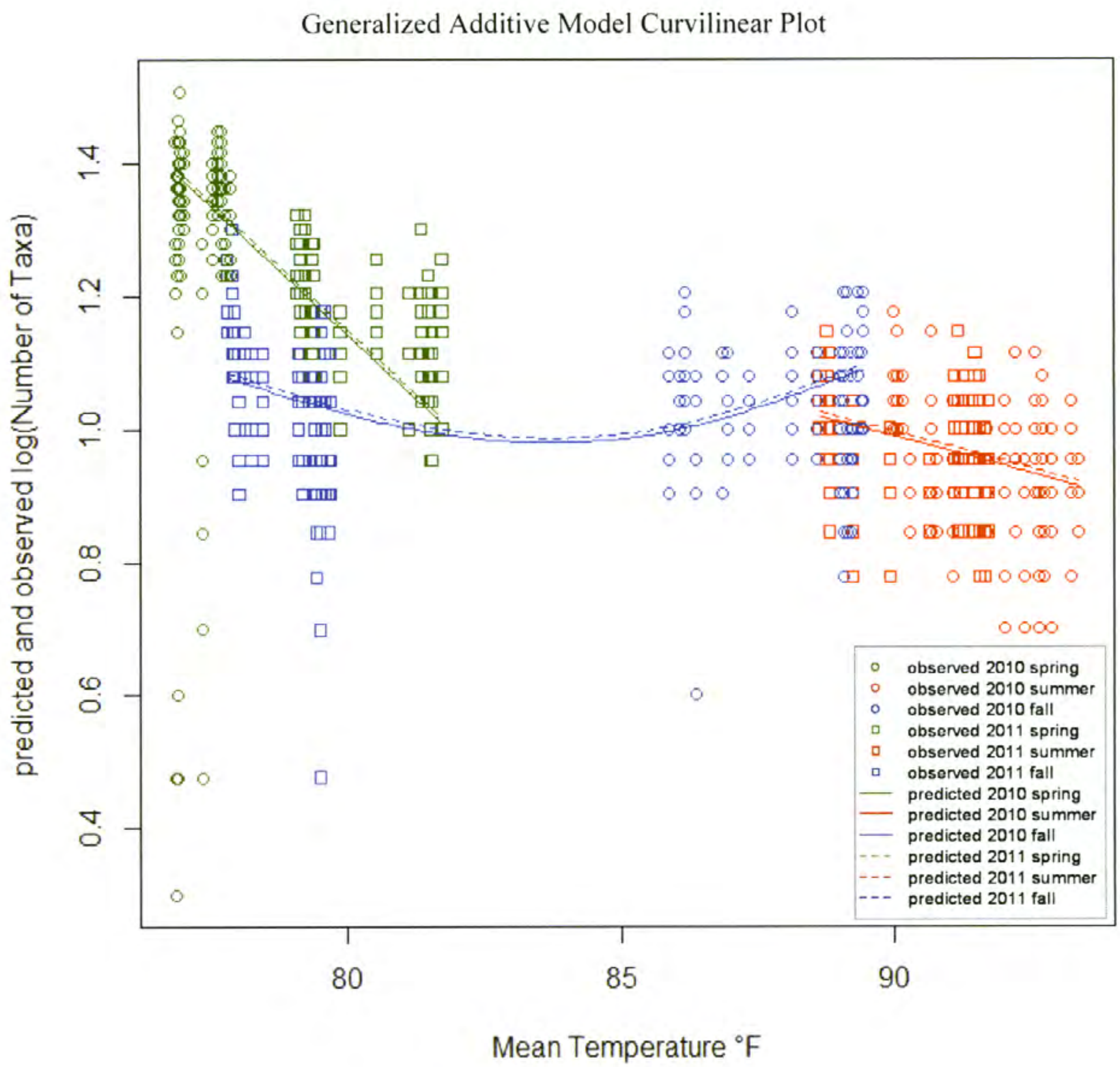
Parametric Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	1.03	0.0345	29.7795	<0.0001
as.factor(Season)2	0.11	0.0662	1.6471	0.1000
as.factor(Season)3	-0.02	0.0558	-0.2809	0.7789
as.factor(Year)2011	0.01	0.0182	0.3911	0.6958
RiverMile	-0.01	0.0024	-5.6628	<0.0001
as.factor(Season)2:RiverMile	0.01	0.0043	2.885	0.0040
as.factor(Season)3:RiverMile	0.03	0.0058	4.5746	<0.0001

Smoothing Terms Inference Table

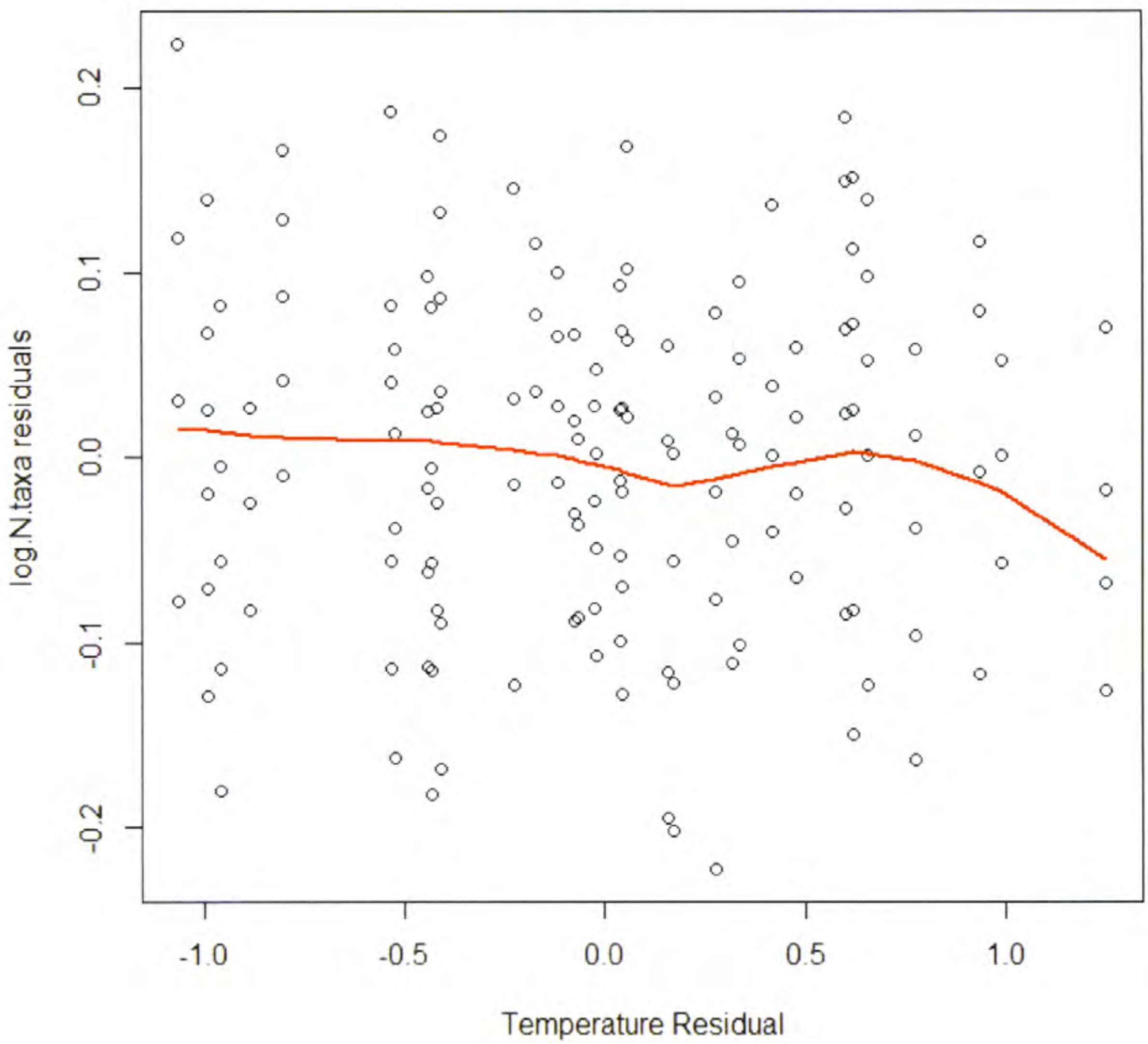
Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	7.92	8.52	12.2403	<0.0001
s(CLOID.mean)	1	1	1.9239	0.1659
s(PSEDWT.mean)	8.9	9	18.6744	<0.0001
s(t1)	1	1	114.1486	<0.0001
s(t2)	1.08	1.15	4.5288	0.0291
s(t3)	1.92	1.99	8.388	0.0003

r-square (adjusted) = 0.7015
GCV score = 0.0098
sample size = 714



Generalized Additive Model Curvilinear Plot
predicted and observed log(Number of Taxa)
0.4
0.6
0.8
1.0
1.2
1.4
80
85
90
Mean Temperature °F
observed 2010 spring
observed 2010 summer
observed 2010 fall
observed 2011 spring
observed 2011 summer
observed 2011 fall
predicted 2010 spring
predicted 2010 summer
predicted 2010 fall
predicted 2011 spring
predicted 2011 summer
predicted 2011 fall

Added Variable Plot



Analysis for dependent variable Count.sum

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	0.2437	0.7838
	as.factor(Year)	1	1.726	0.1894
	RiverMile	1	0.7186	0.3969
	as.factor(Season):RiverMile	2	0.0204	0.9798
smoothed terms	s(SpCondµScm.mean)	7.95	3.5218	0.0004
	s(CLOID.mean)	3.86	2.2923	0.0472
	s(PSEDWT.mean)	8.76	2.9121	0.0022
	s(t1)	3.17	23.3288	<0.0001
	s(t2)	1	0	0.9978
	s(t3)	1	7.3612	0.0068

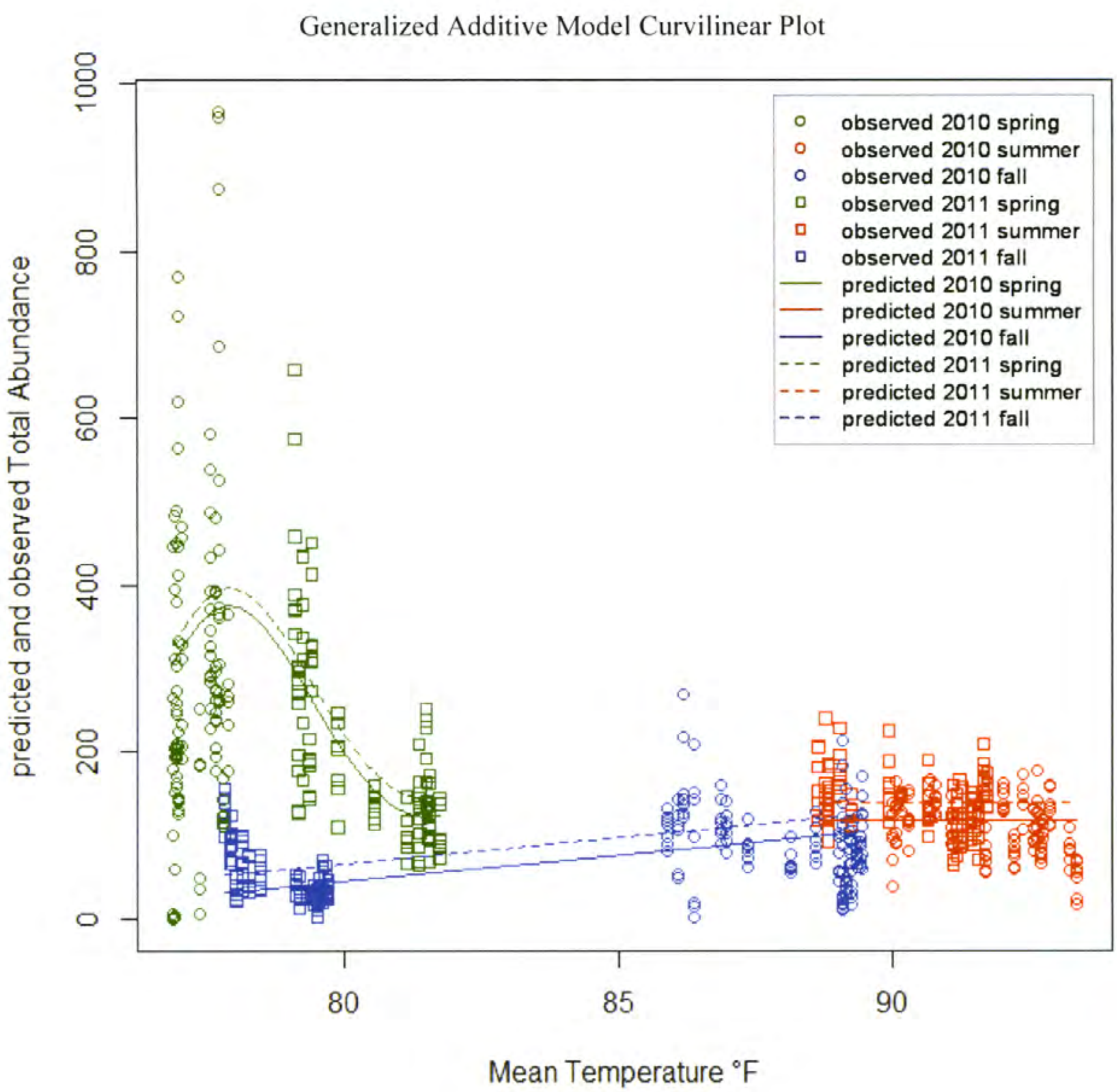
Parametric Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	301.83	256.3833	1.1773	0.2395
as.factor(Season)2	-235.91	373.2097	-0.6321	0.5275
as.factor(Season)3	-251.6	374.9572	-0.671	0.5024
as.factor(Year)2011	21.02	16.0032	1.3138	0.1894
RiverMile	2.08	2.4567	0.8477	0.3969
as.factor(Season)2:RiverMile	-0.4	3.6891	-0.1089	0.9134
as.factor(Season)3:RiverMile	0.53	5.117	0.1033	0.9178

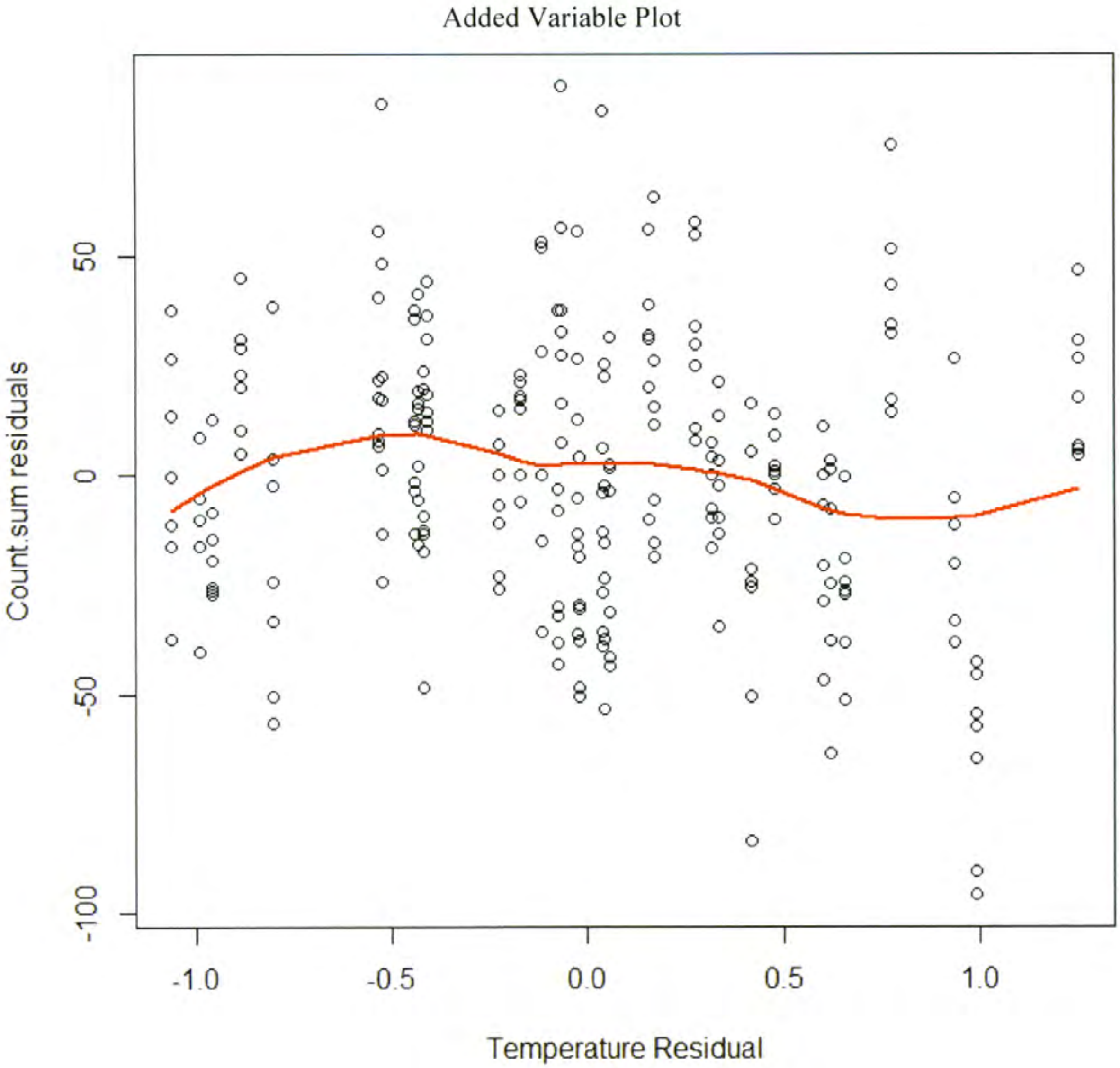
Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	7.95	8.51	3.5218	0.0004
s(CLOID.mean)	3.86	4.78	2.2923	0.0472
s(PSEDWT.mean)	8.76	8.97	2.9121	0.0022
s(t1)	3.17	3.51	23.3288	<0.0001
s(t2)	1	1	0	0.9978
s(t3)	1	1	7.3612	0.0068

r-square (adjusted) = 0.563
GCV score = 6736.9274
sample size = 714



Generalized Additive Model Curvilinear Plot
predicted and observed Total Abundance
Mean Temperature °F
0
200
400
600
800
1000
80
85
90
observed 2010 spring
observed 2010 summer
observed 2010 fall
observed 2011 spring
observed 2011 summer
observed 2011 fall
predicted 2010 spring
predicted 2010 summer
predicted 2010 fall
predicted 2011 spring
predicted 2011 summer
predicted 2011 fall


Added Variable Plot
Count.sum residuals
Temperature Residual
50
0
-50
-100
-1.0
-0.5
0.0
0.5
1.0

Analysis for dependent variable log.Count.sum

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	2.5475	0.0790
	as.factor(Year)	1	0.3615	0.5479
	RiverMile	1	1.1898	0.2758
	as.factor(Season):RiverMile	2	5.9987	0.0026
smoothed terms	s(SpCondµScm.mean)	8.57	9.0337	<0.0001
	s(CLOID.mean)	3.67	1.6454	0.1511
	s(PSEDWT.mean)	8.96	14.6762	<0.0001
	s(t1)	3.71	17.1536	<0.0001
	s(t2)	3.74	3.2812	0.0118
	s(t3)	1.83	18.8298	<0.0001

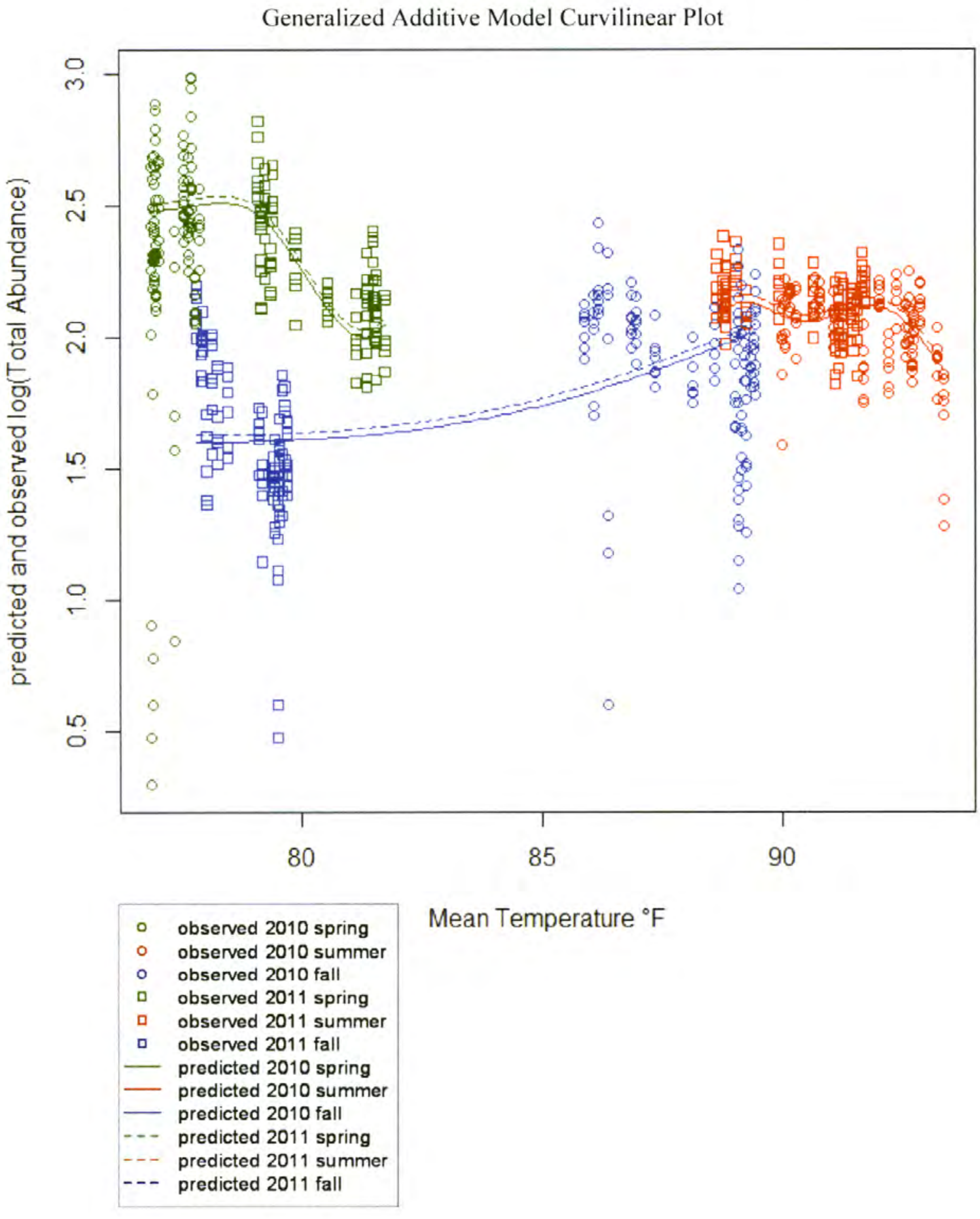
Parametric Coefficients Table

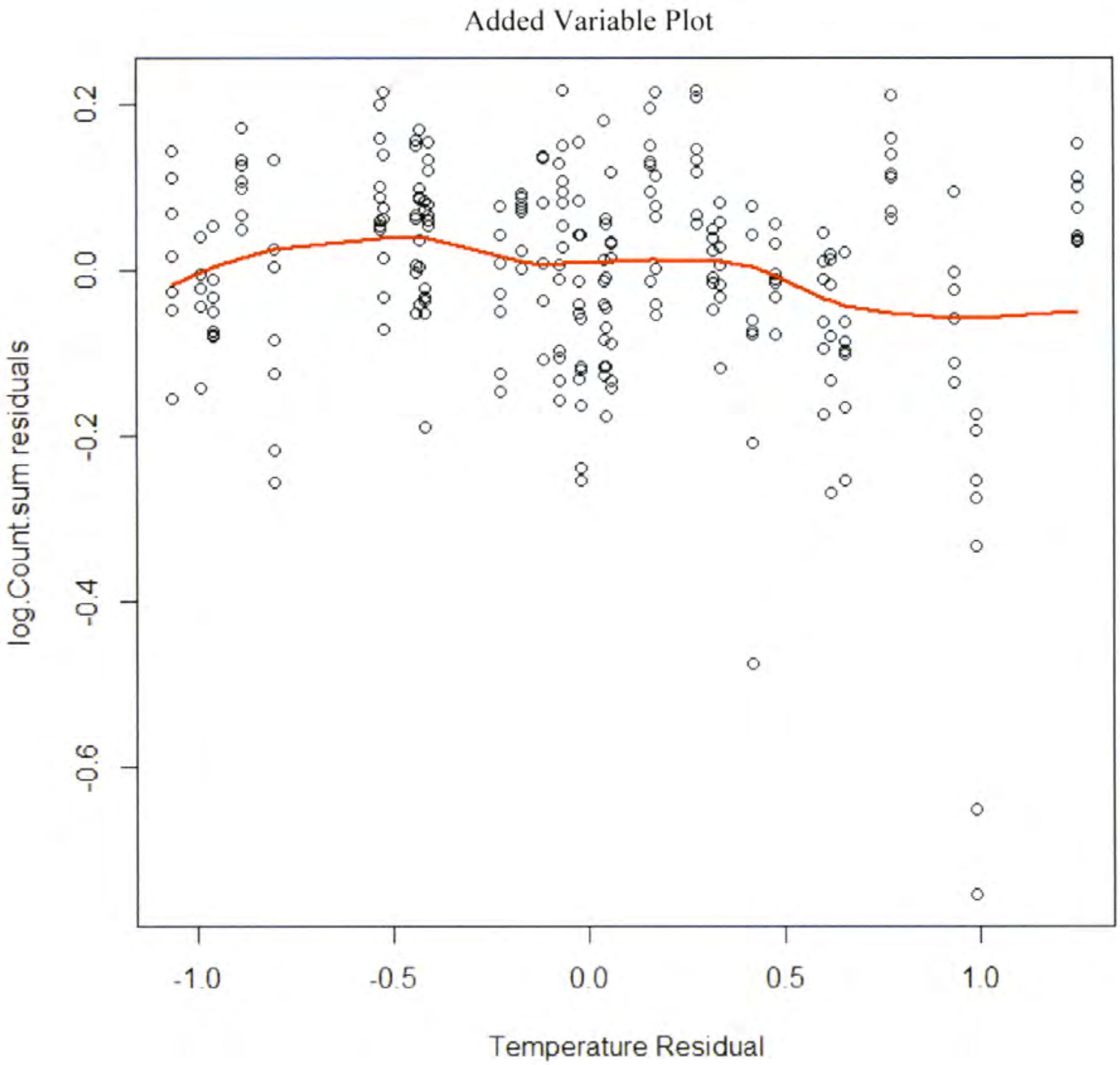
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	5.01	1.3263	3.7796	0.0002
as.factor(Season)2	-6.34	2.9525	-2.1475	0.0321
as.factor(Season)3	-2.38	1.429	-1.6659	0.0962
as.factor(Year)2011	0.03	0.0449	0.6013	0.5479
RiverMile	-0.01	0.0068	-1.0908	0.2758
as.factor(Season)2:RiverMile	0.01	0.0098	1.5003	0.1340
as.factor(Season)3:RiverMile	0.05	0.0138	3.4604	0.0006

Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	8.57	8.88	9.0337	<0.0001
s(CLOID.mean)	3.67	4.58	1.6454	0.1511
s(PSEDWT.mean)	8.96	9	14.6762	<0.0001
s(t1)	3.71	3.93	17.1536	<0.0001
s(t2)	3.74	3.93	3.2812	0.0118
s(t3)	1.83	1.96	18.8298	<0.0001

r-square (adjusted) = 0.6902
GCV score = 0.0438
sample size = 714


Generalized Additive Model Curvilinear Plot
predicted and observed log(Total Abundance)
3.0
2.5
2.0
1.5
1.0
0.5
80
85
90
Mean Temperature °F
observed 2010 spring
observed 2010 summer
observed 2010 fall
observed 2011 spring
observed 2011 summer
observed 2011 fall
predicted 2010 spring
predicted 2010 summer
predicted 2010 fall
predicted 2011 spring
predicted 2011 summer
predicted 2011 fall


Added Variable Plot
log.Count.sum residuals
0.2
0.0
-0.2
-0.4
-0.6
-1.0
-0.5
0.0
0.5
1.0
Temperature Residual

Analysis for dependent variable shannon

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	1.289	0.2762
	as.factor(Year)	1	2.2408	0.1349
	RiverMile	1	12.3441	0.0005
	as.factor(Season):RiverMile	2	5.3192	0.0051
smoothed terms	s(SpCondµScm.mean)	8.21	6.3404	<0.0001
	s(CLOID.mean)	1.81	1.8588	0.1479
	s(PSEDWT.mean)	8.89	12.8412	<0.0001
	s(t1)	2.13	9.5999	<0.0001
	s(t2)	1.72	5.9357	0.0026
	s(t3)	1	3.2727	0.0709

Parametric Coefficients Table

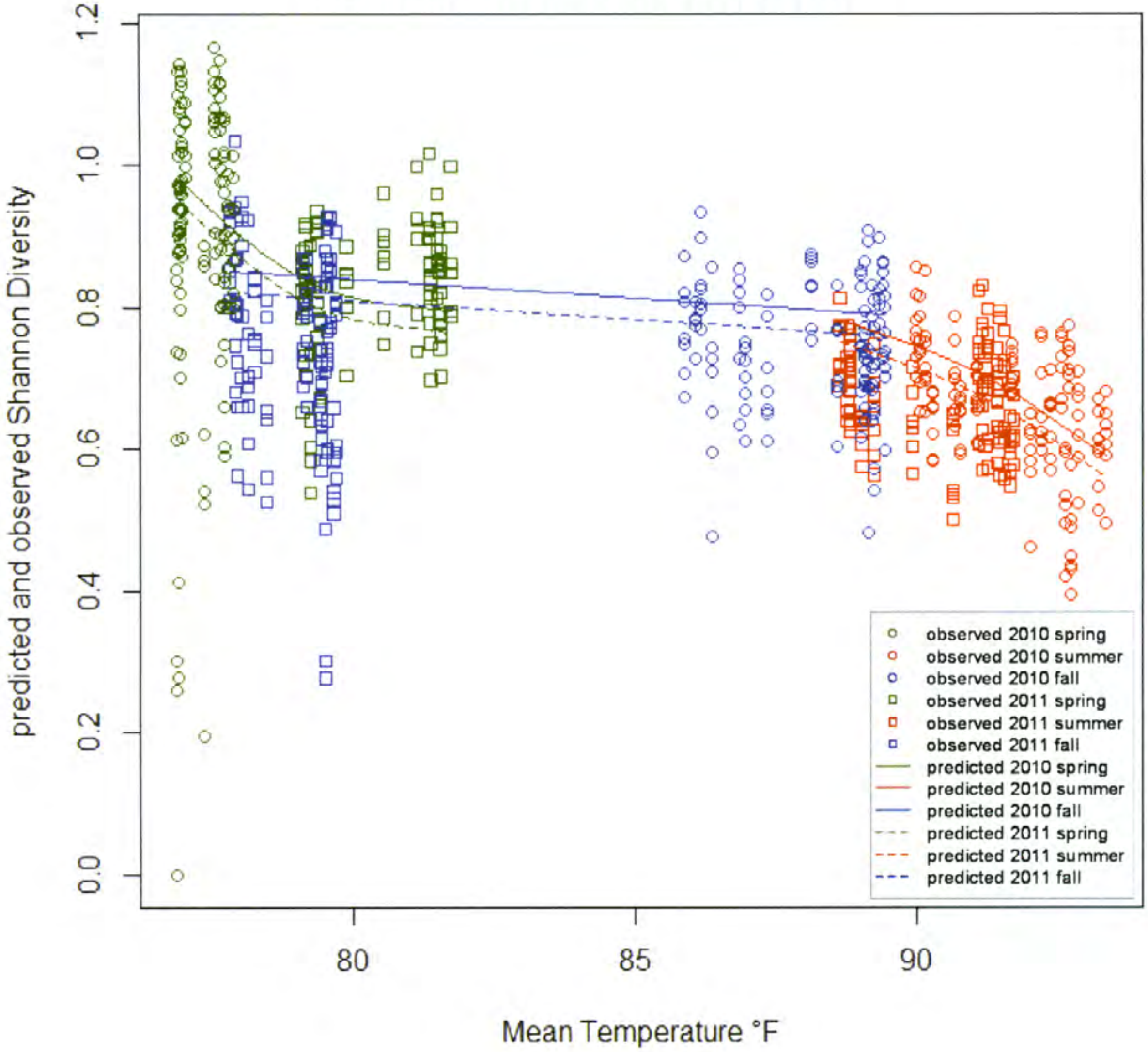
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	0.87	0.1159	7.4974	<0.0001
as.factor(Season)2	-0.07	0.2036	-0.3663	0.7142
as.factor(Season)3	-0.21	0.1597	-1.3272	0.1849
as.factor(Year)2011	-0.03	0.0203	-1.4969	0.1349
RiverMile	-0.01	0.0027	-3.5134	0.0005
as.factor(Season)2:RiverMile	0	0.0047	1.065	0.2873
as.factor(Season)3:RiverMile	0.02	0.0064	3.2452	0.0012

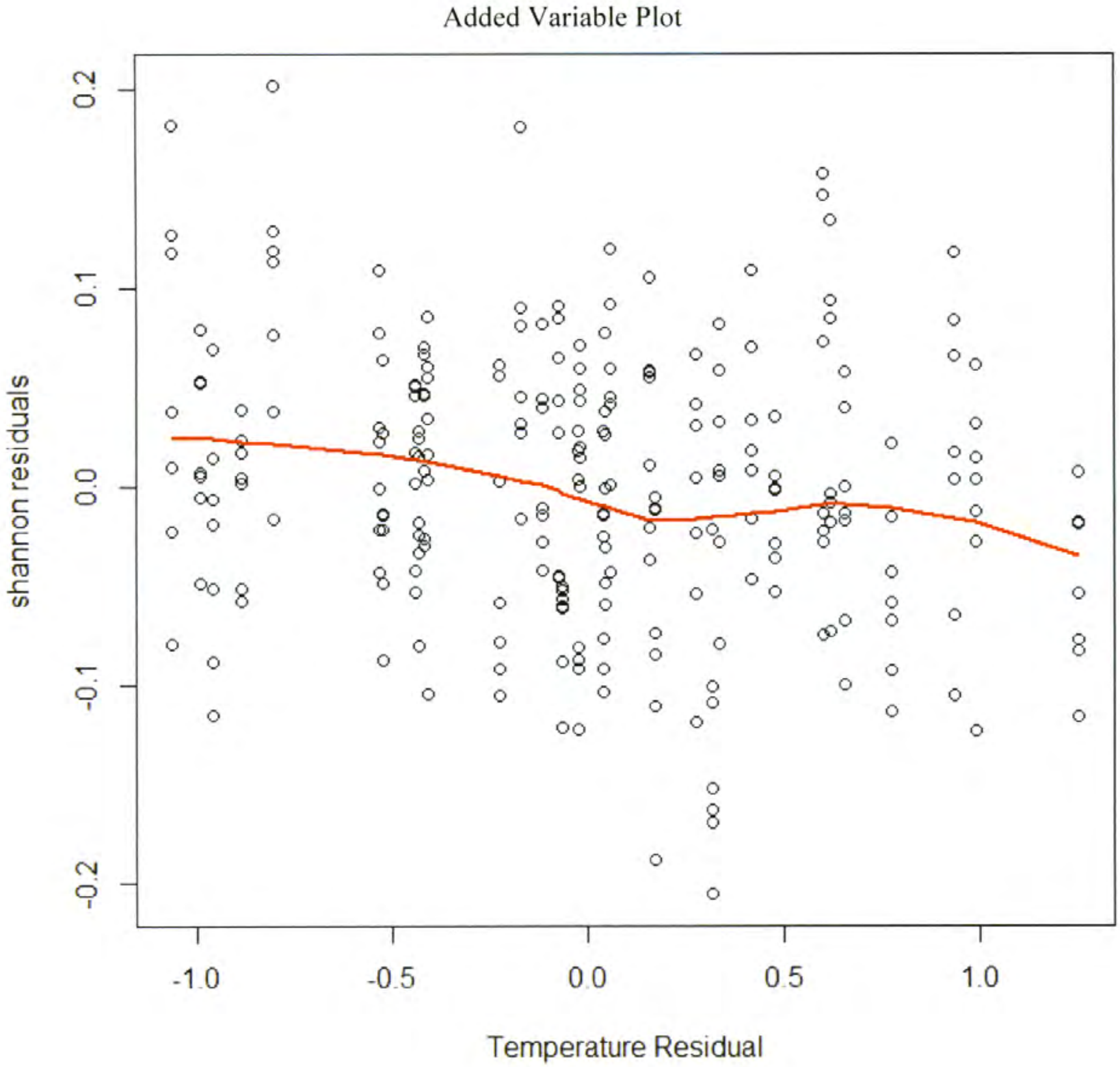
Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	8.21	8.7	6.3404	<0.0001
s(CLOID.mean)	1.81	2.3	1.8588	0.1479
s(PSEDWT.mean)	8.89	8.99	12.8412	<0.0001
s(t1)	2.13	2.47	9.5999	<0.0001
s(t2)	1.72	2.07	5.9357	0.0026
s(t3)	1	1	3.2727	0.0709

r-square (adjusted) = 0.5143
GCV score = 0.0112
sample size = 714

Generalized Additive Model Curvilinear Plot




Added Variable Plot
shannon residuals
Temperature Residual
0.2
0.1
0.0
-0.1
-0.2
-1.0
-0.5
0.0
0.5
1.0

Analysis for dependent variable evenness

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	0.8328	0.4353
	as.factor(Year)	1	6.4774	0.0111
	RiverMile	1	1.8909	0.1695
	as.factor(Season):RiverMile	2	1.8624	0.1561
smoothed terms	s(SpCondµScm.mean)	1	8.3831	0.0039
	s(CLOID.mean)	1	1.793	0.1810
	s(PSEDWT.mean)	3.57	4.5017	0.0010
	s(t1)	3.63	11.5608	<0.0001
	s(t2)	2.58	3.0971	0.0279
	s(t3)	1.9	10.9893	<0.0001

Parametric Coefficients Table

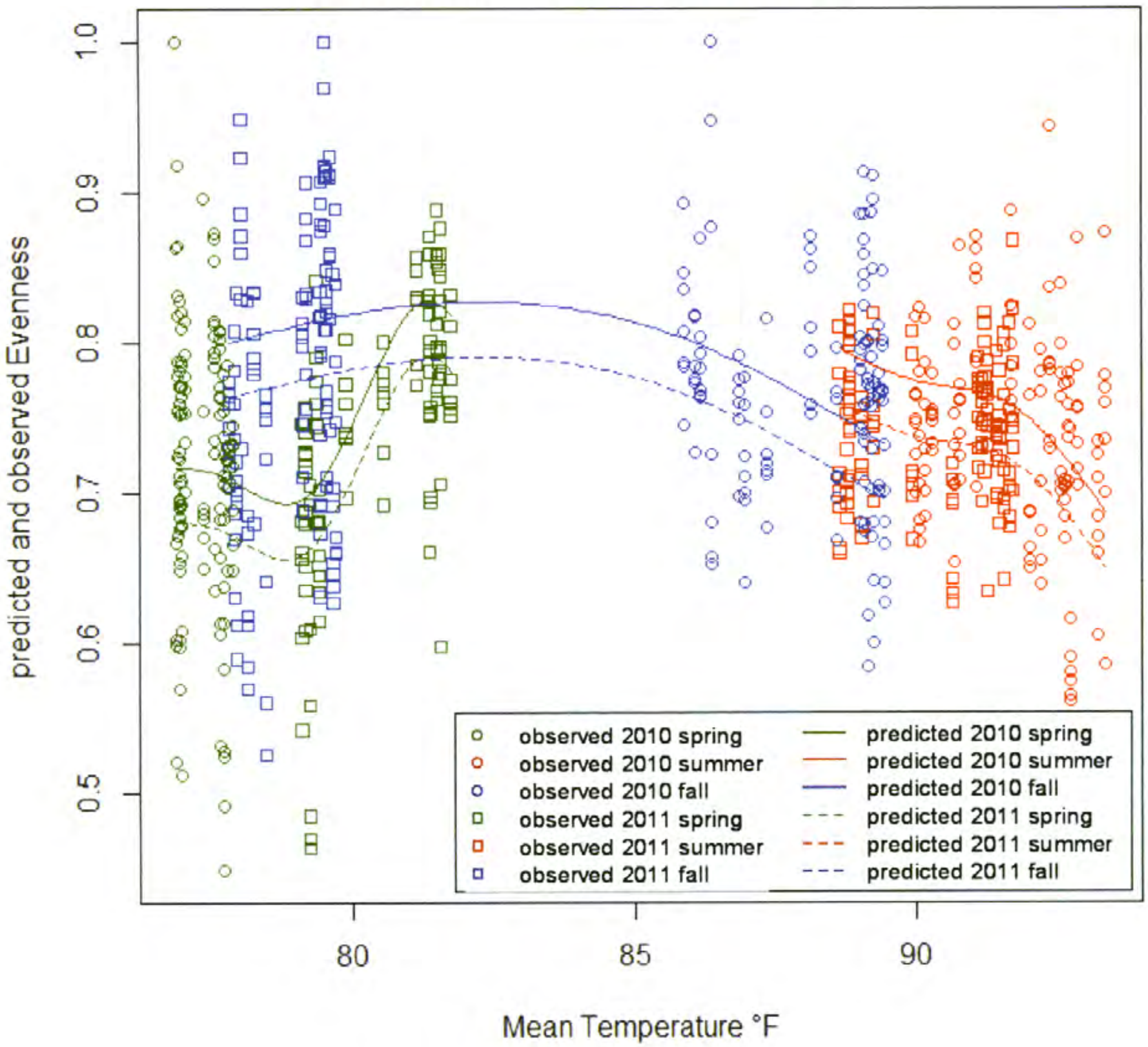
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	0.35	0.3241	1.0714	0.2844
as.factor(Season)2	0.64	0.505	1.2717	0.2039
as.factor(Season)3	0.57	0.4618	1.2349	0.2173
as.factor(Year)2011	-0.04	0.0144	-2.5451	0.0111
RiverMile	0	0.0022	1.3751	0.1695
as.factor(Season)2:RiverMile	-0.01	0.0032	-1.9205	0.0552
as.factor(Season)3:RiverMile	0	0.0031	-1.2322	0.2183

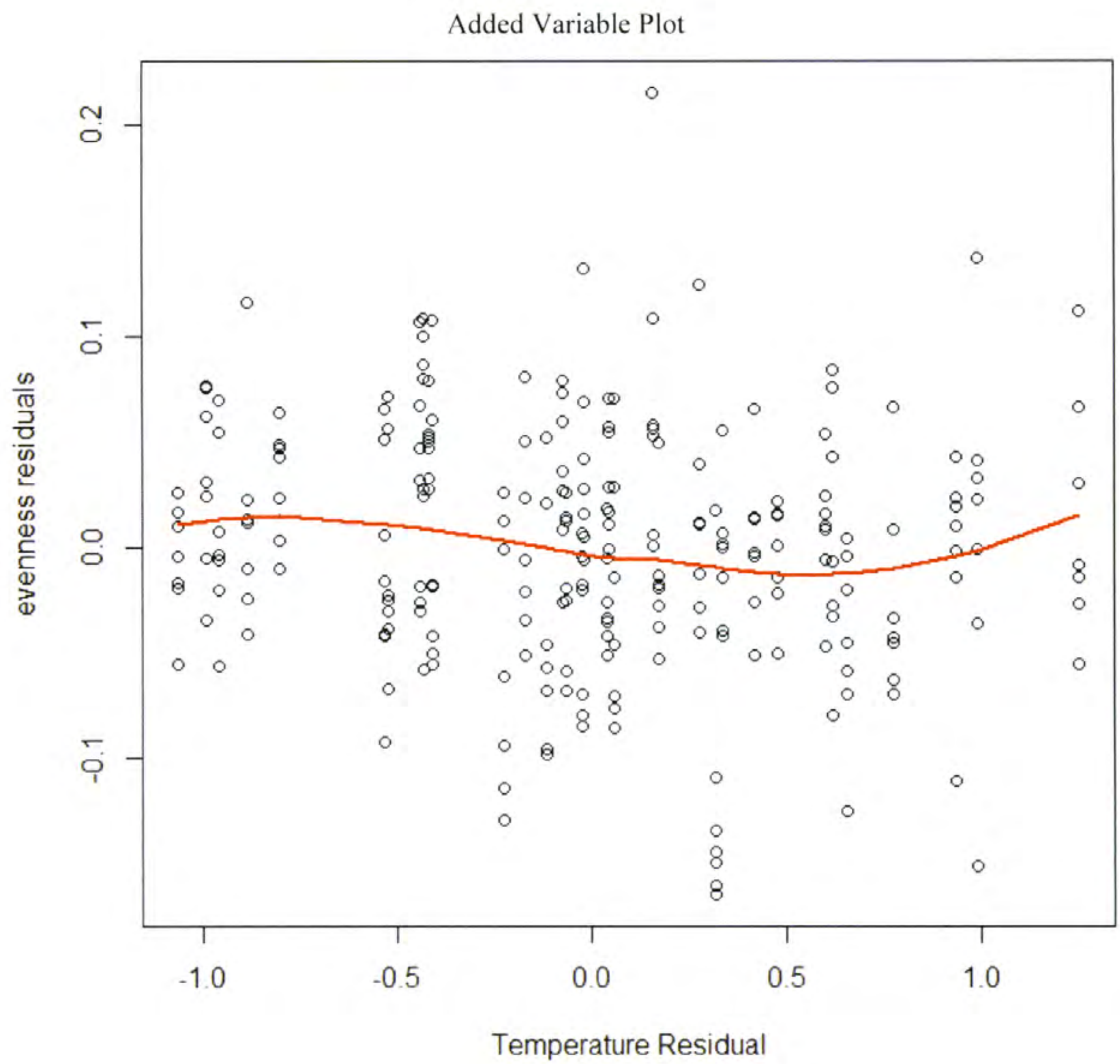
Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	1	1	8.3831	0.0039
s(CLOID.mean)	1	1	1.793	0.1810
s(PSEDWT.mean)	3.57	4.43	4.5017	0.0010
s(t1)	3.63	3.88	11.5608	<0.0001
s(t2)	2.58	2.91	3.0971	0.0279
s(t3)	1.9	1.99	10.9893	<0.0001

r-square (adjusted) = 0.1969
GCV score = 0.0055
sample size = 713

Generalized Additive Model Curvilinear Plot





Added Variable Plot
evenness residuals
0.2
0.1
0.0
-0.1
-1.0
-0.5
0.0
0.5
1.0
Temperature Residual

Analysis for dependent variable HBI.mean

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	13.3908	<0.0001
	as.factor(Year)	1	8.7832	0.0031
	RiverMile	1	2.9534	0.0862
	as.factor(Season):RiverMile	2	4.7878	0.0086
smoothed terms	s(SpCondμScm.mean)	8.87	6.1024	<0.0001
	s(CLOID.mean)	4.61	3.192	0.0053
	s(PSEDWT.mean)	7.85	6.8016	<0.0001
	s(t1)	3.87	29.4368	<0.0001
	s(t2)	3.95	6.8371	<0.0001
	s(t3)	1.48	1.0257	0.3368

Parametric Coefficients Table

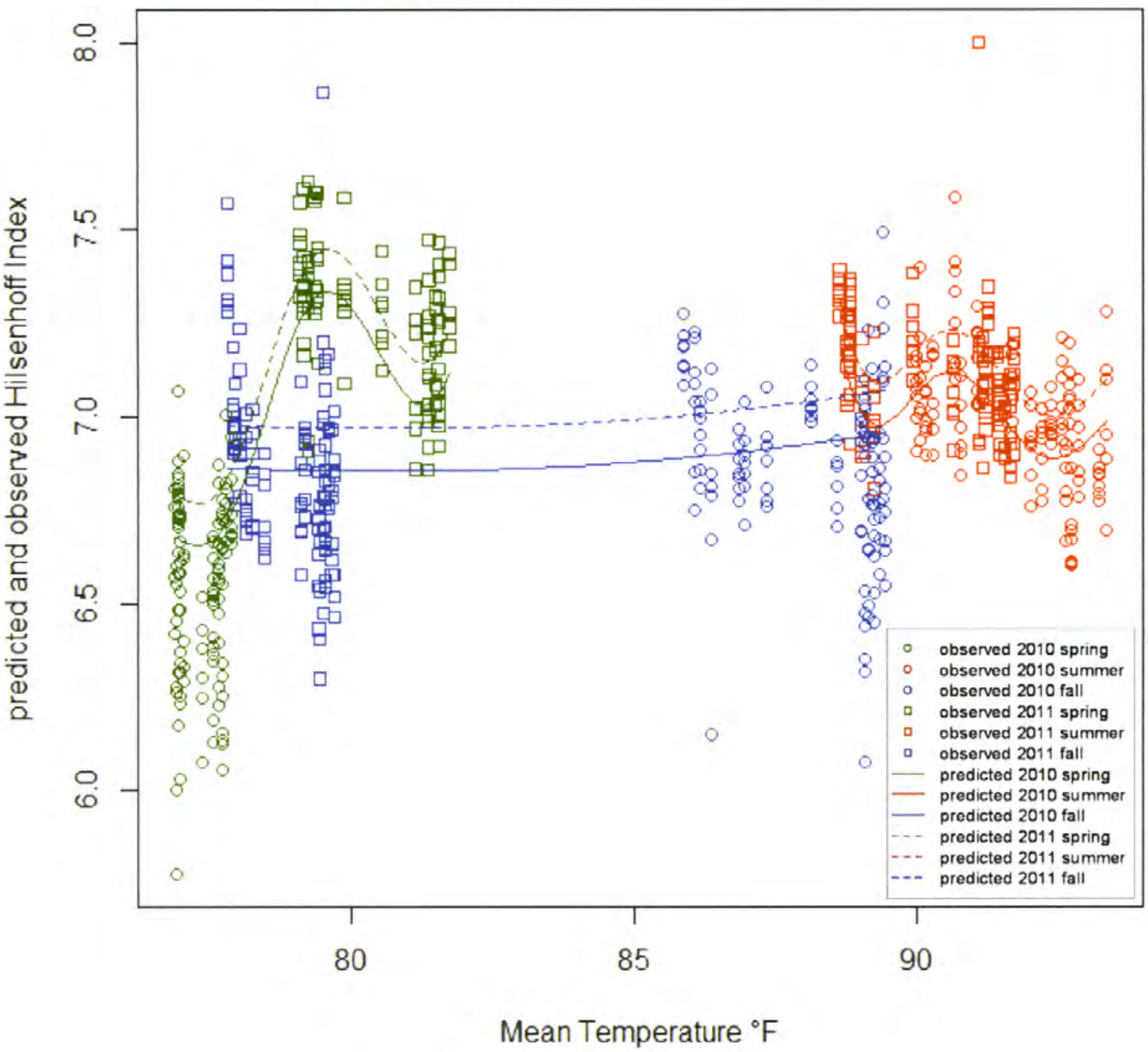
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	6.5	1.2579	5.1706	<0.0001
as.factor(Season)2	5.4	2.8117	1.9215	0.0551
as.factor(Season)3	-4.31	1.3225	-3.2575	0.0012
as.factor(Year)2011	0.11	0.0382	2.9637	0.0031
RiverMile	-0.01	0.0059	-1.7186	0.0862
as.factor(Season)2:RiverMile	0.01	0.0083	1.1903	0.2343
as.factor(Season)3:RiverMile	0.04	0.0118	3.0779	0.0022

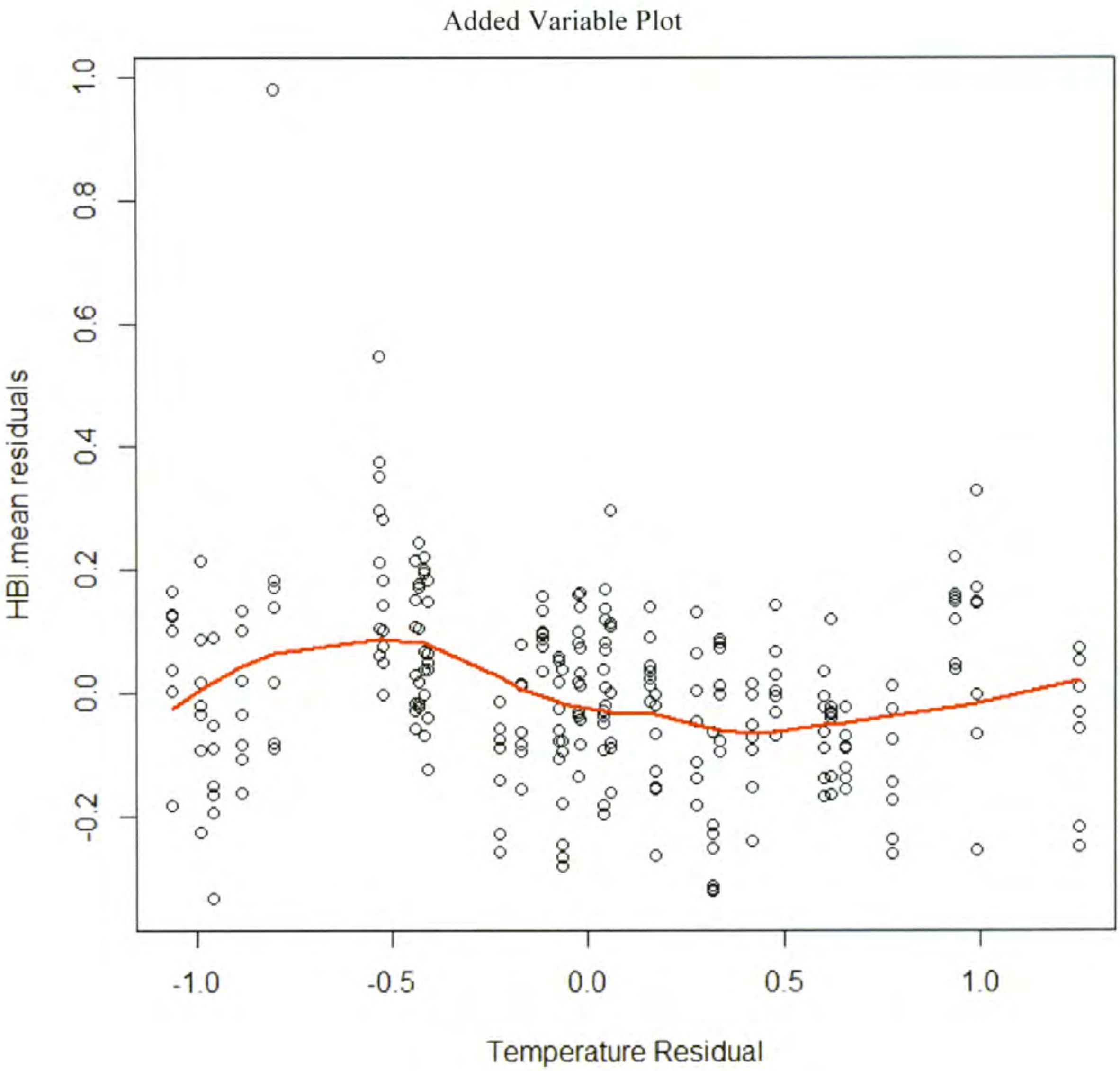
Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondμScm.mean)	8.87	8.98	6.1024	<0.0001
s(CLOID.mean)	4.61	5.68	3.192	0.0053
s(PSEDWT.mean)	7.85	8.54	6.8016	<0.0001
s(t1)	3.87	3.98	29.4368	<0.0001
s(t2)	3.95	4	6.8371	<0.0001
s(t3)	1.48	1.72	1.0257	0.3368

r-square (adjusted) = 0.6841
GCV score = 0.0314
sample size = 710

Generalized Additive Model Curvilinear Plot




Added Variable Plot
HBI.mean residuals
Temperature Residual
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-1.0
-0.5
0.0
0.5
1.0

Analysis for dependent variable N.EPT

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	2.0059	0.1353
	as.factor(Year)	1	0.0017	0.9671
	RiverMile	1	7.0396	0.0082
	as.factor(Season):RiverMile	2	4.497	0.0115
smoothed terms	s(SpCondµScm.mean)	8.09	9.2893	<0.0001
	s(CLOID.mean)	8.79	4.5619	<0.0001
	s(PSEDWT.mean)	8.73	8.9491	<0.0001
	s(t1)	3.73	59.7966	<0.0001
	s(t2)	1	1.849	0.1743
	s(t3)	1.24	10.3939	0.0004

Parametric Coefficients Table

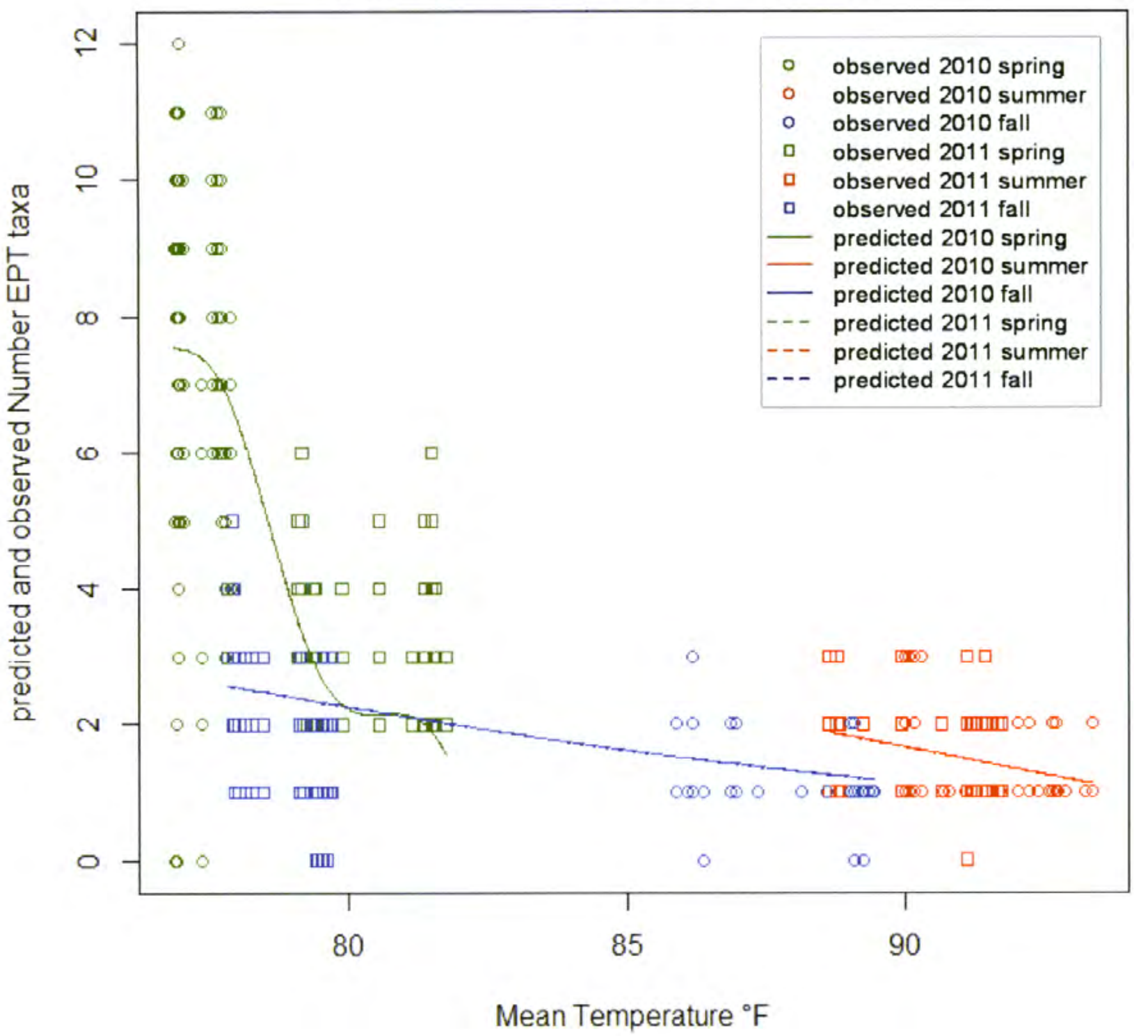
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	-5.09	5.4262	-0.9377	0.3487
as.factor(Season)2	11.68	7.8443	1.4892	0.1369
as.factor(Season)3	10.62	7.9458	1.337	0.1817
as.factor(Year)2011	-0.01	0.2265	-0.0413	0.9671
RiverMile	-0.1	0.0383	-2.6532	0.0082
as.factor(Season)2:RiverMile	0.09	0.0531	1.7208	0.0857
as.factor(Season)3:RiverMile	0.22	0.0751	2.9805	0.0030

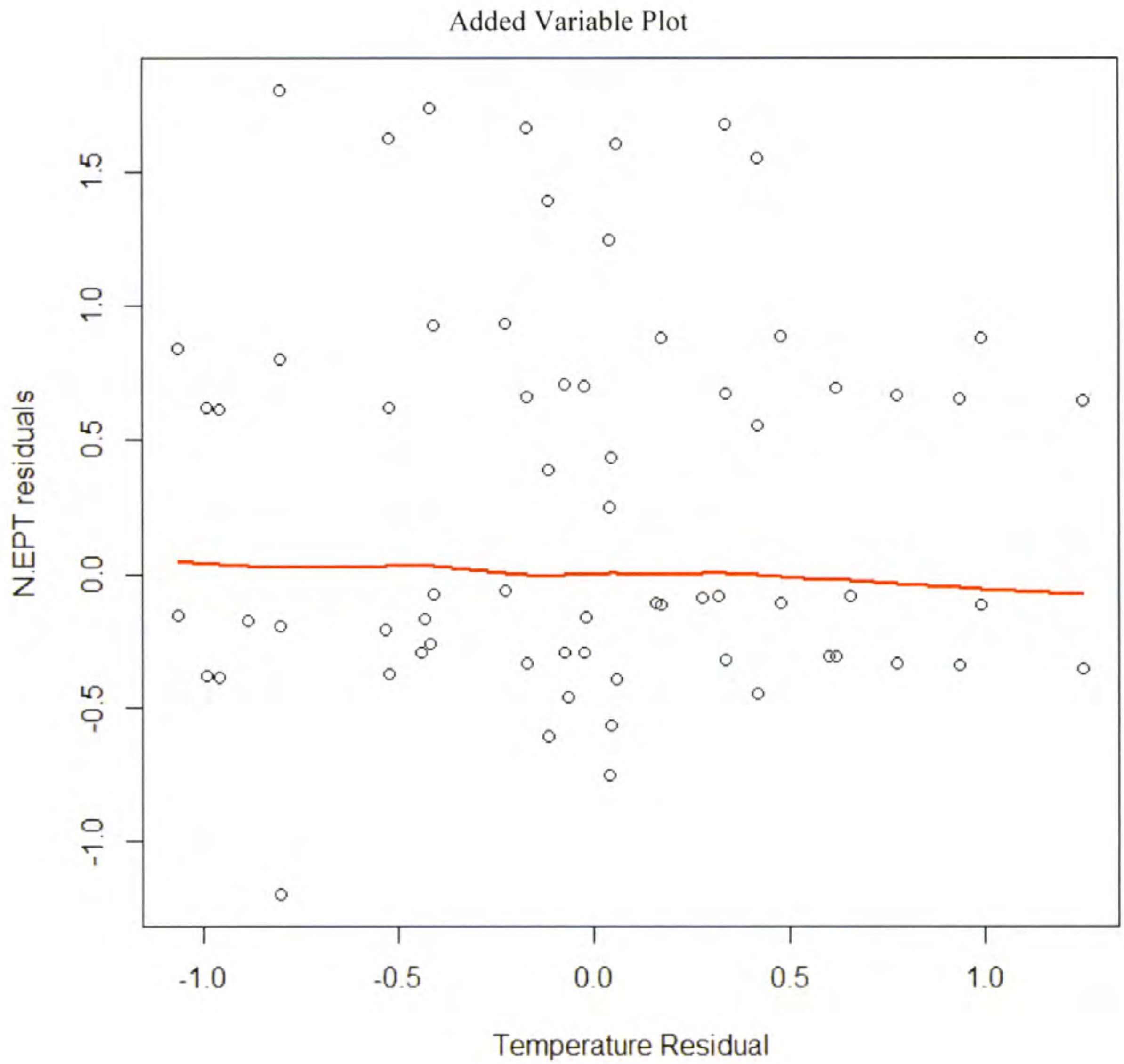
Smoothing Terms Inference Table

Parameter	edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	8.09	8.66	9.2893	<0.0001
s(CLOID.mean)	8.79	8.97	4.5619	<0.0001
s(PSEDWT.mean)	8.73	8.95	8.9491	<0.0001
s(t1)	3.73	3.94	59.7966	<0.0001
s(t2)	1	1	1.849	0.1743
s(t3)	1.24	1.42	10.3939	0.0004

r-square (adjusted) = 0.8012
GCV score = 1.3001
sample size = 714

Generalized Additive Model Curvilinear Plot





Added Variable Plot
N.EPT residuals
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.0
-0.5
0.0
0.5
1.0
Temperature Residual

Analysis for dependent variable log.N.EPT

Analysis of Variance

Type	Source	df/edf	F-stat	p-value
parametric terms	as.factor(Season)	2	2.0451	0.1302
	as.factor(Year)	1	0.6848	0.4082
	RiverMile	1	4.7546	0.0296
	as.factor(Season):RiverMile	2	4.6157	0.0102
smoothed terms	s(SpCondµScm.mean)	7.34	8.0646	<0.0001
	s(CLOID.mean)	8.8	3.3814	0.0005
	s(PSEDWT.mean)	8.85	10.2219	<0.0001
	s(t1)	3.68	36.2273	<0.0001
	s(t2)	1	1.8157	0.1783
	s(t3)	1.81	9.8778	<0.0001

Parametric Coefficients Table

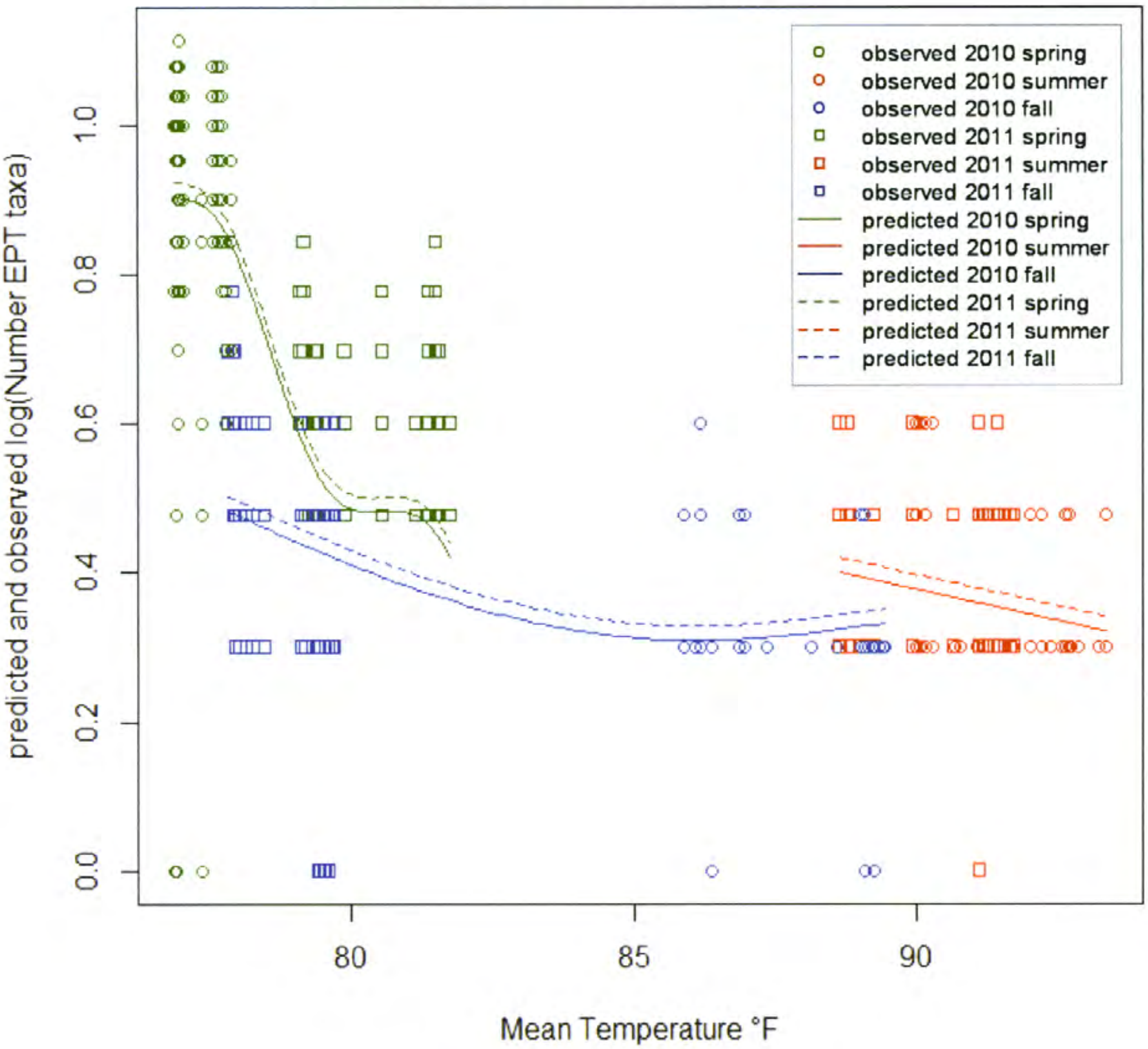
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	-0.16	0.5554	-0.2883	0.7732
as.factor(Season)2	0.98	0.8022	1.2194	0.2231
as.factor(Season)3	0.84	0.8142	1.0287	0.3040
as.factor(Year)2011	0.02	0.0237	0.8275	0.4082
RiverMile	-0.01	0.004	-2.1805	0.0296
as.factor(Season)2:RiverMile	0.01	0.0056	1.7192	0.0860
as.factor(Season)3:RiverMile	0.02	0.0079	3.0234	0.0026

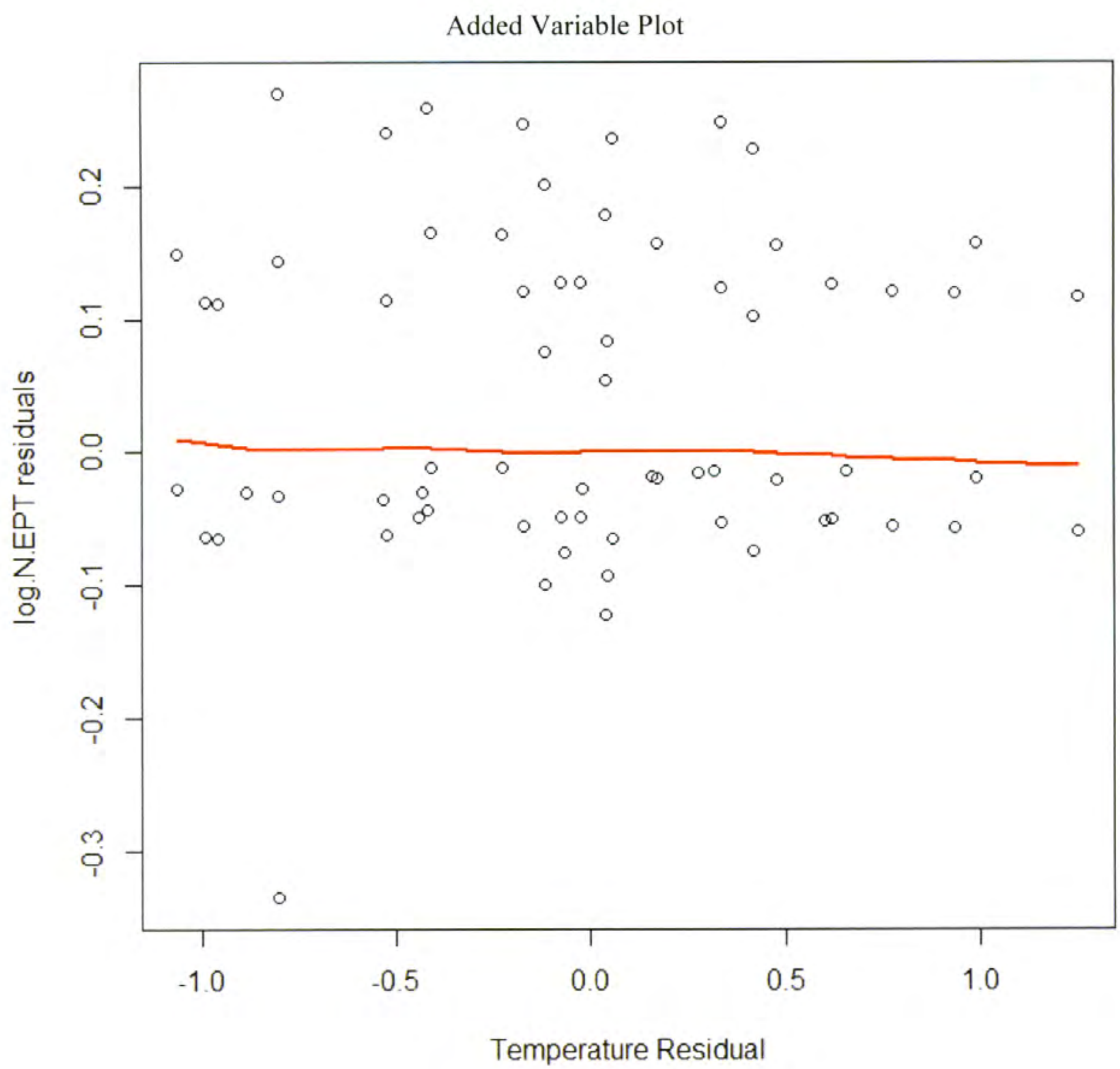
Smoothing Terms Inference Table

Parameter	Edf	Ref.df	F value	p-value
s(SpCondµScm.mean)	7.34	8.09	8.0646	<0.0001
s(CLOID.mean)	8.8	8.97	3.3814	0.0005
s(PSEDWT.mean)	8.85	8.98	10.2219	<0.0001
s(t1)	3.68	3.92	36.2273	<0.0001
s(t2)	1	1	1.8157	0.1783
s(t3)	1.81	1.96	9.8778	<0.0001

r-square (adjusted) = 0.7791
GCV score = 0.0143
sample size = 714

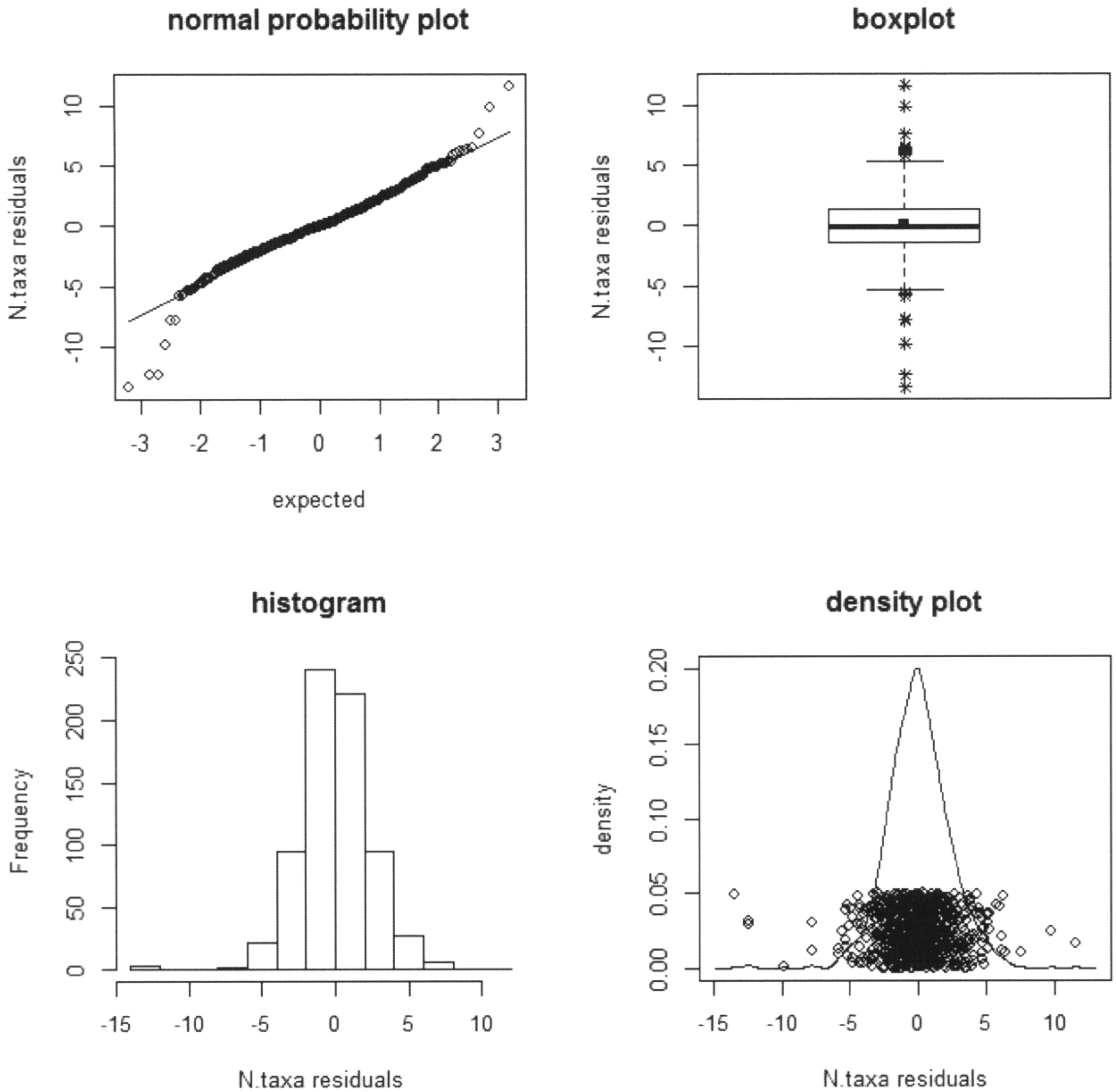
Generalized Additive Model Curvilinear Plot



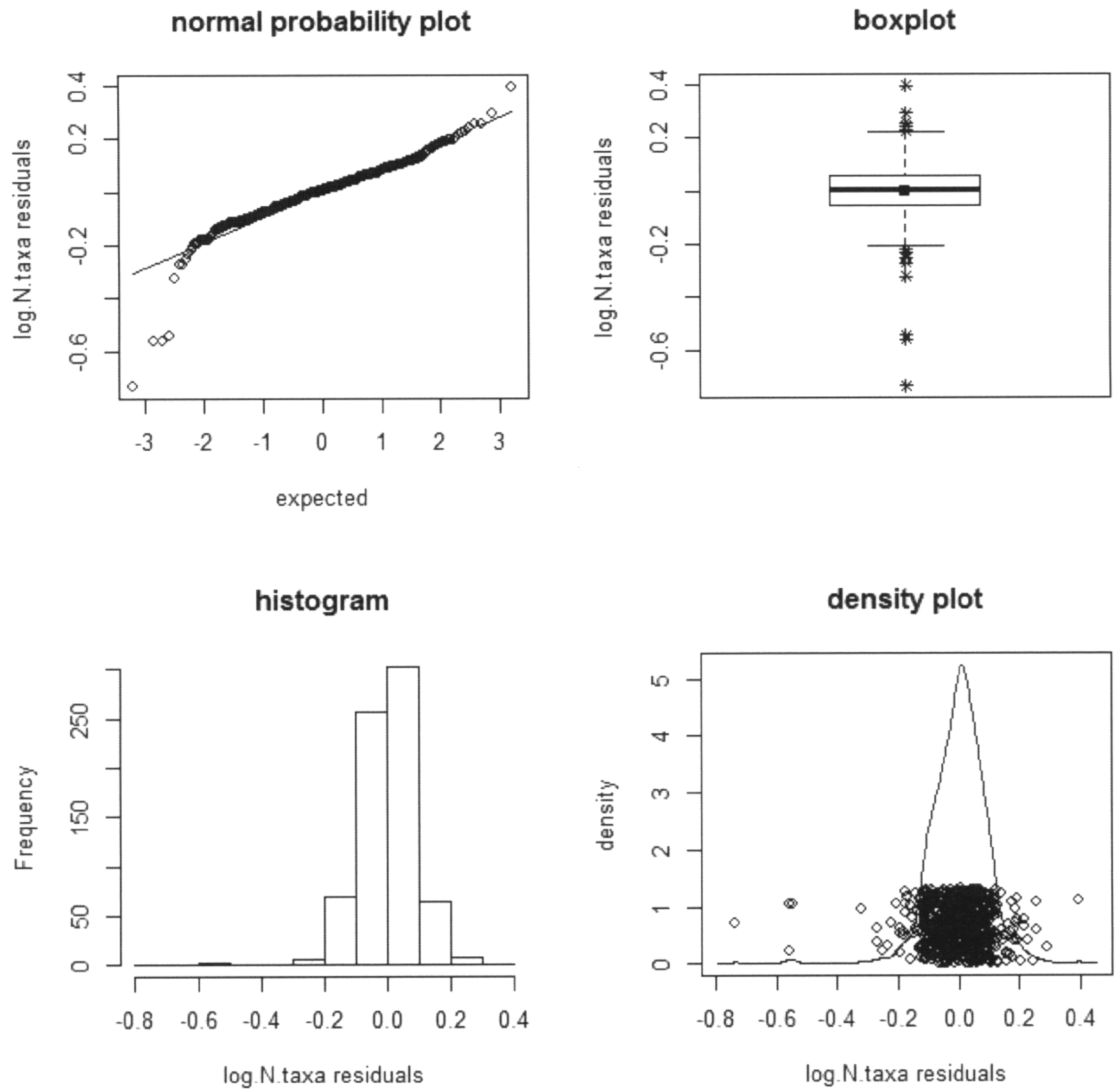


Added Variable Plot
log.N.EPT residuals
0.2
0.1
0.0
-0.1
-0.2
-0.3
-1.0
-0.5
0.0
0.5
1.0
Temperature Residual

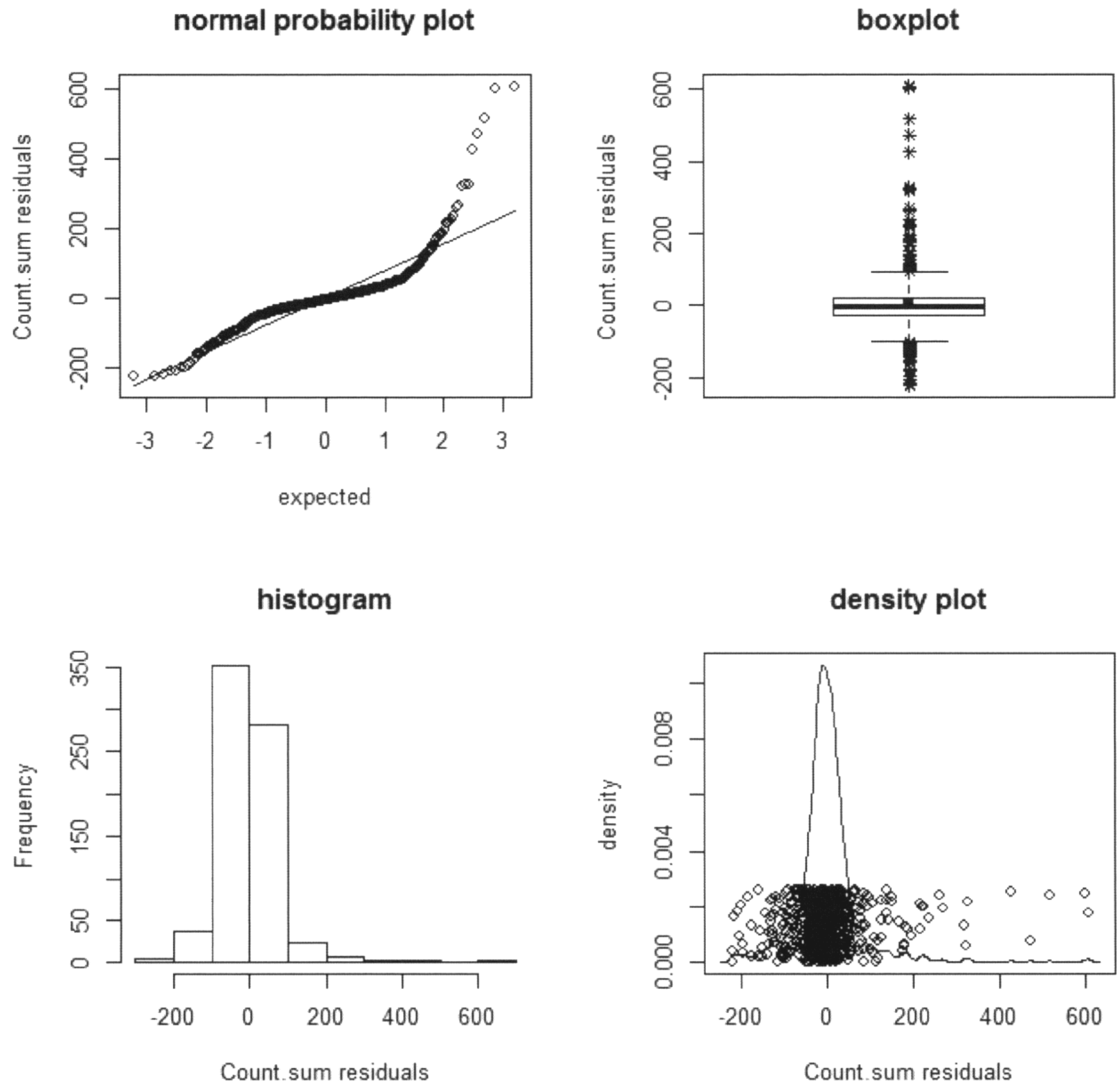
Residual Plots for Number of Taxa



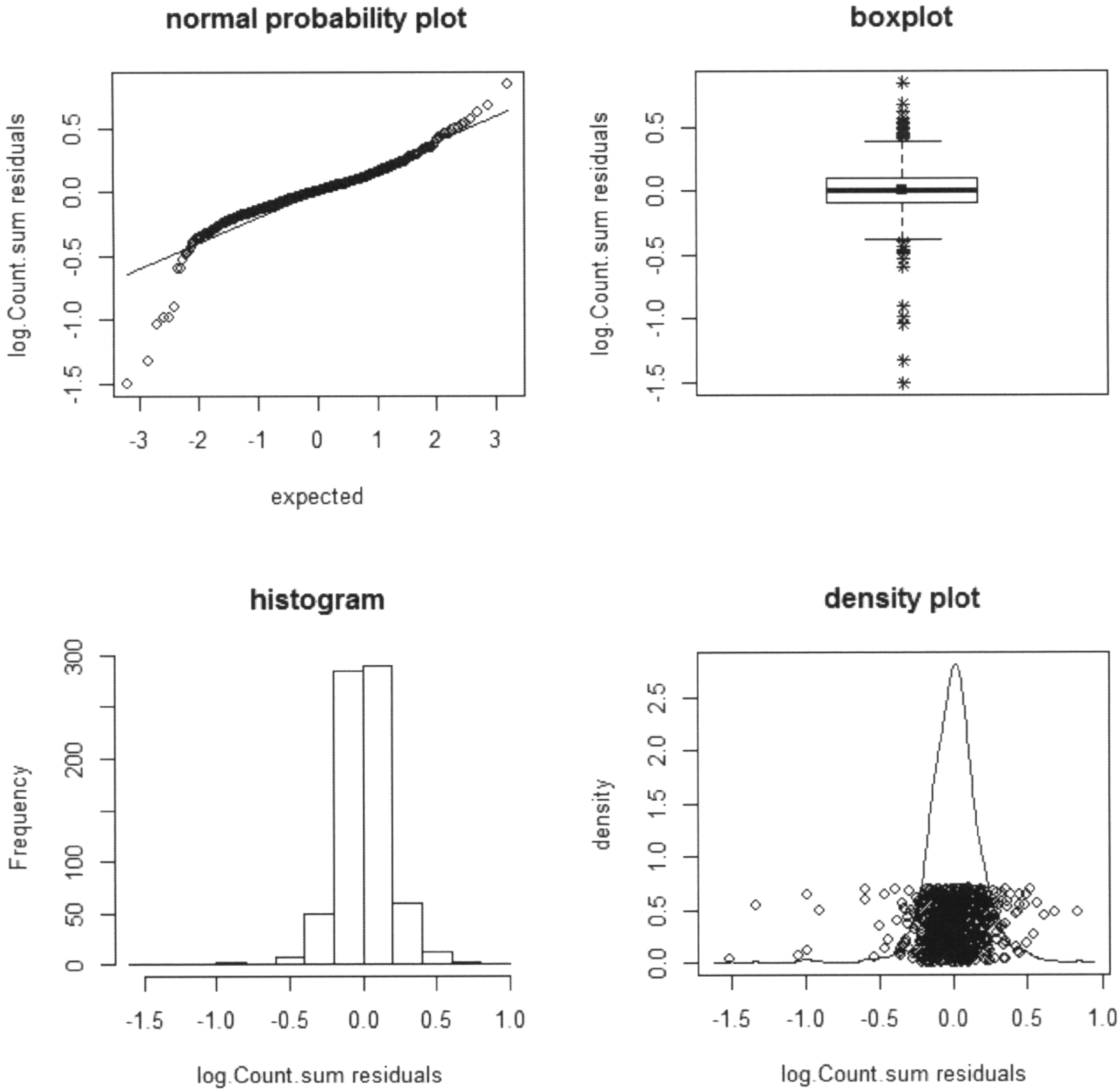
Residual Plots for log(Number of Taxa)

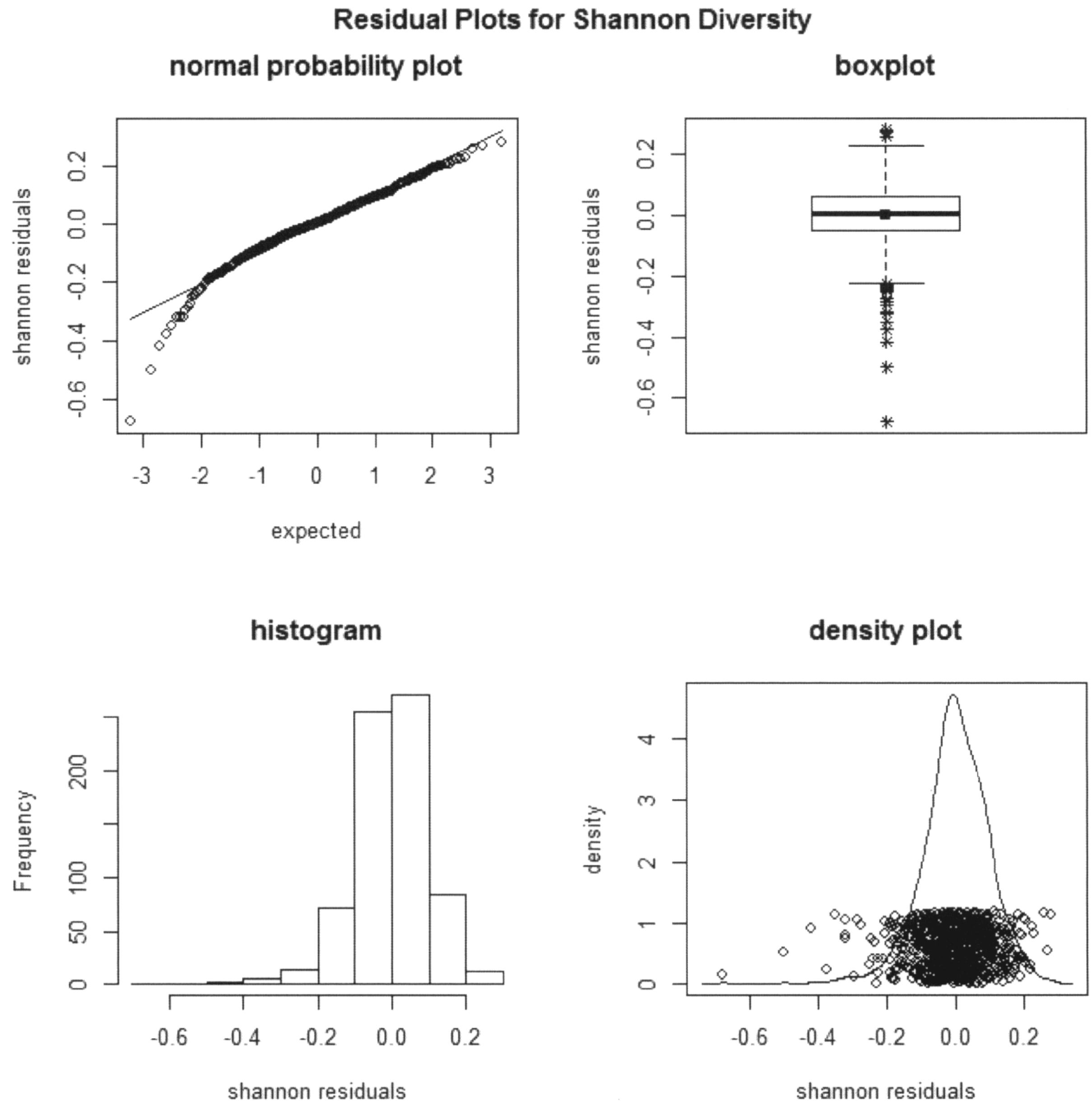


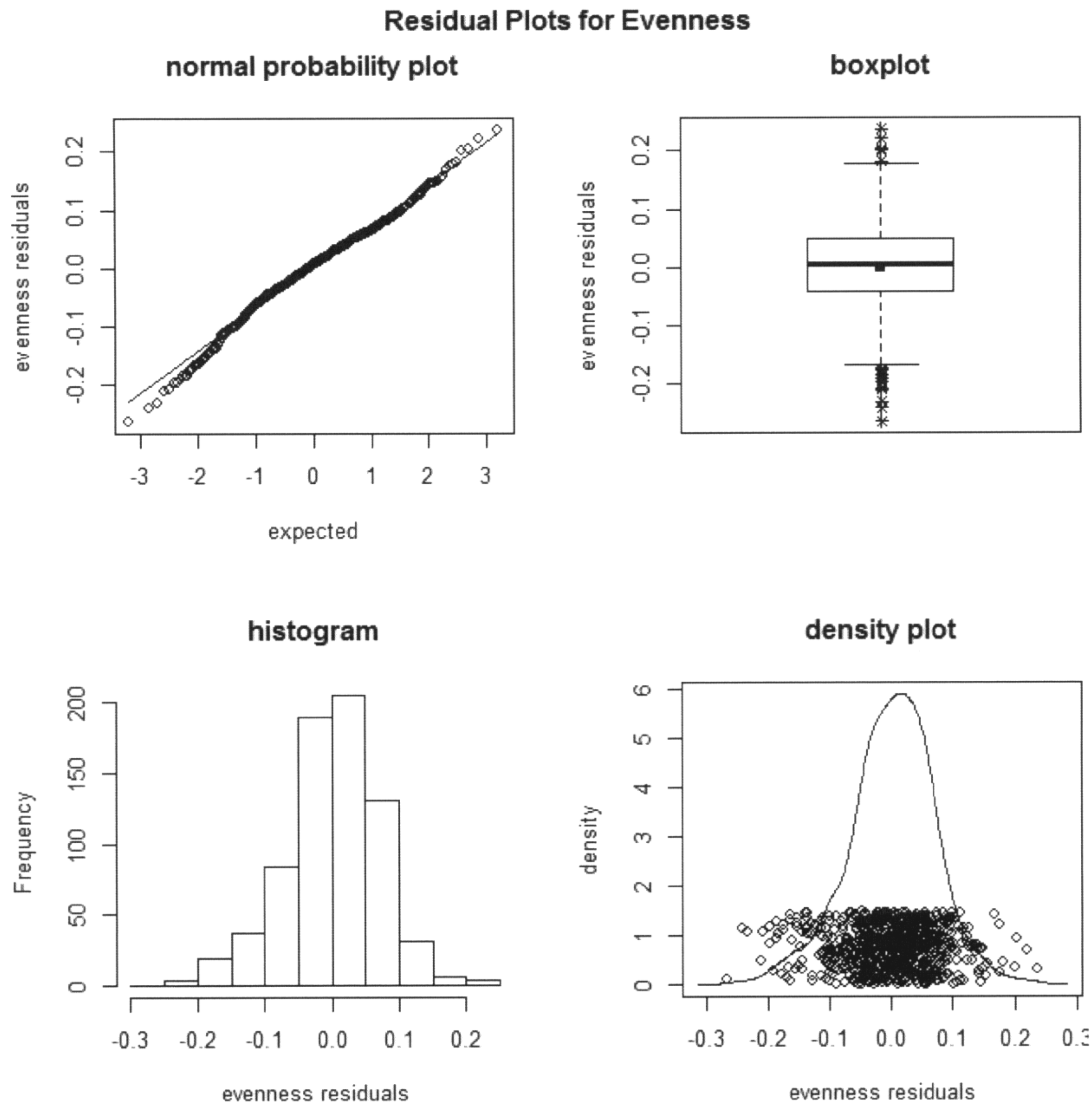
Residual Plots for Total Abundance

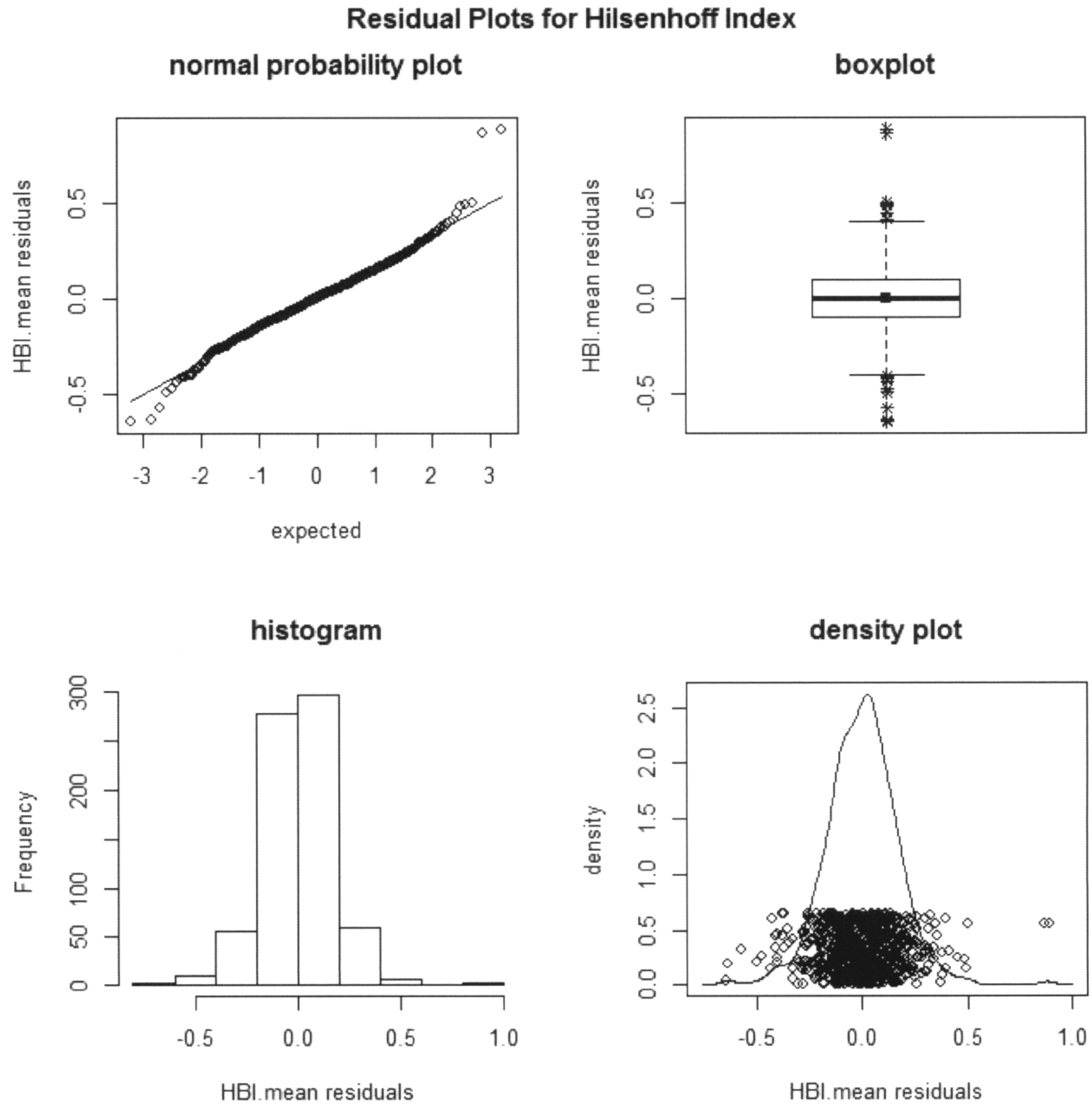


Residual Plots for log(Total Abundance)

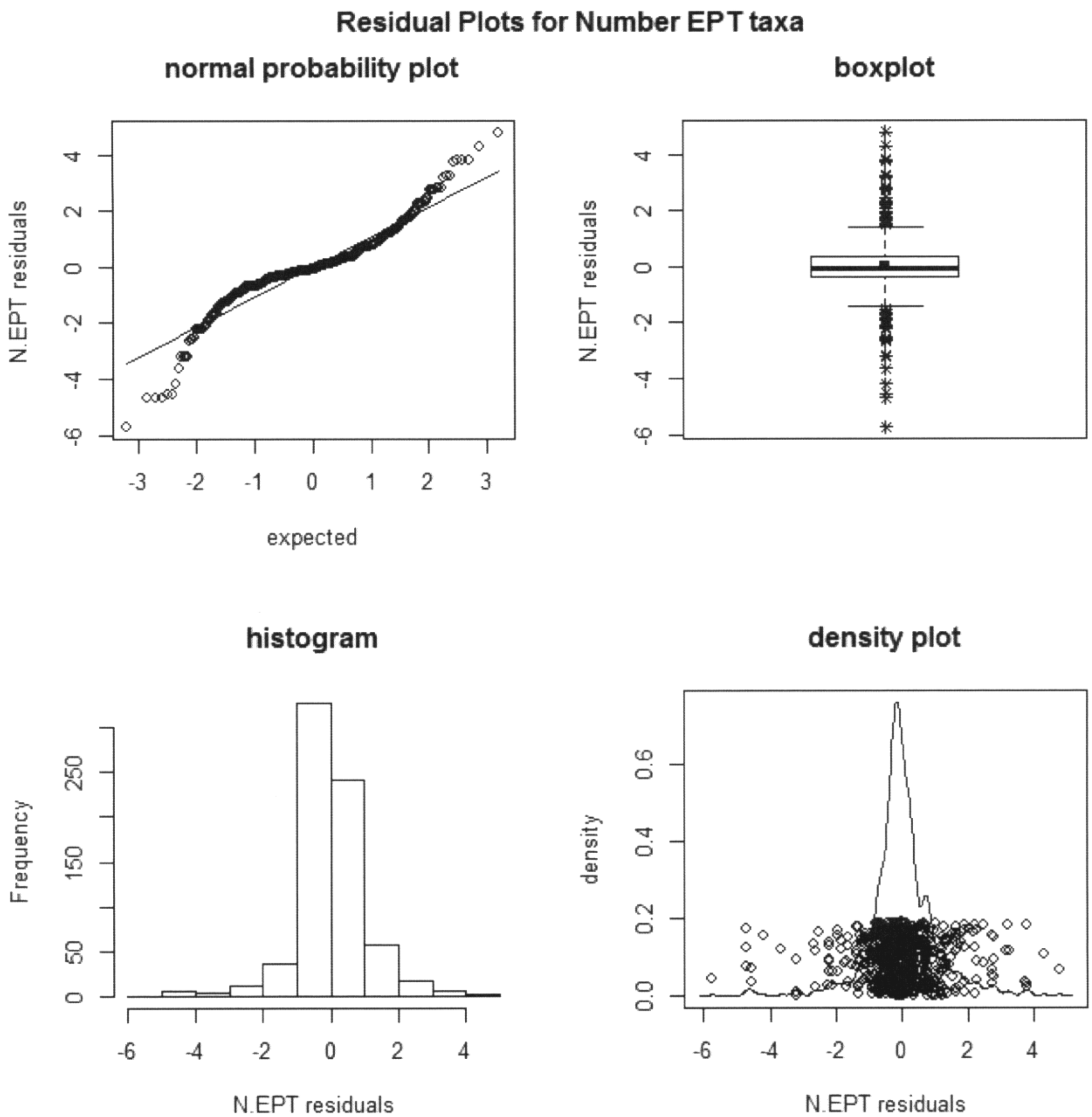



Residual Plots for Shannon Diversity
normal probability plot
shannon residuals
-0.6
-0.4
-0.2
0.0
0.2
-3
-2
-1
0
1
2
3
expected
boxplot
shannon residuals
-0.6
-0.4
-0.2
0.0
0.2
histogram
Frequency
0
50
100
200
-0.6
-0.4
-0.2
0.0
0.2
shannon residuals
density plot
density
0
1
2
3
4
-0.6
-0.4
-0.2
0.0
0.2
shannon residuals

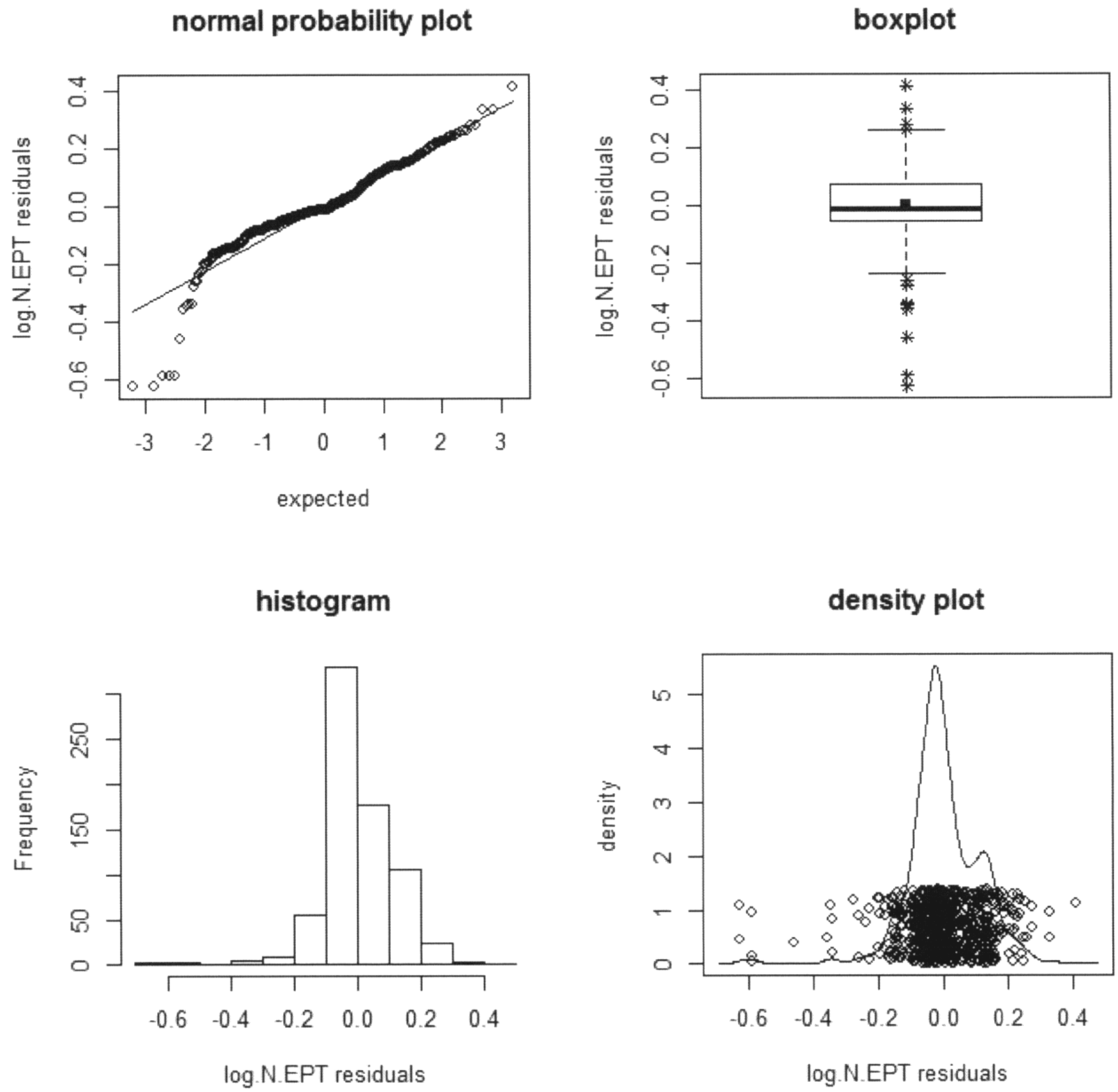

Residual Plots for Evenness
normal probability plot
evenness residuals
expected
boxplot
evenness residuals
histogram
Frequency
evenness residuals
density plot
density
evenness residuals



Residual Plots for Hilsenhoff Index
normal probability plot
HBI.mean residuals
expected
boxplot
HBI.mean residuals
histogram
Frequency
HBI.mean residuals
density plot
density
HBI.mean residuals


Residual Plots for Number EPT taxa
normal probability plot
boxplot
histogram
density plot
N.EPT residuals
expected
Frequency
density

Residual Plots for log(Number EPT taxa)



Analysis of Station Groups ANOVA and ANCOVA Results

Analysis for dependent variable N.taxa

Analysis of Variance

Source	Sum of Squares	df	mean square	F-stat	p-value
Season	10464	2	5232.24	388.8417	<0.0001
Stations	120	2	60.11	4.4671	0.0118
Season:Stations	256	4	63.88	4.7475	0.0009
Residuals	9486	705	13.46	NA	NA
Total	20327	713	NA	NA	NA

Coefficients Table

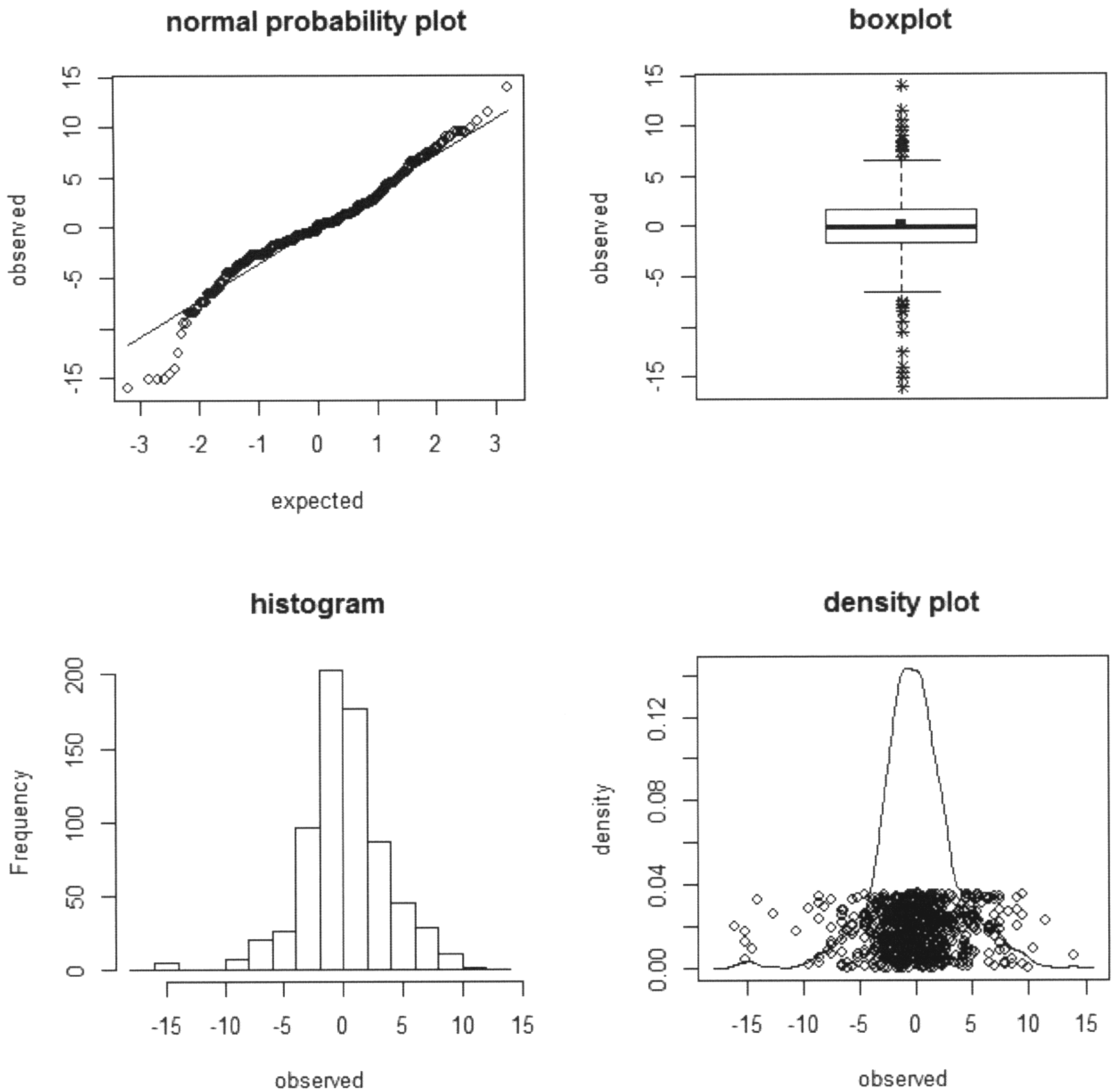
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	17.0645	0.38038	44.8619	<0.0001
Season2	-8.4217	0.53103	-15.8591	<0.0001
Season3	-6.3298	0.53103	-11.9199	<0.0001
StationsMixing Zone	-0.5423	0.5424	-0.9998	0.3177
StationsDown Stream	1.4233	0.68766	2.0697	0.0388
Season2:StationsMixing Zone	-0.7128	0.75419	-0.9451	0.3449
Season3:StationsMixing Zone	-0.3863	0.75419	-0.5122	0.6087
Season2:StationsDown Stream	-1.5151	0.94064	-1.6107	0.1077
Season3:StationsDown Stream	-3.7498	0.94064	-3.9865	<0.0001

root mean-square error = 3.6682
r-square = 0.5333
adjusted r-square = 0.528

Pair-wise comparisons among station groups for N.taxa

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	17.0645	0.3804	44.8619	<0.0001
Spring	Mixing Zone Mean	16.5222	0.3867	42.7299	<0.0001
Spring	DownStream Mean	18.4878	0.5729	32.2716	<0.0001
Spring	Upstream:Mixing Difference	-0.5423	0.5424	-0.9998	0.3177
Spring	Mixingzone:Downstream difference	1.9656	0.6912	2.8439	0.0046
Spring	Upstream:Downstream Difference	1.4233	0.6877	2.0697	0.0388
Summer	Upstream Mean	8.6429	0.3705	23.3245	<0.0001
Summer	Mixing Zone Mean	7.3878	0.3705	19.9374	<0.0001
Summer	DownStream Mean	8.551	0.524	16.3177	<0.0001
Summer	Upstream:Mixing Difference	-1.2551	0.524	-2.3951	0.0169
Summer	Mixingzone:Downstream difference	1.1633	0.6418	1.8125	0.0703
Summer	Upstream:Downstream Difference	-0.0918	0.6418	-0.1431	0.8863
Fall	Upstream Mean	10.7347	0.3705	28.9698	<0.0001
Fall	Mixing Zone Mean	9.8061	0.3705	26.4638	<0.0001
Fall	DownStream Mean	8.4082	0.524	16.0451	<0.0001
Fall	Upstream:Mixing Difference	-0.9286	0.524	-1.772	0.0768
Fall	Mixingzone:Downstream difference	-1.398	0.6418	-2.1782	0.0297
Fall	Upstream:Downstream Difference	-2.3265	0.6418	-3.625	0.0003

distribution plots for N.taxa residuals



Analysis for dependent variable log.N.taxa

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	9.6	2	4.8	281.2308	<0.0001
Stations	0.18	2	0.09	5.127	0.0062
Season:Stations	0.55	4	0.14	8.0352	<0.0001
Residuals	12.04	705	0.02	NA	NA
total	22.36	713	NA	NA	NA

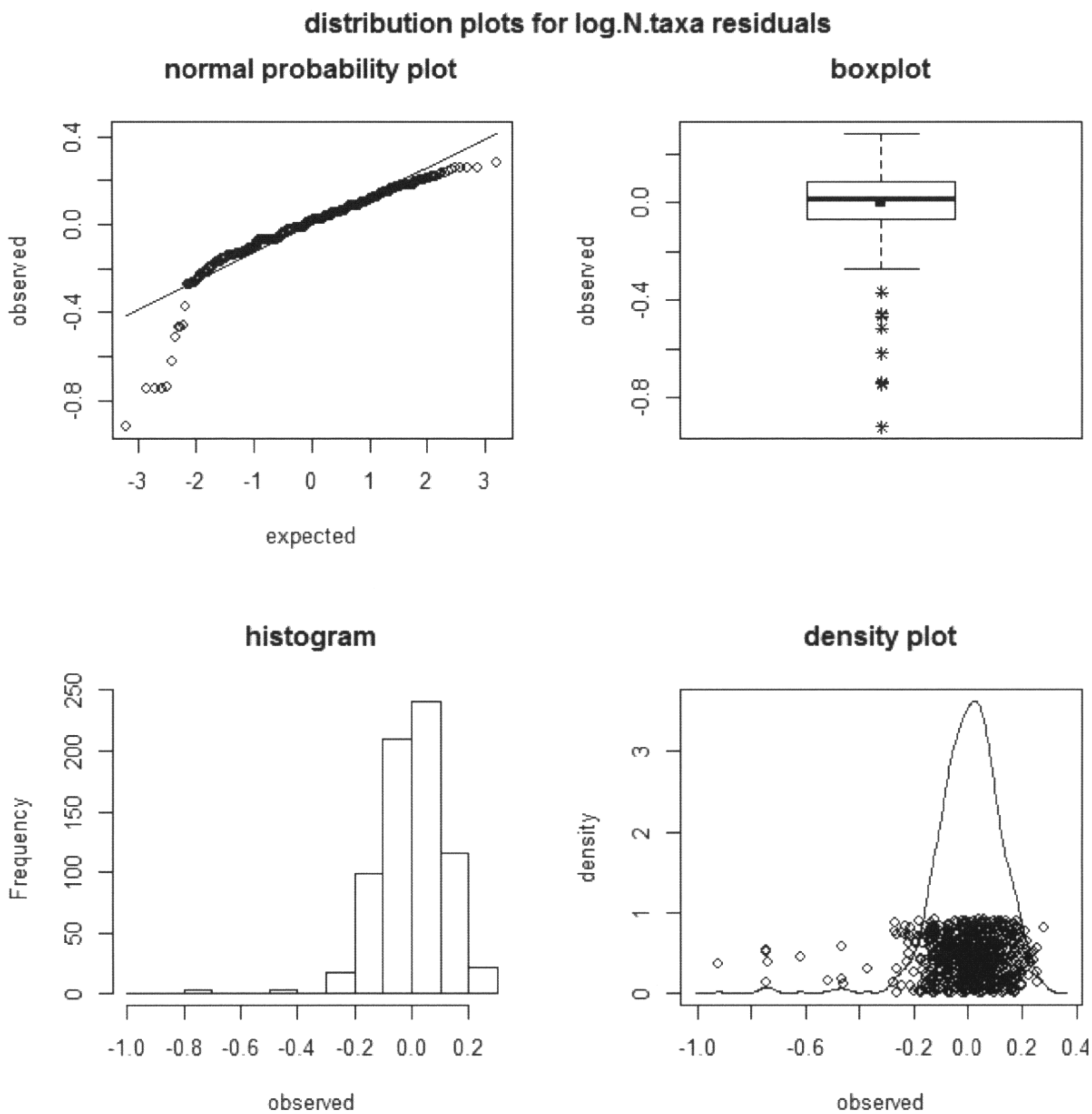
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	1.222	0.01355	90.1836	<0.0001
Season2	-0.2468	0.01892	-13.045	<0.0001
Season3	-0.1629	0.01892	-8.6125	<0.0001
StationsMixing Zone	-0.0065	0.01932	-0.3379	0.7355
StationsDown Stream	0.0486	0.0245	1.983	0.0478
Season2:StationsMixing Zone	-0.0539	0.02687	-2.0077	0.0451
Season3:StationsMixing Zone	-0.0273	0.02687	-1.0163	0.3099
Season2:StationsDown Stream	-0.0504	0.03351	-1.5053	0.1327
Season3:StationsDown Stream	-0.162	0.03351	-4.8355	<0.0001

root mean-square error = 0.1307
r-square = 0.4618
adjusted r-square = 0.4557

Pair-wise comparisons among station groups for log.N.taxa

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	1.222	0.0135	90.1836	<0.0001
Spring	Mixing Zone Mean	1.2154	0.0138	88.2431	<0.0001
Spring	DownStream Mean	1.2705	0.0204	62.2598	<0.0001
Spring	Upstream:Mixing Difference	-0.0065	0.0193	-0.3379	0.7355
Spring	Mixingzone:Downstream difference	0.0551	0.0246	2.2382	0.0255
Spring	Upstream:Downstream Difference	0.0486	0.0245	1.983	0.0478
Summer	Upstream Mean	0.9752	0.0132	73.8815	<0.0001
Summer	Mixing Zone Mean	0.9147	0.0132	69.3005	<0.0001
Summer	DownStream Mean	0.9733	0.0187	52.1422	<0.0001
Summer	Upstream:Mixing Difference	-0.0605	0.0187	-3.2392	0.0013
Summer	Mixingzone:Downstream difference	0.0586	0.0229	2.5633	0.0106
Summer	Upstream:Downstream Difference	-0.0019	0.0229	-0.0816	0.9350
Fall	Upstream Mean	1.059	0.0132	80.2336	<0.0001
Fall	Mixing Zone Mean	1.0252	0.0132	77.6705	<0.0001
Fall	DownStream Mean	0.9456	0.0187	50.6562	<0.0001
Fall	Upstream:Mixing Difference	-0.0338	0.0187	-1.8124	0.0704
Fall	Mixingzone:Downstream difference	-0.0796	0.0229	-3.4825	0.0005
Fall	Upstream:Downstream Difference	-0.1134	0.0229	-4.9623	<0.0001



distribution plots for log.N.taxa residuals
normal probability plot
boxplot
histogram
density plot
observed
expected
Frequency
density
0.4
0.0
-0.4
-0.8
-3
-2
-1
0
1
2
3
250
200
150
100
50
-1.0
-0.8
-0.6
-0.4
-0.2
0.2
0.4

Analysis for dependent variable Count.sum

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	3918559	2	1959279.71	217.6092	<0.0001
Stations	203918	2	101958.89	11.3242	<0.0001
Season:Stations	18662	4	4665.46	0.5182	0.7224
Residuals	6347582	705	9003.66	NA	NA
total	10488721	713	NA	NA	NA

Coefficients Table

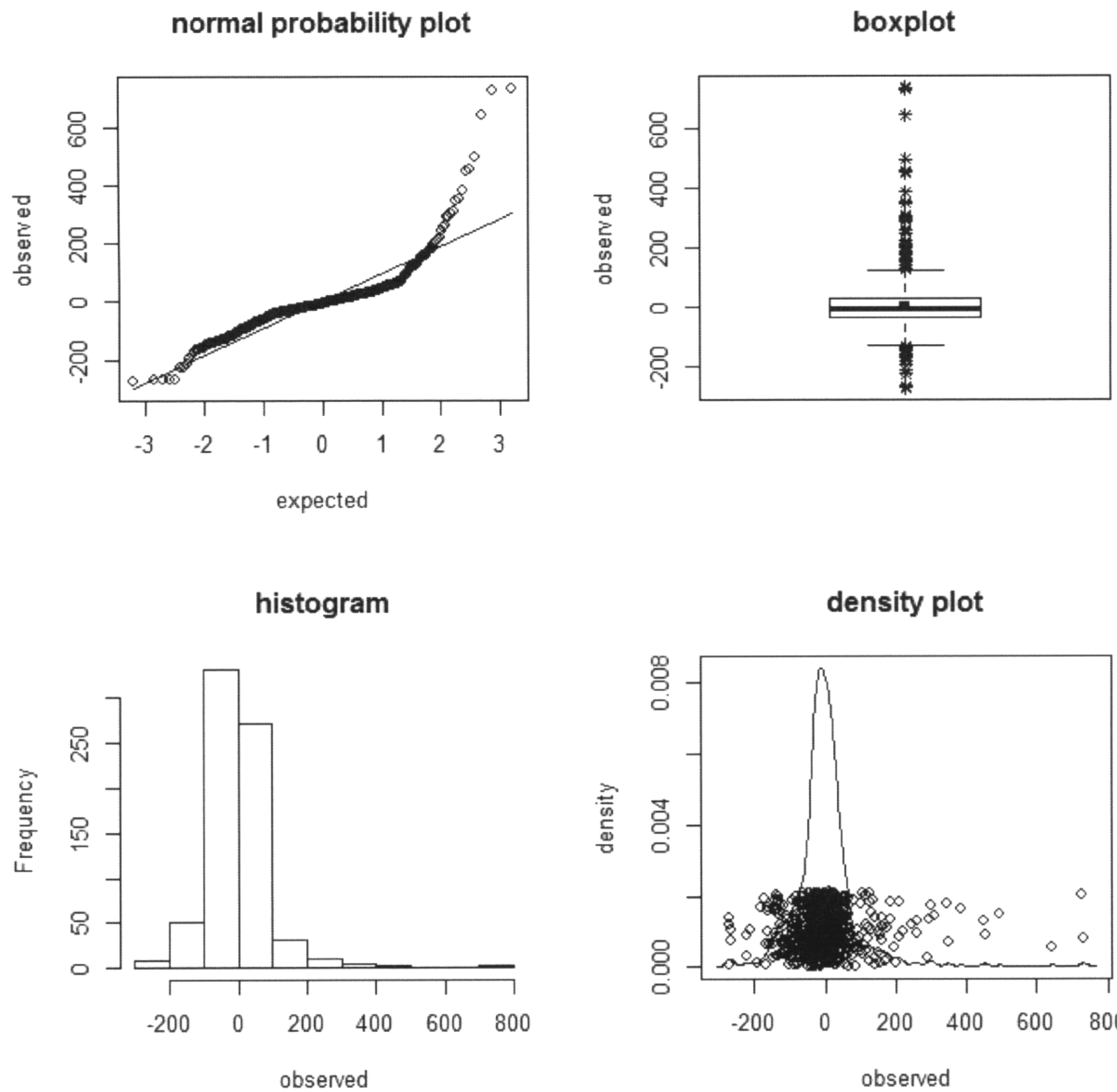
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	273.5699	9.83939	27.8035	<0.0001
Season2	-136.825	13.73636	-9.9608	<0.0001
Season3	-180.6311	13.73636	-13.1499	<0.0001
StationsMixing Zone	-42.8588	14.03048	-3.0547	0.0023
StationsDown Stream	-38.4236	17.78806	-2.1601	0.0311
Season2:StationsMixing Zone	24.818	19.50904	1.2721	0.2037
Season3:StationsMixing Zone	10.522	19.50904	0.5393	0.5898
Season2:StationsDown Stream	5.8011	24.33182	0.2384	0.8116
Season3:StationsDown Stream	-9.4744	24.33182	-0.3894	0.6971

root mean-square error = 94.8876
r-square = 0.3948
adjusted r-square = 0.388

Pair-wise comparisons among station groups for Count.sum

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	273.5699	9.8394	27.8035	<0.0001
Spring	Mixing Zone Mean	230.7111	10.002	23.0664	<0.0001
Spring	DownStream Mean	235.1463	14.819	15.8679	<0.0001
Spring	Upstream:Mixing Difference	-42.8588	14.0305	-3.0547	0.0023
Spring	Mixingzone:Downstream difference	4.4352	17.8785	0.2481	0.8041
Spring	Upstream:Downstream Difference	-38.4236	17.7881	-2.1601	0.0311
Summer	Upstream Mean	136.7449	9.5851	14.2664	<0.0001
Summer	Mixing Zone Mean	118.7041	9.5851	12.3842	<0.0001
Summer	DownStream Mean	104.1224	13.5554	7.6813	<0.0001
Summer	Upstream:Mixing Difference	-18.0408	13.5554	-1.3309	0.1837
Summer	Mixingzone:Downstream difference	-14.5816	16.6019	-0.8783	0.3801
Summer	Upstream:Downstream Difference	-32.6224	16.6019	-1.965	0.0498
Fall	Upstream Mean	92.9388	9.5851	9.6962	<0.0001
Fall	Mixing Zone Mean	60.602	9.5851	6.3225	<0.0001
Fall	DownStream Mean	45.0408	13.5554	3.3227	0.0009
Fall	Upstream:Mixing Difference	-32.3367	13.5554	-2.3855	0.0173
Fall	Mixingzone:Downstream difference	-15.5612	16.6019	-0.9373	0.3489
Fall	Upstream:Downstream Difference	-47.898	16.6019	-2.8851	0.0040

distribution plots for Count.sum residuals



Analysis for dependent variable log.Count.sum

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	33.79	2	16.9	213.3803	<0.0001
Stations	3.32	2	1.66	20.9453	<0.0001
Season:Stations	2.59	4	0.65	8.175	<0.0001
Residuals	55.83	705	0.08	NA	NA
total	95.53	713	NA	NA	NA

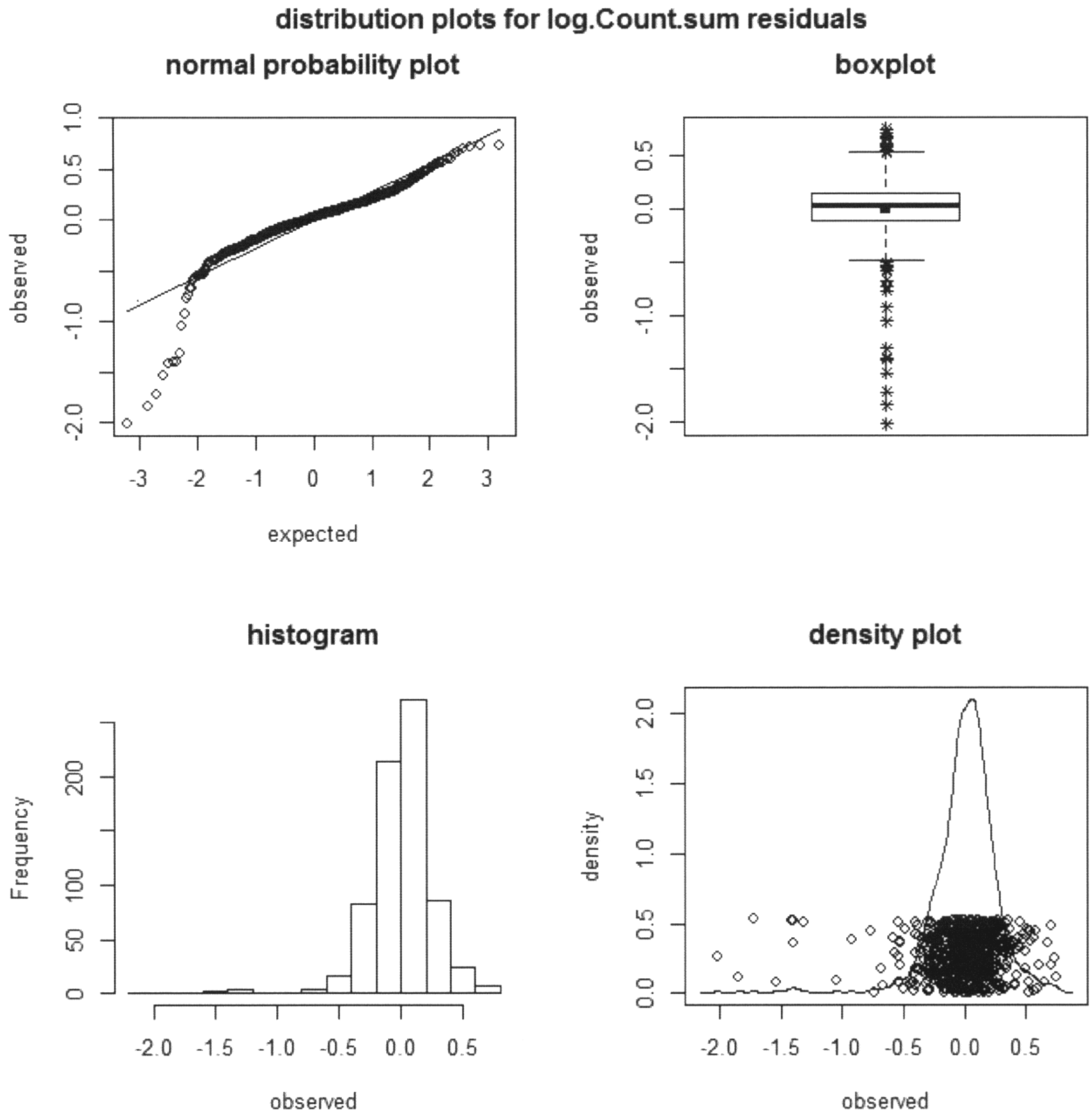
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	2.317	0.02918	79.4037	<0.0001
Season2	-0.1908	0.04074	-4.6827	<0.0001
Season3	-0.4082	0.04074	-10.0216	<0.0001
StationsMixing Zone	-0.0738	0.04161	-1.7725	0.0767
StationsDown Stream	0.0137	0.05275	0.26	0.7949
Season2:StationsMixing Zone	-0.0013	0.05786	-0.022	0.9825
Season3:StationsMixing Zone	-0.1128	0.05786	-1.9494	0.0516
Season2:StationsDown Stream	-0.1335	0.07216	-1.8501	0.0647
Season3:StationsDown Stream	-0.3984	0.07216	-5.5205	<0.0001

root mean-square error = 0.2814
r-square = 0.4156
adjusted r-square = 0.409

Pair-wise comparisons among station groups for log.Count.sum

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	2.317	0.0292	79.4037	<0.0001
Spring	Mixing Zone Mean	2.2432	0.0297	75.6261	<0.0001
Spring	DownStream Mean	2.3307	0.0439	53.0341	<0.0001
Spring	Upstream:Mixing Difference	-0.0738	0.0416	-1.7725	0.0767
Spring	Mixingzone:Downstream difference	0.0875	0.053	1.6497	0.0994
Spring	Upstream:Downstream Difference	0.0137	0.0528	0.26	0.7949
Summer	Upstream Mean	2.1262	0.0284	74.7995	<0.0001
Summer	Mixing Zone Mean	2.0512	0.0284	72.1602	<0.0001
Summer	DownStream Mean	2.0064	0.0402	49.9116	<0.0001
Summer	Upstream:Mixing Difference	-0.075	0.0402	-1.8663	0.0624
Summer	Mixingzone:Downstream difference	-0.0448	0.0492	-0.9091	0.3636
Summer	Upstream:Downstream Difference	-0.1198	0.0492	-2.4329	0.0152
Fall	Upstream Mean	1.9087	0.0284	67.1484	<0.0001
Fall	Mixing Zone Mean	1.7222	0.0284	60.586	<0.0001
Fall	DownStream Mean	1.5241	0.0402	37.913	<0.0001
Fall	Upstream:Mixing Difference	-0.1865	0.0402	-4.6403	<0.0001
Fall	Mixingzone:Downstream difference	-0.1981	0.0492	-4.0235	0.0001
Fall	Upstream:Downstream Difference	-0.3846	0.0492	-7.8123	<0.0001


distribution plots for log.Count.sum residuals
normal probability plot
observed
expected
-2.0 -1.0 0.0 0.5 1.0
-3 -2 -1 0 1 2 3
boxplot
observed
-2.0 -1.0 0.0 0.5
histogram
Frequency
observed
0 50 100 200
-2.0 -1.5 -1.0 -0.5 0.0 0.5
density plot
density
observed
0.0 0.5 1.0 1.5 2.0
-2.0 -1.5 -1.0 -0.5 0.0 0.5

Analysis for dependent variable shannon

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	4.95	2	2.47	170.8087	<0.0001
Stations	0.01	2	0.01	0.4337	0.6483
Season:Stations	0.63	4	0.16	10.8714	<0.0001
Residuals	10.21	705	0.01	NA	NA
total	15.8	713	NA	NA	NA

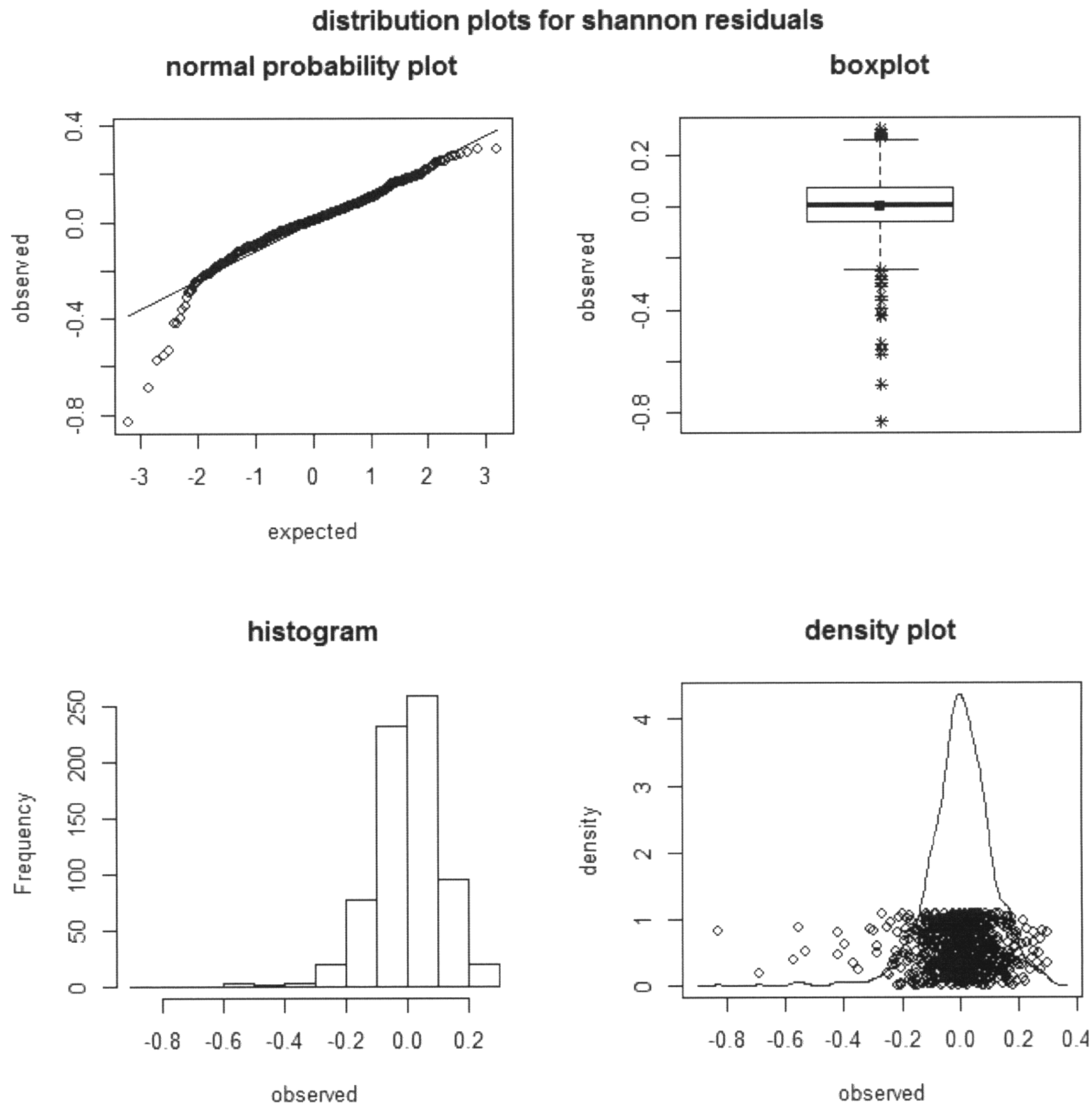
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	0.8329	0.01248	66.7419	<0.0001
Season2	-0.1436	0.01742	-8.2437	<0.0001
Season3	-0.0702	0.01742	-4.0314	<0.0001
StationsMixing Zone	0.0544	0.0178	3.0577	0.0023
StationsDown Stream	0.0685	0.02256	3.0355	0.0025
Season2:StationsMixing Zone	-0.1241	0.02474	-5.016	<0.0001
Season3:StationsMixing Zone	-0.0605	0.02474	-2.445	0.0147
Season2:StationsDown Stream	-0.0644	0.03086	-2.0852	0.0374
Season3:StationsDown Stream	-0.1332	0.03086	-4.317	<0.0001

root mean-square error = 0.1204
r-square = 0.3538
adjusted r-square = 0.3465

Pair-wise comparisons among station groups for shannon

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	0.8329	0.0125	66.7419	<0.0001
Spring	Mixing Zone Mean	0.8874	0.0127	69.9458	<0.0001
Spring	DownStream Mean	0.9014	0.0188	47.9585	<0.0001
Spring	Upstream:Mixing Difference	0.0544	0.0178	3.0577	0.0023
Spring	Mixingzone:Downstream difference	0.0141	0.0227	0.6206	0.5351
Spring	Upstream:Downstream Difference	0.0685	0.0226	3.0355	0.0025
Summer	Upstream Mean	0.6893	0.0122	56.6985	<0.0001
Summer	Mixing Zone Mean	0.6196	0.0122	50.9651	<0.0001
Summer	DownStream Mean	0.6934	0.0172	40.3322	<0.0001
Summer	Upstream:Mixing Difference	-0.0697	0.0172	-4.0541	0.0001
Summer	Mixingzone:Downstream difference	0.0738	0.0211	3.5064	0.0005
Summer	Upstream:Downstream Difference	0.0041	0.0211	0.1963	0.8445
Fall	Upstream Mean	0.7627	0.0122	62.7352	<0.0001
Fall	Mixing Zone Mean	0.7566	0.0122	62.2346	<0.0001
Fall	DownStream Mean	0.698	0.0172	40.5948	<0.0001
Fall	Upstream:Mixing Difference	-0.0061	0.0172	-0.354	0.7235
Fall	Mixingzone:Downstream difference	-0.0587	0.0211	-2.7857	0.0055
Fall	Upstream:Downstream Difference	-0.0647	0.0211	-3.0747	0.0022


distribution plots for shannon residuals
normal probability plot
observed
expected
boxplot
observed
histogram
Frequency
observed
density plot
density
observed

Analysis for dependent variable evenness

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	0.2	2	0.1	16.5838	<0.0001
Stations	0.06	2	0.03	4.9408	0.0074
Season:Stations	0.15	4	0.04	5.9544	0.0001
Residuals	4.29	704	0.01	NA	NA
total	4.7	712	NA	NA	NA

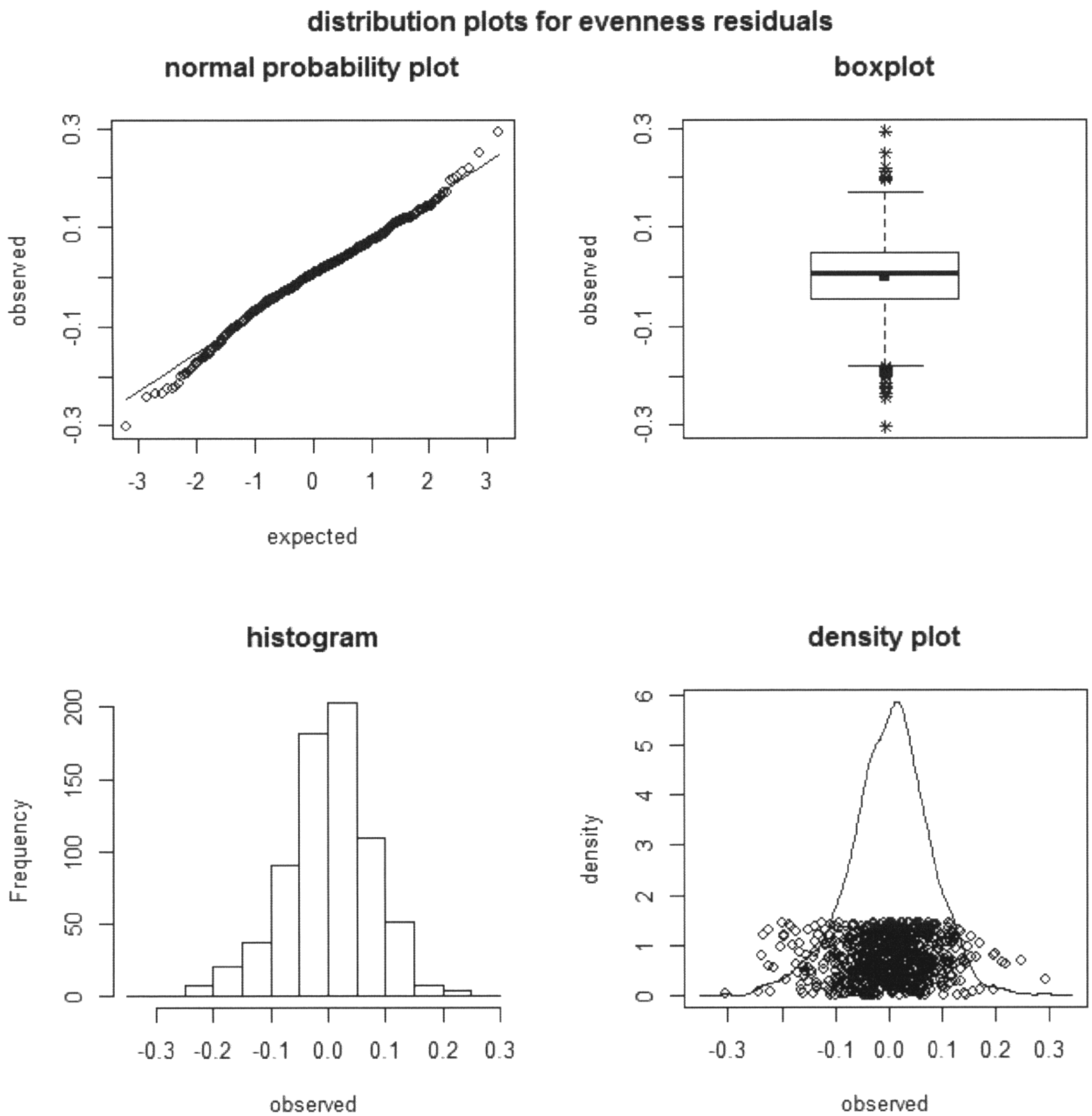
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	0.7074	0.00814	86.9179	<0.0001
Season2	0.0406	0.01133	3.5814	0.0004
Season3	0.0444	0.01133	3.9152	<0.0001
StationsMixing Zone	0.0453	0.01157	3.9156	<0.0001
StationsDown Stream	0.0192	0.01466	1.3131	0.1896
Season2:StationsMixing Zone	-0.0687	0.01607	-4.2734	<0.0001
Season3:StationsMixing Zone	-0.0261	0.01607	-1.626	0.1044
Season2:StationsDown Stream	-0.0149	0.02003	-0.7418	0.4585
Season3:StationsDown Stream	0.0284	0.02003	1.4161	0.1572

root mean-square error = 0.0781
r-square = 0.0867
adjusted r-square = 0.0764

Pair-wise comparisons among station groups for evenness

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	0.7074	0.0081	86.9179	<0.0001
Spring	Mixing Zone Mean	0.7527	0.0082	91.4753	<0.0001
Spring	DownStream Mean	0.7266	0.0122	59.6028	<0.0001
Spring	Upstream:Mixing Difference	0.0453	0.0116	3.9156	0.0001
Spring	Mixingzone:Downstream difference	-0.0261	0.0147	-1.7724	0.0768
Spring	Upstream:Downstream Difference	0.0192	0.0147	1.3131	0.1896
Summer	Upstream Mean	0.7479	0.0079	94.8542	<0.0001
Summer	Mixing Zone Mean	0.7246	0.0079	91.8912	<0.0001
Summer	DownStream Mean	0.7523	0.0112	67.4654	<0.0001
Summer	Upstream:Mixing Difference	-0.0234	0.0112	-2.0952	0.0365
Summer	Mixingzone:Downstream difference	0.0277	0.0137	2.0318	0.0425
Summer	Upstream:Downstream Difference	0.0044	0.0137	0.3212	0.7482
Fall	Upstream Mean	0.7517	0.0079	95.3339	<0.0001
Fall	Mixing Zone Mean	0.7709	0.0079	97.7668	<0.0001
Fall	DownStream Mean	0.7993	0.0112	71.6814	<0.0001
Fall	Upstream:Mixing Difference	0.0192	0.0112	1.7203	0.0858
Fall	Mixingzone:Downstream difference	0.0284	0.0137	2.0819	0.0377
Fall	Upstream:Downstream Difference	0.0476	0.0137	3.4865	0.0005


distribution plots for evenness residuals
normal probability plot
observed
expected
boxplot
observed
histogram
Frequency
observed
density plot
density
observed

Analysis for dependent variable HBI.mean

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	5.49	2	2.74	33.5823	<0.0001
Stations	3.23	2	1.61	19.7522	<0.0001
Season:Stations	0.69	4	0.17	2.1251	0.0761
Residuals	57.28	701	0.08	NA	NA
total	66.69	709	NA	NA	NA

Coefficients Table

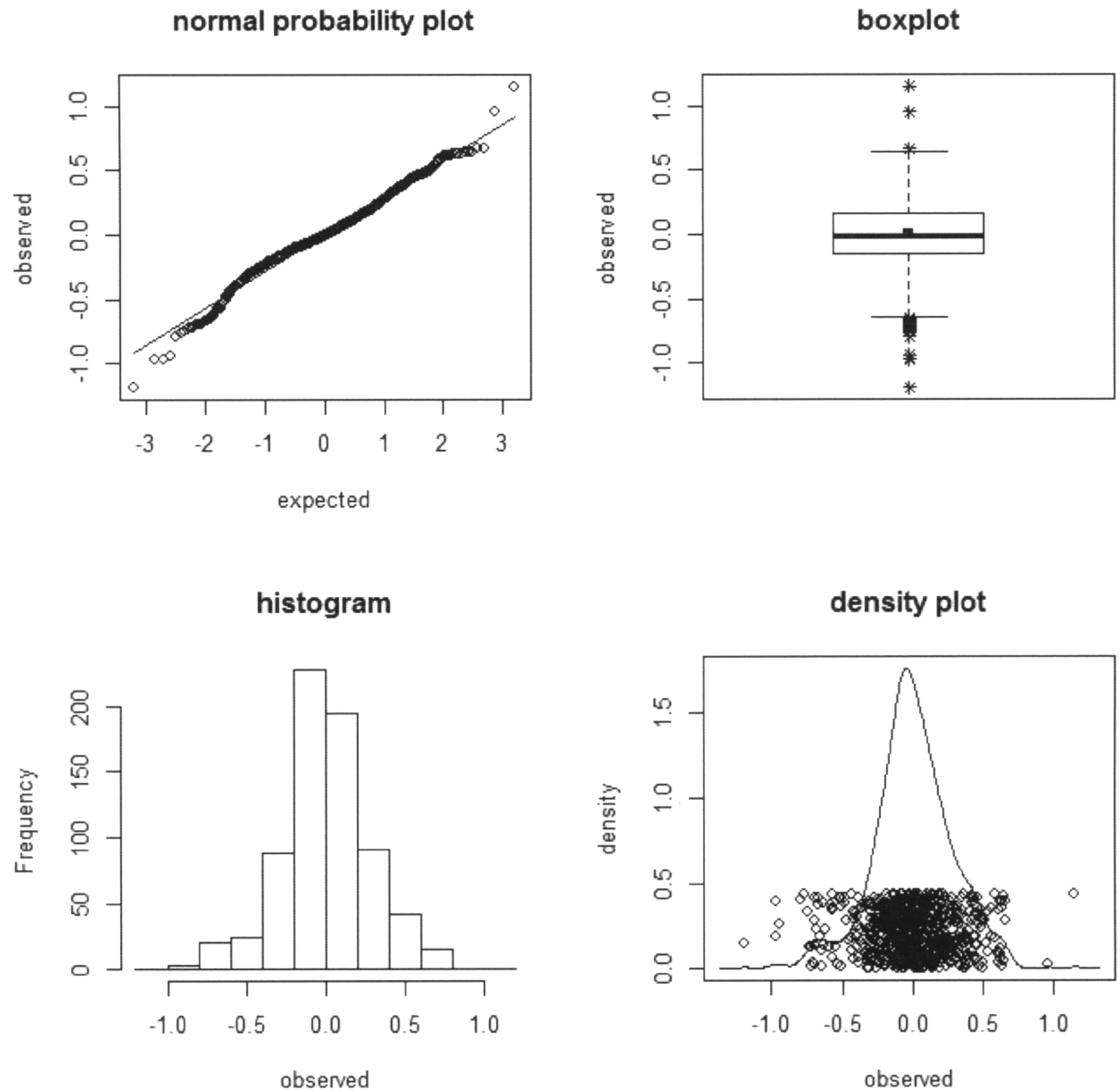
Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	6.969	0.0303	230.0044	<0.0001
Season2	0.1636	0.04185	3.9078	0.0001
Season3	-0.024	0.04185	-0.5731	0.5668
StationsMixing Zone	-0.1473	0.04273	-3.4473	0.0006
StationsDown Stream	-0.1584	0.05395	-2.9366	0.0034
Season2:StationsMixing Zone	0.0019	0.0591	0.0318	0.9746
Season3:StationsMixing Zone	0.0634	0.0591	1.0727	0.2838
Season2:StationsDown Stream	0.0716	0.07357	0.9728	0.3310
Season3:StationsDown Stream	-0.0674	0.07357	-0.9155	0.3602

root mean-square error = 0.2858
r-square = 0.1411
adjusted r-square = 0.1313

Pair-wise comparisons among station groups for HBI.mean

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	6.969	0.0303	230.0044	<0.0001
Spring	Mixing Zone Mean	6.8217	0.0301	226.4042	<0.0001
Spring	DownStream Mean	6.8106	0.0446	152.5618	<0.0001
Spring	Upstream:Mixing Difference	-0.1473	0.0427	-3.4473	0.0006
Spring	Mixingzone:Downstream difference	-0.0111	0.0539	-0.2067	0.8363
Spring	Upstream:Downstream Difference	-0.1584	0.054	-2.9366	0.0034
Summer	Upstream Mean	7.1326	0.0289	247.0184	<0.0001
Summer	Mixing Zone Mean	6.9871	0.0289	241.982	<0.0001
Summer	DownStream Mean	7.0457	0.0408	172.541	<0.0001
Summer	Upstream:Mixing Difference	-0.1454	0.0408	-3.5613	0.0004
Summer	Mixingzone:Downstream difference	0.0586	0.05	1.1707	0.2421
Summer	Upstream:Downstream Difference	-0.0869	0.05	-1.737	0.0828
Fall	Upstream Mean	6.945	0.0289	240.5232	<0.0001
Fall	Mixing Zone Mean	6.8611	0.0289	237.6175	<0.0001
Fall	DownStream Mean	6.7192	0.0408	164.5463	<0.0001
Fall	Upstream:Mixing Difference	-0.0839	0.0408	-2.0546	0.0403
Fall	Mixingzone:Downstream difference	-0.1419	0.05	-2.8371	0.0047
Fall	Upstream:Downstream Difference	-0.2258	0.05	-4.5147	<0.0001

distribution plots for HBI.mean residuals



Analysis for dependent variable N.EPT

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	2385	2	1192.74	432.3417	<0.0001
Stations	2	2	0.9	0.3273	0.7210
Season:Stations	78	4	19.51	7.0705	<0.0001
Residuals	1945	705	2.76	NA	NA
total	4410	713	NA	NA	NA

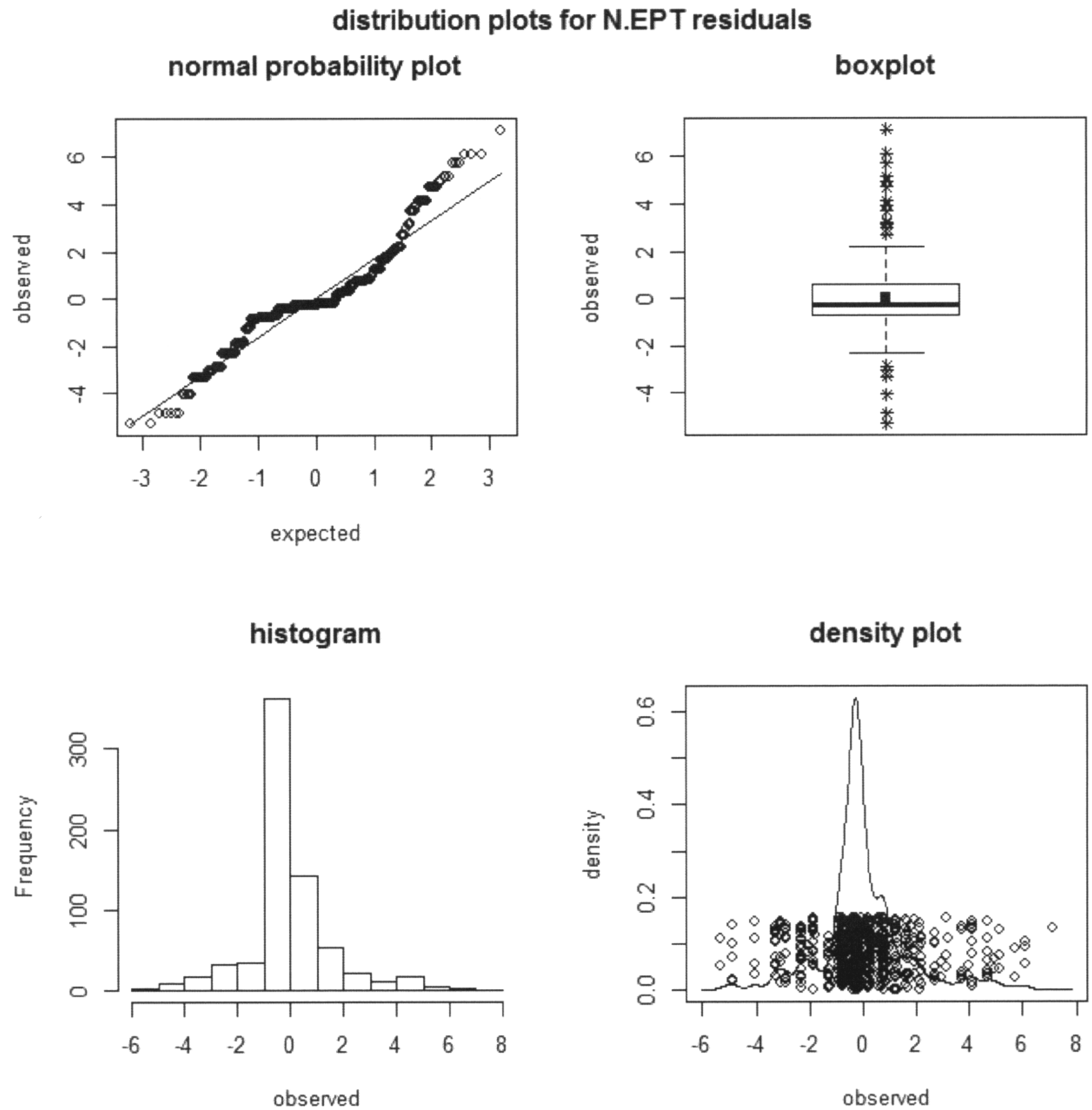
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	4.871	0.17223	28.2812	<0.0001
Season2	-3.4832	0.24045	-14.4863	<0.0001
Season3	-3.0853	0.24045	-12.8313	<0.0001
StationsMixing Zone	0.429	0.2456	1.7469	0.0811
StationsDown Stream	1.1778	0.31137	3.7827	0.0002
Season2:StationsMixing Zone	-0.6331	0.3415	-1.8539	0.0642
Season3:StationsMixing Zone	-0.9596	0.3415	-2.8101	0.0051
Season2:StationsDown Stream	-1.3207	0.42592	-3.1008	0.0020
Season3:StationsDown Stream	-2.2288	0.42592	-5.233	<0.0001

root mean-square error = 1.661
r-square = 0.559
adjusted r-square = 0.554

Pair-wise comparisons among station groups for N.EPT

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	4.871	0.1722	28.2812	<0.0001
Spring	Mixing Zone Mean	5.3	0.1751	30.2718	<0.0001
Spring	DownStream Mean	6.0488	0.2594	23.3185	<0.0001
Spring	Upstream:Mixing Difference	0.429	0.2456	1.7469	0.0811
Spring	Mixingzone:Downstream difference	0.7488	0.313	2.3926	0.0170
Spring	Upstream:Downstream Difference	1.1778	0.3114	3.7827	0.0002
Summer	Upstream Mean	1.3878	0.1678	8.2712	<0.0001
Summer	Mixing Zone Mean	1.1837	0.1678	7.0548	<0.0001
Summer	DownStream Mean	1.2449	0.2373	5.2465	<0.0001
Summer	Upstream:Mixing Difference	-0.2041	0.2373	-0.8601	0.3900
Summer	Mixingzone:Downstream difference	0.0612	0.2906	0.2107	0.8332
Summer	Upstream:Downstream Difference	-0.1429	0.2906	-0.4916	0.6232
Fall	Upstream Mean	1.7857	0.1678	10.643	<0.0001
Fall	Mixing Zone Mean	1.2551	0.1678	7.4805	<0.0001
Fall	DownStream Mean	0.7347	0.2373	3.0963	0.0020
Fall	Upstream:Mixing Difference	-0.5306	0.2373	-2.2362	0.0256
Fall	Mixingzone:Downstream difference	-0.5204	0.2906	-1.7908	0.0738
Fall	Upstream:Downstream Difference	-1.051	0.2906	-3.6166	0.0003



distribution plots for N.EPT residuals
normal probability plot
observed
expected
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-2
-1
0
1
2
3
-4
-2
0
2
4
6
boxplot
observed
-4
-2
0
2
4
6
histogram
Frequency
0
100
200
300
observed
-6
-4
-2
0
2
4
6
8
density plot
density
0.0
0.2
0.4
0.6
observed
-6
-4
-2
0
2
4
6
8

Analysis for dependent variable log.N.EPT

Analysis of Variance

Source	Sum of Squares	df	Mean Square	F-stat	p-value
Season	24.56	2	12.28	495.1696	<0.0001
Stations	0.25	2	0.12	5.0183	0.0069
Season:Stations	1.49	4	0.37	15.0369	<0.0001
Residuals	17.48	705	0.02	NA	NA
total	43.78	713	NA	NA	NA

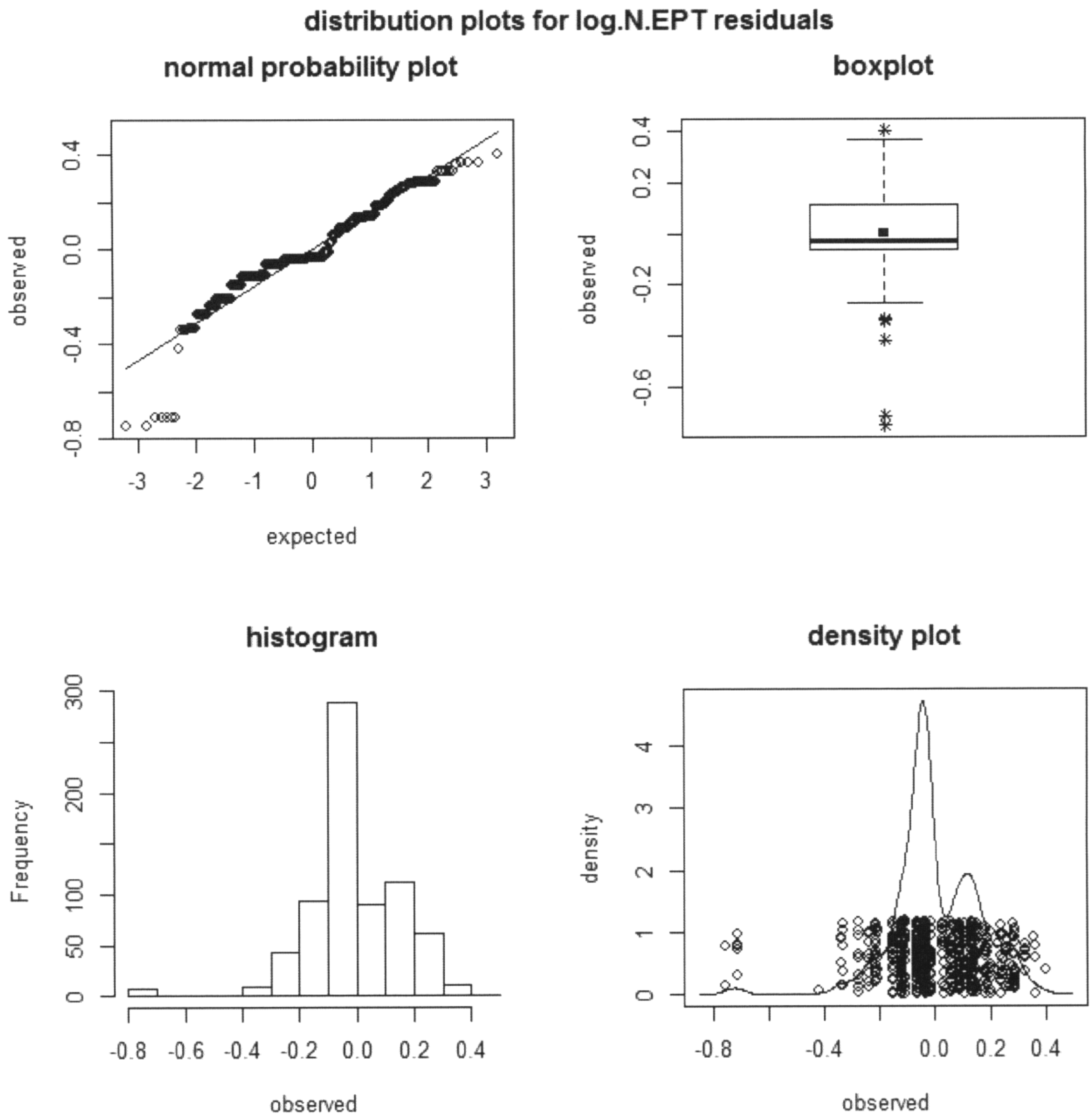
Coefficients Table

Parameter	Estimate	Std. Err.	t-value	p-value
(Intercept)	0.7122	0.01633	43.6184	<0.0001
Season2	-0.3476	0.0228	-15.2488	<0.0001
Season3	-0.2941	0.0228	-12.9009	<0.0001
StationsMixing Zone	0.0392	0.02328	1.6851	0.0924
StationsDown Stream	0.0988	0.02952	3.3455	0.0009
Season2:StationsMixing Zone	-0.071	0.03237	-2.193	0.0286
Season3:StationsMixing Zone	-0.1168	0.03237	-3.608	0.0003
Season2:StationsDown Stream	-0.1228	0.04038	-3.0414	0.0024
Season3:StationsDown Stream	-0.3059	0.04038	-7.5764	<0.0001

root mean-square error = 0.1575
r-square = 0.6007
adjusted r-square = 0.5962

Pair-wise comparisons among station groups for log.N.EPT

Season	Mean	Estimate	Std.Err.	t-value	p-value
Spring	Upstream Mean	0.7122	0.0163	43.6184	<0.0001
Spring	Mixing Zone Mean	0.7514	0.0166	45.273	<0.0001
Spring	DownStream Mean	0.811	0.0246	32.9772	<0.0001
Spring	Upstream:Mixing Difference	0.0392	0.0233	1.6851	0.0924
Spring	Mixingzone:Downstream difference	0.0595	0.0297	2.0061	0.0452
Spring	Upstream:Downstream Difference	0.0988	0.0295	3.3455	0.0009
Summer	Upstream Mean	0.3646	0.0159	22.9227	<0.0001
Summer	Mixing Zone Mean	0.3329	0.0159	20.9259	<0.0001
Summer	DownStream Mean	0.3406	0.0225	15.1396	<0.0001
Summer	Upstream:Mixing Difference	-0.0318	0.0225	-1.4119	0.1584
Summer	Mixingzone:Downstream difference	0.0077	0.0276	0.2798	0.7797
Summer	Upstream:Downstream Difference	-0.0241	0.0276	-0.873	0.3830
Fall	Upstream Mean	0.4181	0.0159	26.2874	<0.0001
Fall	Mixing Zone Mean	0.3406	0.0159	21.4106	<0.0001
Fall	DownStream Mean	0.211	0.0225	9.3785	<0.0001
Fall	Upstream:Mixing Difference	-0.0776	0.0225	-3.4485	0.0006
Fall	Mixingzone:Downstream difference	-0.1296	0.0276	-4.7039	<0.0001
Fall	Upstream:Downstream Difference	-0.2072	0.0276	-7.5196	<0.0001


distribution plots for log.N.EPT residuals
normal probability plot
observed
expected
boxplot
observed
histogram
Frequency
observed
density plot
density
observed

Upstream Control vs. Mixing Zone Summary

Variable	Season	Upstream Mean	Mixing Zone Mean	Difference	p-value	Percent Difference	Code
N.taxa	Spring	17.0645	16.5222	-0.5423	0.3177	-3.18	-
N.taxa	Summer	8.6429	7.3878	-1.2551	0.0169	-14.52	**
N.taxa	Fall	10.7347	9.8061	-0.9286	0.0768	-8.65	-
Count.sum	Spring	273.5699	230.7111	-42.8588	0.0023	-15.67	**
Count.sum	Summer	136.7449	118.7041	-18.0408	0.1837	-13.19	-
Count.sum	Fall	92.9388	60.602	-32.3367	0.0173	-34.79	****
shannon	Spring	0.8329	0.8874	0.0544	0.0023	6.53	**
shannon	Summer	0.6893	0.6196	-0.0697	0.0001	-10.11	**
shannon	Fall	0.7627	0.7566	-0.0061	0.7235	-0.8	-
evenness	Spring	0.7074	0.7527	0.0453	0.0001	6.4	**
evenness	Summer	0.7479	0.7246	-0.0234	0.0365	-3.13	**
evenness	Fall	0.7517	0.7709	0.0192	0.0858	2.55	-
HBI.mean	Spring	6.969	6.8217	-0.1473	0.0006	-2.11	**
HBI.mean	Summer	7.1326	6.9871	-0.1454	0.0004	-2.04	**
HBI.mean	Fall	6.945	6.8611	-0.0839	0.0403	-1.21	**
N.EPT	Spring	4.871	5.3	0.429	0.0811	8.81	-
N.EPT	Summer	1.3878	1.1837	-0.2041	0.3900	-14.71	-
N.EPT	Fall	1.7857	1.2551	-0.5306	0.0256	-29.71	****

Codes:

not significant	-
significant with effect < 25%	**
significant with effect > 25%	****

Upstream Control vs. Downstream Recovery Summary

Variable	Season	Upstream Mean	Downstream Mean	Difference	p-value	Percent Difference	Code
N.taxa	Spring	17.0645	18.4878	1.4233	0.0388	8.34	**
N.taxa	Summer	8.6429	8.551	-0.0918	0.8863	-1.06	-
N.taxa	Fall	10.7347	8.4082	-2.3265	0.0003	-21.67	**
Count.sum	Spring	273.5699	235.1463	-38.4236	0.0311	-14.05	**
Count.sum	Summer	136.7449	104.1224	-32.6224	0.0498	-23.86	**
Count.sum	Fall	92.9388	45.0408	-47.898	0.0040	-51.54	****
shannon	Spring	0.8329	0.9014	0.0685	0.0025	8.22	**
shannon	Summer	0.6893	0.6934	0.0041	0.8445	0.59	-
shannon	Fall	0.7627	0.698	-0.0647	0.0022	-8.48	**
evenness	Spring	0.7074	0.7266	0.0192	0.1896	2.71	-
evenness	Summer	0.7479	0.7523	0.0044	0.7482	0.59	-
evenness	Fall	0.7517	0.7993	0.0476	0.0005	6.33	**
HBI.mean	Spring	6.969	6.8106	-0.1584	0.0034	-2.27	**
HBI.mean	Summer	7.1326	7.0457	-0.0869	0.0828	-1.22	-
HBI.mean	Fall	6.945	6.7192	-0.2258	<0.0001	-3.25	**
N.EPT	Spring	4.871	6.0488	1.1778	0.0002	24.18	**
N.EPT	Summer	1.3878	1.2449	-0.1429	0.6232	-10.3	-
N.EPT	Fall	1.7857	0.7347	-1.051	0.0003	-58.86	****

Codes:

not significant	-
significant with effect < 25%	**
significant with effect > 25%	****

Upstream Control vs. Mixing Zone Summary, log-results

Variable	Season	Upstream Mean	Mixing Zone Mean	Difference	p-value	Percent Difference	Code
log.N.taxa	Spring	1.222	1.2154	-0.0065	0.7355	-1.49	-
log.N.taxa	Summer	0.9752	0.9147	-0.0605	0.0013	-13	**
log.N.taxa	Fall	1.059	1.0252	-0.0338	0.0704	-7.49	-
log.Count.sum	Spring	2.317	2.2432	-0.0738	0.0767	-15.63	-
log.Count.sum	Summer	2.1262	2.0512	-0.075	0.0624	-15.86	-
log.Count.sum	Fall	1.9087	1.7222	-0.1865	<0.0001	-34.91	****
log.N.EPT	Spring	0.7122	0.7514	0.0392	0.0924	9.45	-
log.N.EPT	Summer	0.3646	0.3329	-0.0318	0.1584	-7.06	-
log.N.EPT	Fall	0.4181	0.3406	-0.0776	0.0006	-16.36	**

Codes:

not significant	-
significant with effect < 25%	**
significant with effect > 25%	****

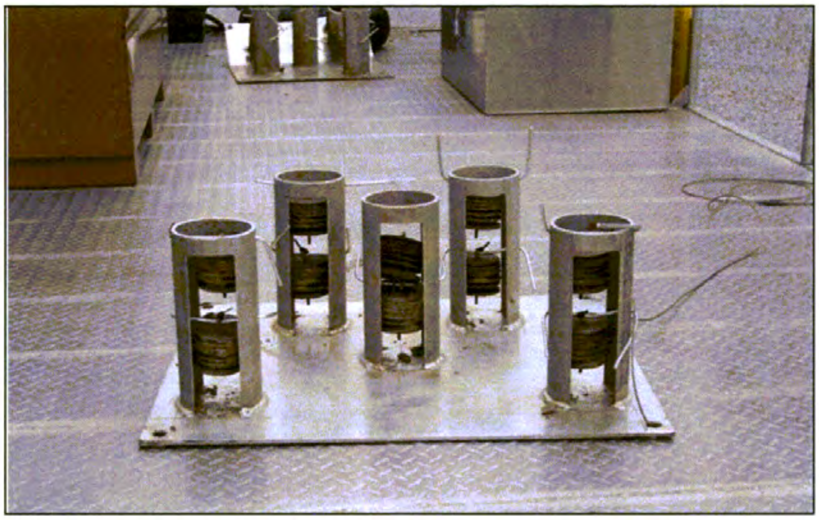
Upstream Control vs. Downstream Recovery Summary, log-results

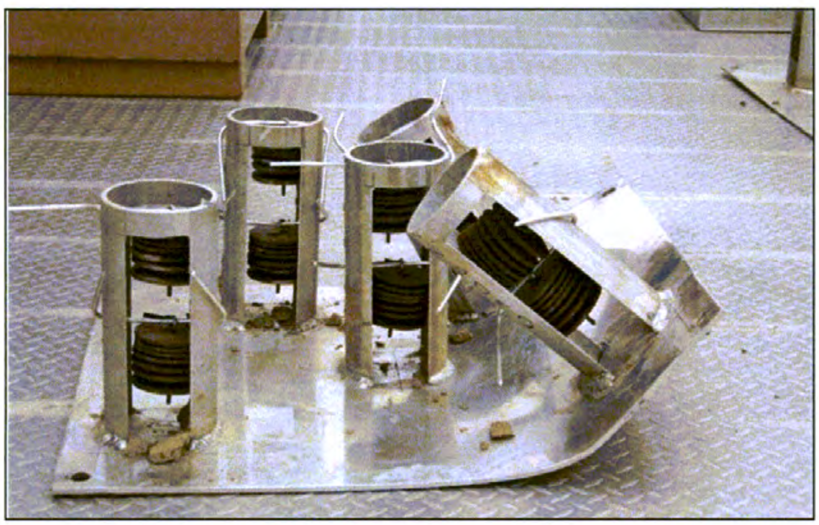
Variable	Season	Upstream Mean	Downstream Mean	Difference	p-value	Percent Difference	Code
log.N.taxa	Spring	1.222	1.2705	0.0486	0.0478	11.84	**
log.N.taxa	Summer	0.9752	0.9733	-0.0019	0.9350	-0.44	-
log.N.taxa	Fall	1.059	0.9456	-0.1134	<0.0001	-22.98	**
log.Count.sum	Spring	2.317	2.3307	0.0137	0.7949	3.2	-
log.Count.sum	Summer	2.1262	2.0064	-0.1198	0.0152	-24.11	**
log.Count.sum	Fall	1.9087	1.5241	-0.3846	<0.0001	-58.75	****
log.N.EPT	Spring	0.7122	0.811	0.0988	0.0009	25.55	****
log.N.EPT	Summer	0.3646	0.3406	-0.0241	0.3830	-5.4	-
log.N.EPT	Fall	0.4181	0.211	-0.2072	<0.0001	-37.94	****

Codes:

not significant	-
significant with effect < 25%	**
significant with effect > 25%	****

7.4. Appendix D Plate Sampler Photos





7.5. Appendix E Three-Dimensional Flow & Thermal Discharge Model Final Report

THREE-DIMENSIONAL FLOW AND THERMAL DISCHARGE MODELING FOR PLANT JAMES M. BARRY

FINAL REPORT

TO ALABAMA POWER COMPANY

From

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Phone: (205) 664-6168
Email: wegarrett@southernco.com

June 15, 2012

The Auburn University is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age or veteran status.

Abstract

A three-dimensional Environmental Fluid Dynamics Code (EFDC) model was developed to simulate unsteady flow patterns and temperature distributions in the Mobile River between the USGS streamflow gaging station at Bucks to the intersection of the Mobile River and I-65 bridge. The model simulation domain covered a segment (about 10.6 river miles) of the Mobile River and included the intake canal (~0.5 miles) and discharge canal (~1.4 river miles) of Plant Barry, and the model was called "Barry EFDC model". The model developed for Plant Barry had a total of 2,881 horizontal grids and six horizontal layers along the depth direction; therefore, there were a total of 17,286 three-dimensional computational cells in the simulation domain. The average grid size DX and DY were 28.2 m (92.5 ft.) and 42.5 m (139.4 ft.), respectively. The intake canal and discharge canal of Plant Barry were modeled using 660 and 768 three-dimensional computational cells, respectively. The once-through cooling water system of Plant Barry was modeled by EFDC using two withdrawal and return flow boundaries with measured temperature increases between the intake canal and discharge canal. The upstream boundary conditions were flow rates and water temperatures measured at the USGS gaging station at Bucks, and the downstream boundary conditions were measured water surface elevations and measured plus estimated water temperatures at the intersection of the Mobile River and I-65 bridge. All necessary input data files were developed and prepared for the Barry EFDC model for the 2010 and 2011 simulation runs. The model was run successfully using 2010 and 2011 input data. Model results were compared with measured data such as water surface elevations (three monitoring stations) and water temperatures at the shallow, middle-depth, and deep layers (18 monitoring stations). For the 2011 model simulations, the root-mean-square errors (RMSEs) for water temperatures at the intake canal (middle depth) for units 1–3 and units 4–5 were 0.32 °C and 0.29 °C. The RMSE values for water temperatures at the mixing zone left bank, right bank, mid-depth, and deep depth monitoring stations were 0.83 °C, 1.07 °C, 0.76 °C, and 0.88 °C, respectively. The relative errors (the ratio of mean absolute error to the observed mean) were less than 2.5% for all the stations. Absolute differences between observed means and modeled means for all monitoring stations ranged from 0.01 °C to 0.57 °C, with an average value of 0.26 °C. The Nash-Sutcliffe coefficients (a parameter to measure goodness-of-fit between modeled and observed data) for all monitoring stations ranged from 0.95 to 0.99 (the optimum value is 1.0), which indicated that modeled water temperatures matched well with observed water temperatures at these monitoring stations. Simulated vertical temperature profiles were compared with and matched reasonably well with observed profiles at all the profiling stations. Modeled velocities and discharges at the cross section near the downstream boundary matched well with observed ones that were measured using Acoustic Doppler Current Profiler (ADCP) during June 29–30, and August 24–25, 2011.

Acknowledgement

This study was funded by Alabama Power Company. The principle technical contact person at Alabama Power Company is Dr. William E. Garrett Jr., Supervisor of Environmental Affairs – Compliance Studies. We thank Mr. Jonathan B. Ponstein, P.E., Mr. Tim George, P.E., and Dr. William E. Garrett Jr. for providing necessary data for the study. We thank review comments on the report from APC.

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Chapter 1 Introduction

1.1 Objectives of the Study

This final report summarizes results for a fixed-price research agreement between Auburn University and Alabama Power Company (APC). The principle technical contact person at Alabama Power Company was Dr. William E. Garrett Jr., Supervisor of Environmental Affairs – Compliance Studies. The principle investigator at Auburn University was Dr. Xing Fang, P.E., Associate Professor in the Department of Civil Engineering. This report summarizes results from a modeling study conducted from August 16, 2010, to June 15, 2012.

The objective of the study is to develop and calibrate a three-dimensional (3D) Environmental Fluid Dynamics Code (EFDC) model for flow and water temperature simulations using field data that APC collected in 2010 and 2011, and to have acceptable model accuracy. The study site is a segment of the Mobile River near APC's James M. Barry Electric Generating Plant ("Plant Barry") near Bucks, AL (Figure 1.1). The Mobile River near Plant Barry is tidally influenced due to its connection to Mobile Bay and the Gulf of Mexico (Figure 1.1).

1.2. Scope of the Study and Tasks

In order to develop and calibrate a three-dimensional EFDC model for thermal discharge modeling in the Mobile River near Plant Barry, including the intake and discharge canals, the following steps were proposed for the project and are listed below. The EFDC model developed for the project is called "Barry EFDC model" in the following discussion.

(1). Collecting and understanding necessary information for the study site

(2). Generating computational grids using hydrographic bathymetry data

(3). Preparing all necessary model input data files for the Barry EFDC model

(4). Testing and calibrating the Barry EFDC model using existing field data that APC collected in 2010 and 2011 for Plant Barry

(5). Analyzing modeling results and generating the necessary graphs and tables to summarize model results

(6). Developing a final project report for Alabama Power Company

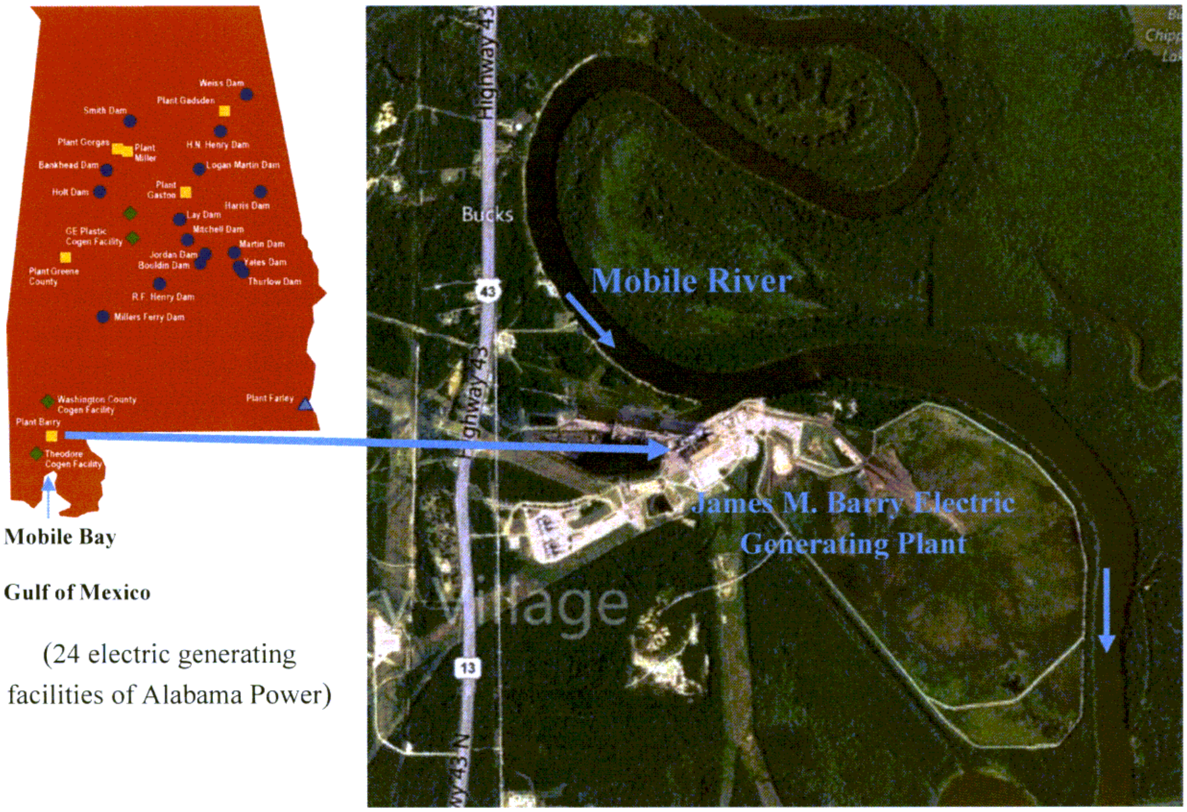


Figure 1.1 James M. Barry Electric Generating Plant along the Mobile River near Bucks.

Based on the objective of the study, the following tasks that defined and described the scope of the study were performed by researchers ("we" or "us" in the following writing) at Auburn University with support from Alabama Power Company:

(1). Worked with Alabama Power Company to clearly define specific modeling results on thermal discharge modeling for Plant Barry that should be summarized in the final report.

(2). Worked on computational grid generation using hydrographic bathymetry data provided by Alabama Power Company. The hydrographic bathymetry data gave river bottom elevations over the cross sections along the Mobile River within the simulation domain.

(3) Prepared all necessary model input data files for the Barry EFDC model and for 2010 model runs. The major input files for an EFDC model include a master input file, boundary condition data files, initial condition data files, and a meteorological data file. The master input file allows modelers to input model-controlling parameters that include all necessary model parameters to control how the model runs, e.g., starting and ending simulation time, model time step, types of boundary conditions, and where the intake (cooling water withdrawal) and discharge (return flow) are located. The boundary condition data files include time-series data of streamflow rates or water surface elevations and water temperatures at the upstream and downstream boundary locations.

(4) Tested and calibrated the Barry EFDC model using existing field data that APC collected in 2010. The model was tested for a simulation period in which all input data were available. Testing the model would allow us to identify potential data errors (e.g., when field data over a data collection period did not follow consistent patterns or variations that field data had in all other data collection periods), correct any problems in data preparation, and diagnose any potential modeling problems. Testing the model led to possible modifications and corrections of input data files and/or necessary revision of the computational grid system.

(5) Worked and coordinated with APC to develop a data collection plan that should provide well-defined boundary conditions and field measurements for model calibration and improvement. Additional field data were collected by APC in summer and fall of 2011, and were used for improving the Barry EFDC model.

(6) Used additional field data that APC collected in 2011 to calibrate and refine the Barry EFDC model to obtain acceptable model accuracy. We prepared all necessary model input data files for the Barry EFDC model for the simulation period in 2011 (April 26 to August 29, 2011). We revised and refined the computational grids based on the simulation results of 2010 model runs.

(7) Analyzed model results and generated the necessary graphs and tables to summarize model improvement and calibration results. We used concepts and theories in fluid mechanics, hydrodynamics, and heat transfer to analyze model results and extracted useful information from simulation results. The EFDC Explorer (Craig 2011) and other graphing software were used to develop necessary graphs and tables to present, visualize, and summarize simulation results.

(8) Developed a final project report for Alabama Power Company. Results from the Barry EFDC model runs were first presented in a PowerPoint presentation. The methodology, model development, model testing, model calibration, model results, and a result analysis are summarized in the final report. The final report was delivered to Alabama Power Company through Dr. Garrett on June 15, 2012.

1.3 Deliverables

Dr. Fang communicated and consulted with Dr. Garrett regularly to make sure the project moved forward as planned and to request necessary model input data. Researchers at Auburn University reported study progress and model results as follows:

1). Simple progress reports were provided monthly to Alabama Power Company in short memo format and/or by e-mail.

2). The final project report presented here summarizes methodology, model results, and a result analysis of EFDC hydrothermal modeling for Plant Barry. Appendix A provides technical background of EFDC model theory. Appendix B provides a brief summary on data files for the Barry EFDC model. Appendix C provides an analysis and summary of 2011 field data collected at APC's monitoring stations. Appendix D provides a brief summary of model results for 2010 simulation runs.

3). Researchers at Auburn University provided Alabama Power Company the calibrated working model for the Plant Barry modeling study, which includes executable model file(s) and all necessary input data files and output data files for model calibration runs.

1.4 Executive Summary

A three-dimensional Environmental Fluid Dynamics Code (EFDC) model was developed to simulate unsteady flow patterns and temperature distributions in the Mobile River near APC's Plant Barry. The EFDC model was developed for a segment (about 10.6 river miles) of the Mobile River near Bucks, Alabama, including the intake canal and discharge canal of Plant Barry, and it is called "Barry EFDC model".

Several versions of the computational grids were developed for the Barry EFDC model for 2010 and 2011 testing and calibration runs. All necessary input data files were prepared for 2010 and 2011 runs, and the model was run successfully for both 2010 and 2011 input data. Only the most recent EFDC model for Plant Barry is described in the report.

The Barry EFDC model had a total of 2,881 horizontal grids and six horizontal layers along the depth or vertical direction; therefore, there were a total of 17,286 three-dimensional computational cells in the simulation domain. Bottom elevations of model grids ranged from about -18.8 m to -0.7 m below mean sea level (using NAVD 1988 datum). The Mobile River in the simulation domain was divided into seven computational grids along the transverse direction, i.e., along the river cross section or perpendicular to flow direction. The intake canal and discharge canal of Plant Barry were modeled using 660 and 768 three-dimensional computational cells, respectively. Plant Barry was modeled as two withdrawals from the intake canal and two return flows to the discharge canal with temperature increases varying with time (depending on plant operations). Meteorological data used for the Barry EFDC model were from Mobile Regional Airport, and closely matched the data from APC's weather station near Plant

Barry. The upstream boundary of the Barry EFDC model was at the USGS streamflow gaging station at Bucks, Alabama. Measured discharges and water temperatures at the Bucks station were used as the upstream boundary. Measured water surface elevations and water temperatures at the downstream location (at the Interstate-65 bridge) were used as the downstream boundary condition.

The Barry EFDC model was run for 125 days from Julian day 115 (April 26, 2011) to Julian day 240 (August 29, 2011). Model results were compared with measured data such as water surface elevations, and water temperatures at the shallow, middle-depth, and deep layers at APC's monitoring stations of Plant Barry. Overall agreement between modeled results and measured data was very good.

For 2011 model simulations, the root-mean-square errors (RMSEs) for water temperatures at the intake canal (middle depth) for units 1–3 and units 4–5 were 0.32 °C and 0.29 °C, respectively. The RMSE values for water temperatures at the mixing zone left bank, right bank, mid-depth, and deep depth monitoring stations were 0.83 °C, 1.07 °C, 0.76 °C, and 0.88 °C, respectively. The relative errors (the ratio of mean absolute error to the observed mean) are less than 2.5% for all the stations. Absolute differences between observed means and modeled means for all monitoring stations ranged from 0.01 °C to 0.57 °C, with an average value of 0.26 °C. The Nash-Sutcliffe coefficients (a parameter to measure goodness-of-fit between modeled and observed data) for all monitoring stations ranged from 0.95 to 0.99 (the optimum value is 1.0), which indicated that modeled water temperatures matched well with observed water temperatures at these monitoring stations. Simulated vertical temperature profiles were compared with and matched reasonably well with observed profiles at all the profiling stations, *i.e.*, the 13 macroinvertebrate plate stations. Modeled velocities and discharges at the cross section near the downstream boundary matched well with observed ones that were measured using ADCP during June 29–30, and August 24–25, 2011.

Chapter 2 Model Development

A three-dimensional EFDC model was developed to simulate flow velocities and water temperature distributions over time in the Mobile River near APC's James M. Barry Electric Generating Plant (called "Plant Barry" in the report). The simulation domain is a portion of the Mobile River from the USGS streamflow gaging station at Bucks to the intersection of the Mobile River and Interstate 65 (Figure 2.1). This EFDC computational simulation model is called "Barry EFDC model" for the following discussion, and is described and summarized below. Technical background of EFDC model theory is briefly summarized in Appendix A.

2.1 Grid Generation of the Study Area

The first step to develop an EFDC model for the Mobile River was to generate computational grids using hydrographic bathymetry data. Figure 2.2 shows that the bathymetry data provided by APC matched well with the Mobile River shoreline GIS shapefile downloaded from AlabamaView. The simulation domain of the Barry EFDC model is a segment of the Mobile River between the upstream boundary and the downstream boundary. The upstream boundary is a cross section of the Mobile River at the USGS streamflow gaging station 02470629 at Bucks (Figure 2.3). The downstream boundary is a cross section of the Mobile River at the intersection of the Mobile River and I-65 bridge (Figure 2.4). The distance between the upstream and downstream boundaries is about 10.6 river miles. The simulation domain includes the intake canal and the discharge canal (Figure 2.1) of Plant Barry.

Several versions of the computational grids were developed for the Barry EFDC model for 2010 and 2011 testing and calibration runs. All necessary input data files were prepared for 2010 and 2011 model runs, and the model was run successfully for both 2010 and 2011 input data. Only the most recent EFDC model for Plant Barry study is described below. Model results for updated 2010 model runs are briefly summarized in Appendix D.

The Barry EFDC model has a total of 2,881 horizontal grids and six horizontal layers along depth direction (a total of 17,286 three-dimensional computational cells). Bottom elevations of model grids are shown as color contours in Figure 2.5 to Figure 2.8, and ranged from about -18.8 to -0.7 m below mean sea level (msl) (using NAVD 1988 datum). There are a total of 2,643 horizontal grids in the Mobile River (not including the intake and discharge canals). The intake canal and discharge canal of Plant Barry were modeled using 110 and 128 computational grids or 660 and 768 three-dimensional computational cells, respectively. The grid size DX along the cross section ranged from 14.3 to 60.1 m (47 to 197.2 ft) and DY along the flow direction ranged from 9.9 to 101.2 m (32.5 to 332 ft). The average DX is 28.2 m (92.5 ft) and the average DY is 42.5 m (139.4 ft) for the Barry EFDC model.

The horizontal model grids developed for the Barry EFDC model were based on NAVD 1988 horizontal datum and Universal Transverse Mercator (UTM) projection coordinate system. The horizontal grids were developed using the shoreline GIS shapefile (Figure 2.2) of the Mobile River downloaded from AlabamaView (http://www.alabamaview.org/). AlabamaView provides centralized access to downloadable remotely sensed imagery and GIS layers for the general public. The GIS data were downloaded for Mobile County in Alabama that includes the study area of the Mobile River between the upstream and downstream boundaries of the Barry EFDC model. The shoreline data were further validated using AutoCAD data and hydrographic data (Figure 2.2) developed by the U.S. Army Corps of Engineers (the data were provided by APC).

Figure 2.5 shows that the Mobile River in the simulation domain was divided into seven computational grids along the transverse direction (along the river cross section or perpendicular to flow direction). The average width of the Mobile River in the simulation domain is about 672 ft or 205 m, therefore typical grid width along the cross section is about 96 ft or 29 m. The grids were divided into six horizontal layers along the vertical or depth direction. This grid generation was based on and supported by observed water temperature data provided by APC that were analyzed and are summarized in **Appendix C.** APC collected water temperature data at several monitoring stations from April 18 to September 21, 2011. An analysis of observed temperature data shows that there were temperature variations along river cross sections (from the left to right river bank) and along the vertical or depth direction (from the water surface to river bottom). For example, observed temperature differences in the Plant Barry mixing zone (BAMZ) between shallow depth at the left bank monitoring station and deep depth monitoring station ranged from -1.0 to 8.1 ^{o}C, with an average difference of 1.1 ^{o}C (Table C.3). Observed temperature differences between shallow depths at the left bank and right bank in the BAMZ ranged from -5.1 to 7.9 ^{o}C, with an average difference of 0.2 ^{o}C. For 2011 simulations, the Barry EFDC model with seven computational cells in the traverse direction and six horizontal layers in the depth direction allowed the EFDC not only to reasonably predict temperature variations in both directions but also to correctly simulate unsteady and complex flow movements and circulations in the Mobile River and in the intake and discharge canals of Plant Barry.

The EFDC model (Hamrick 1992a) typically creates equal-thickness three-dimensional computational cells for each horizontal grid if the number of horizontal layers specified for a EFDC model is greater than 1. Layer 1 is near the river bottom and Layer 6 is near the water surface, as show in Figure 2.5. For example, the Barry EFDC model has six horizontal layers along the vertical direction, if one horizontal grid has a water depth of 2.4 m; the EFDC model creates six computational cells with a thickness of 0.4 m for the grid. If another horizontal grid at the center of a cross section of the Mobile River has a water depth of 12.0 m, the EFDC model creates six computational cells with a thickness of 2.0 m for the grid. Figure 2.5 (top frame) shows EFDC grids of the Mobile River near the upstream boundary for the Barry EFDC model. Figure 2.5 (bottom frame) shows a graphic view of six horizontal layers along the vertical direction for the seven horizontal grids at the upstream boundary (the USGS Bucks gaging station). The maximum water depth of the Bucks cross section (Figure 2.5) was about 12.8 m at the particular time (12:00 PM or noon on April 26, 2011) and flow condition. The maximum water depth of the river cross sections in the simulation domain ranged from about 2.8 ft (discharge canal) to 62.5 ft (0.9 m to 19.0 m), depending on freshwater inflow from the upstream boundary and tidal waves from the downstream boundary.

Plant Barry in the Barry EFDC model was represented or modeled using two cooling water withdrawals from the intake canal and two return flows to the discharge canal as model boundary conditions. Figure 2.6 shows a satellite image showing withdrawal (intake) and discharge locations of Plant Barry and EFDC grids of the Mobile River near Plant Barry, intake canal, and a portion of the discharge canal showing the intake and discharge locations for units 1–3 and units 4–5. The intake canal is relatively wide (~ 312.6 ft or 95 m) and was modeled as six horizontal grids along the cross section (Figure 2.6). There are 13 horizontal grids connecting between the Mobile River and the intake canal of Plant Barry (Figure 2.6), which allow EFDC to appropriately model flow interactions and exchanges between the Mobile River and the intake canal. The discharge canal is a relatively narrow channel (~ 75.5 ft or 23 m) and was transversely divided into two horizontal grids (Figure 2.6 and Figure 2.7). Figure 2.7 shows an overall view of model grids in the Mobile River near Plant Barry and in the intake canal and discharge canal of Plant Barry. On Figure 2.7, "W" stands for flow withdrawal boundary and "R" stands for return flow boundary for the Barry EFDC model. The intake canal has a total of 660 three-dimensional computational cells with six horizontal layers (110×6), and the discharge canal was modeled with 768 three-dimensional computational cells (64×2×6). In comparison to river segments relatively far away from Plant Barry, there are more horizontal grids in the Mobile River near the intake canal and the discharge canal (Figure 2.7) in order to more accurately model water temperature distributions and interactions between the Mobile River and the intake or discharge canals of Plant Barry.

The downstream boundary of the Barry EFDC model is located at the intersection of the Mobile River and I-65 bridge. The river section near the downstream boundary is represented by seven horizontal grids in the traverse direction (Figure 2.8). Observed water surface elevations and water temperatures provided by APC were used as boundary conditions at those seven horizontal grids for the Barry EFDC model simulations in 2010 and 2011.

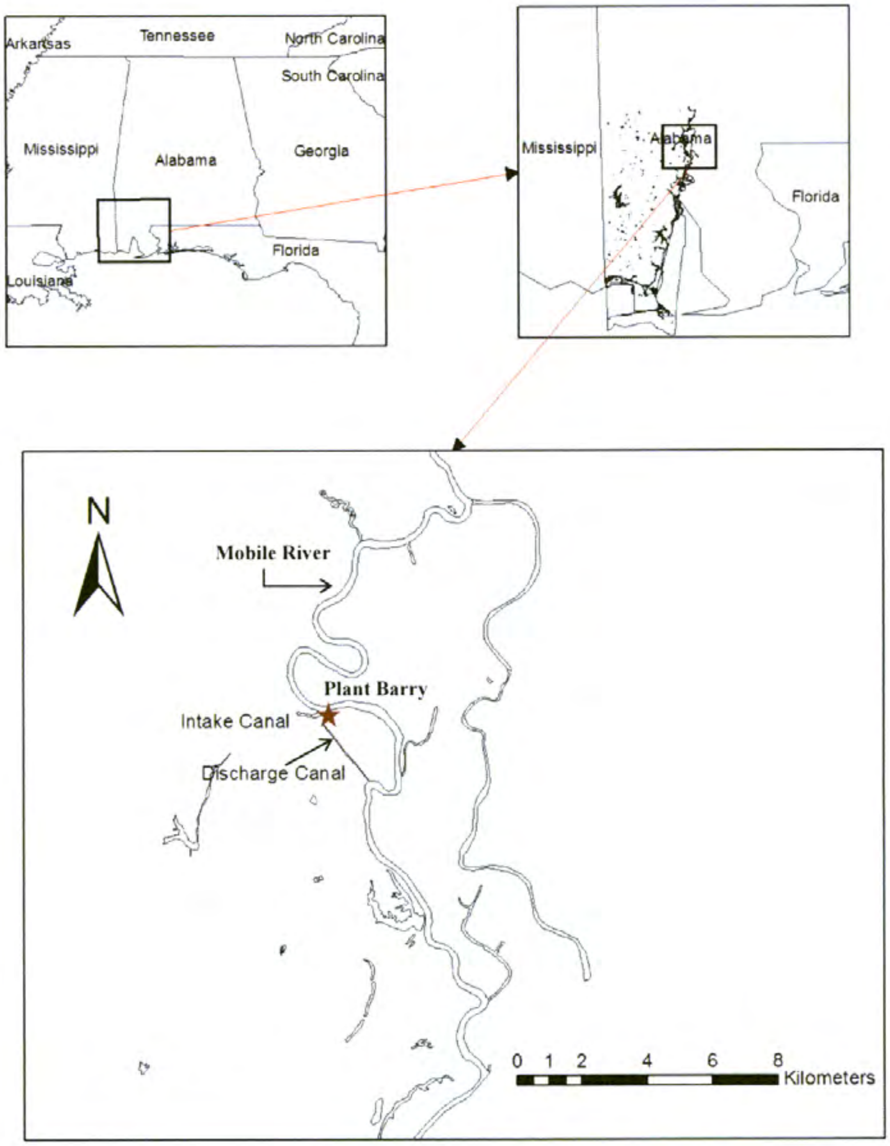


Figure 2.1 Location of APC's Plant Barry on the Mobile River, AL

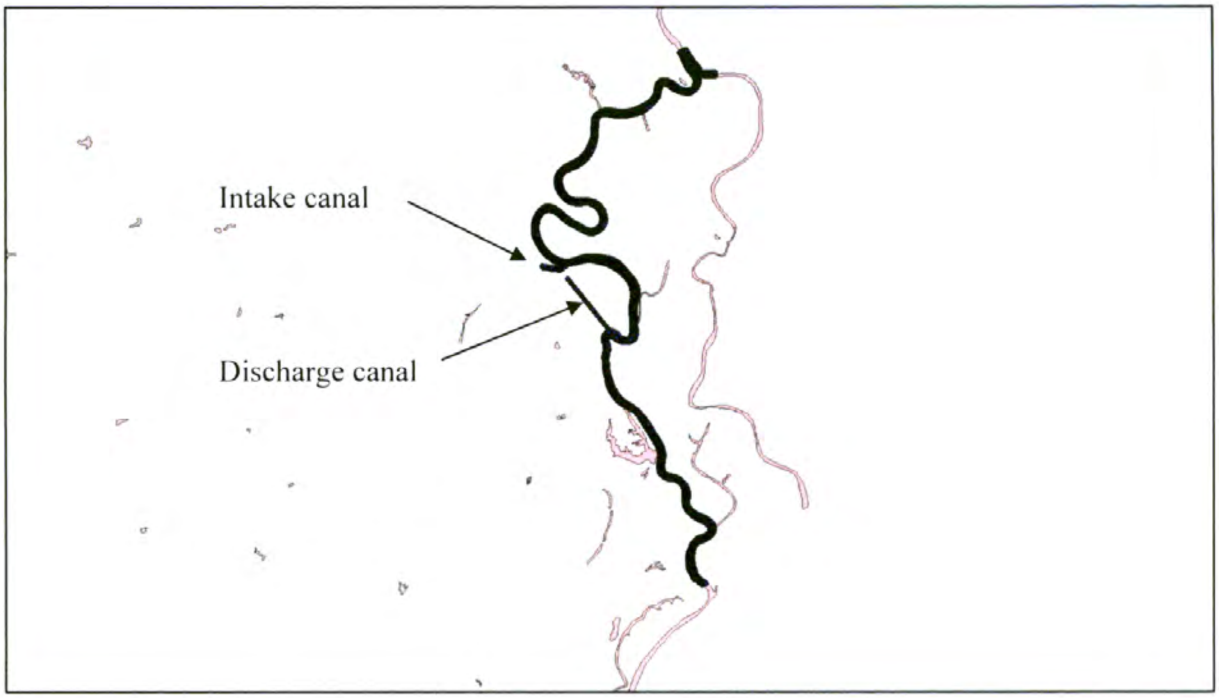
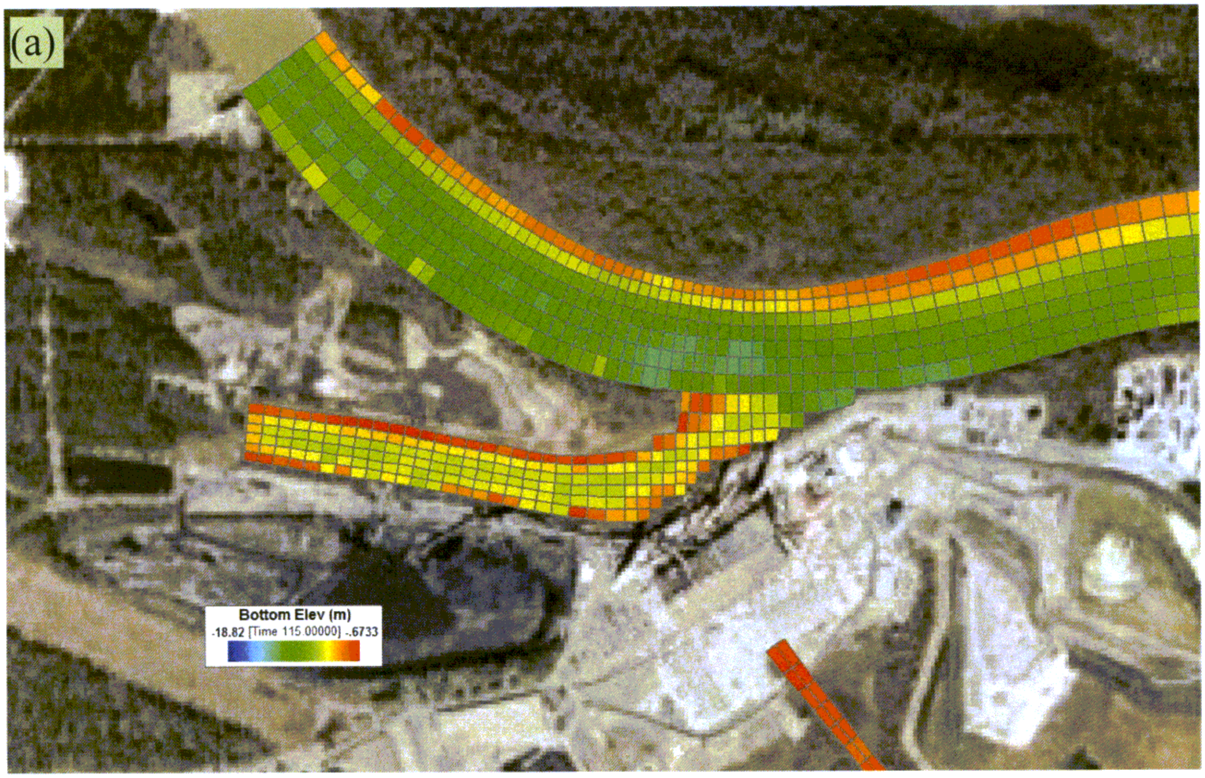


Figure 2.2 Bathymetry data of the Mobile River, provided by APC and overlapped on GIS shapefile from AlabamaView.

Figure 2.3 Upstream boundary location of the Barry EFDC model – USGS Bucks gaging station on the Mobile River.

Figure 2.4 Downstream boundary location of the Barry EFDC model – the intersection of the Mobile River and I-65 bridge.



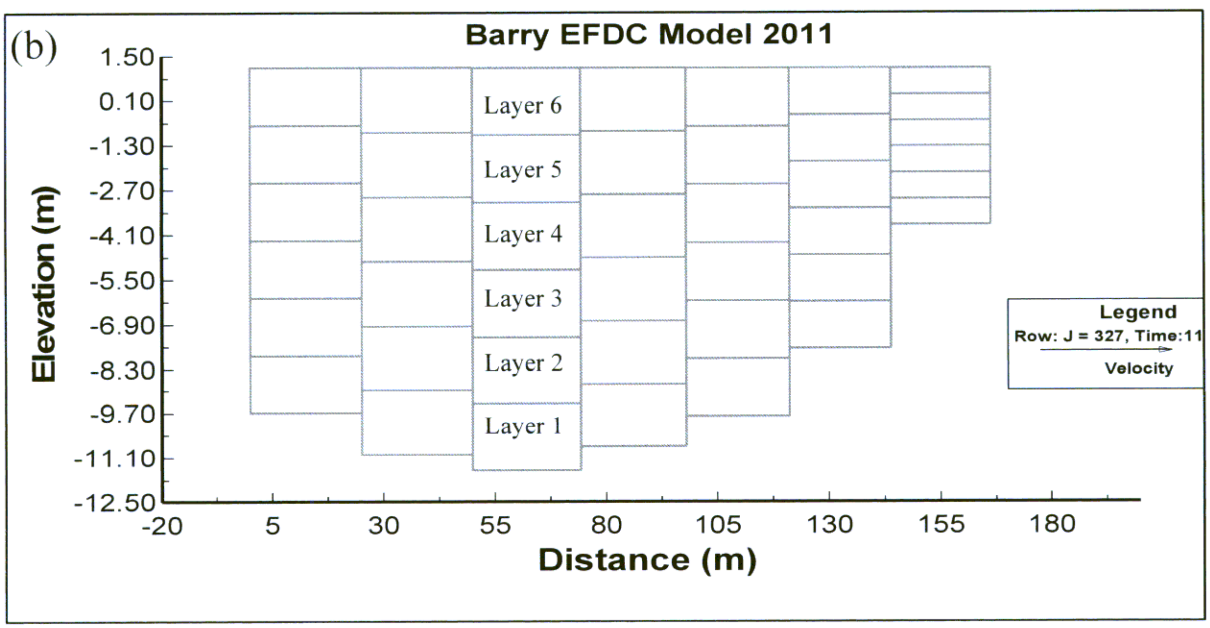
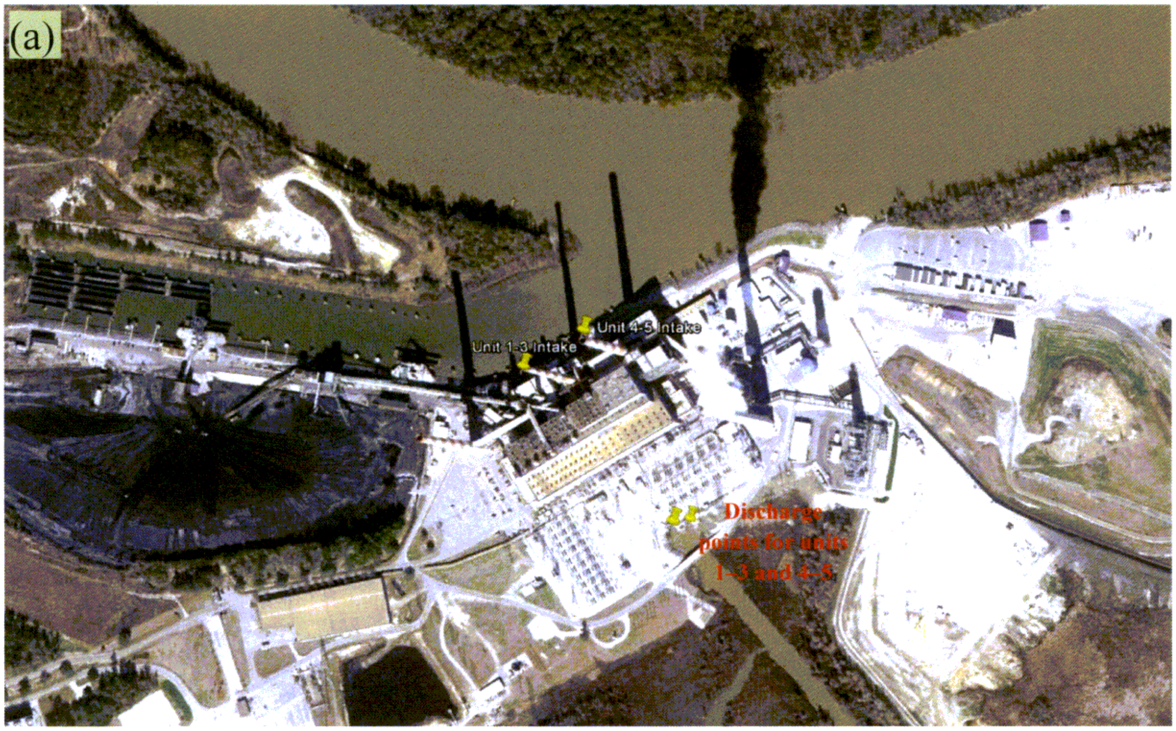


Figure 2.5 (a) EFDC grids of the Mobile River near the USGS Bucks gaging station (the upstream boundary of the Barry EFDC model), and (b) a graphic view of six horizontal layers in the vertical direction of the seven horizontal grids at the upstream boundary.



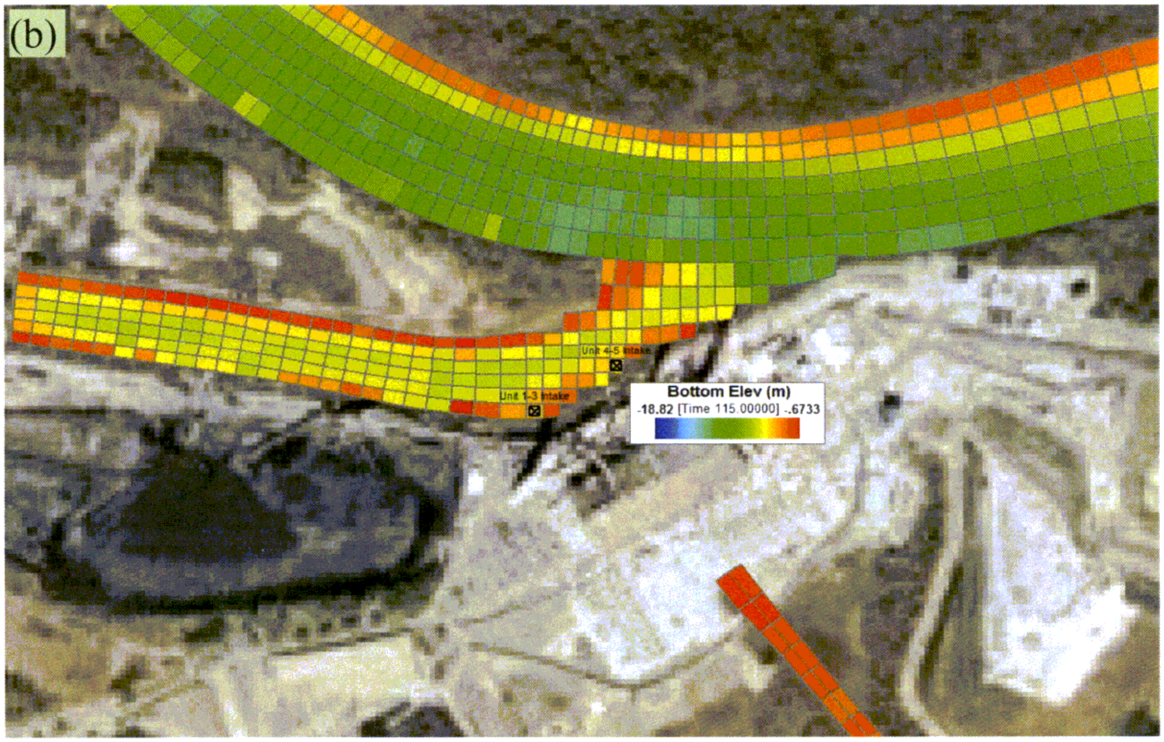


Figure 2.6 (a) Satellite image showing withdrawal (intake) and discharge locations of Plant Barry, and (b) EFDC grids of the Mobile River near Plant Barry, intake canal, and a portion of discharge canal showing the intake and discharge locations for units 1-3 and units 4-5.

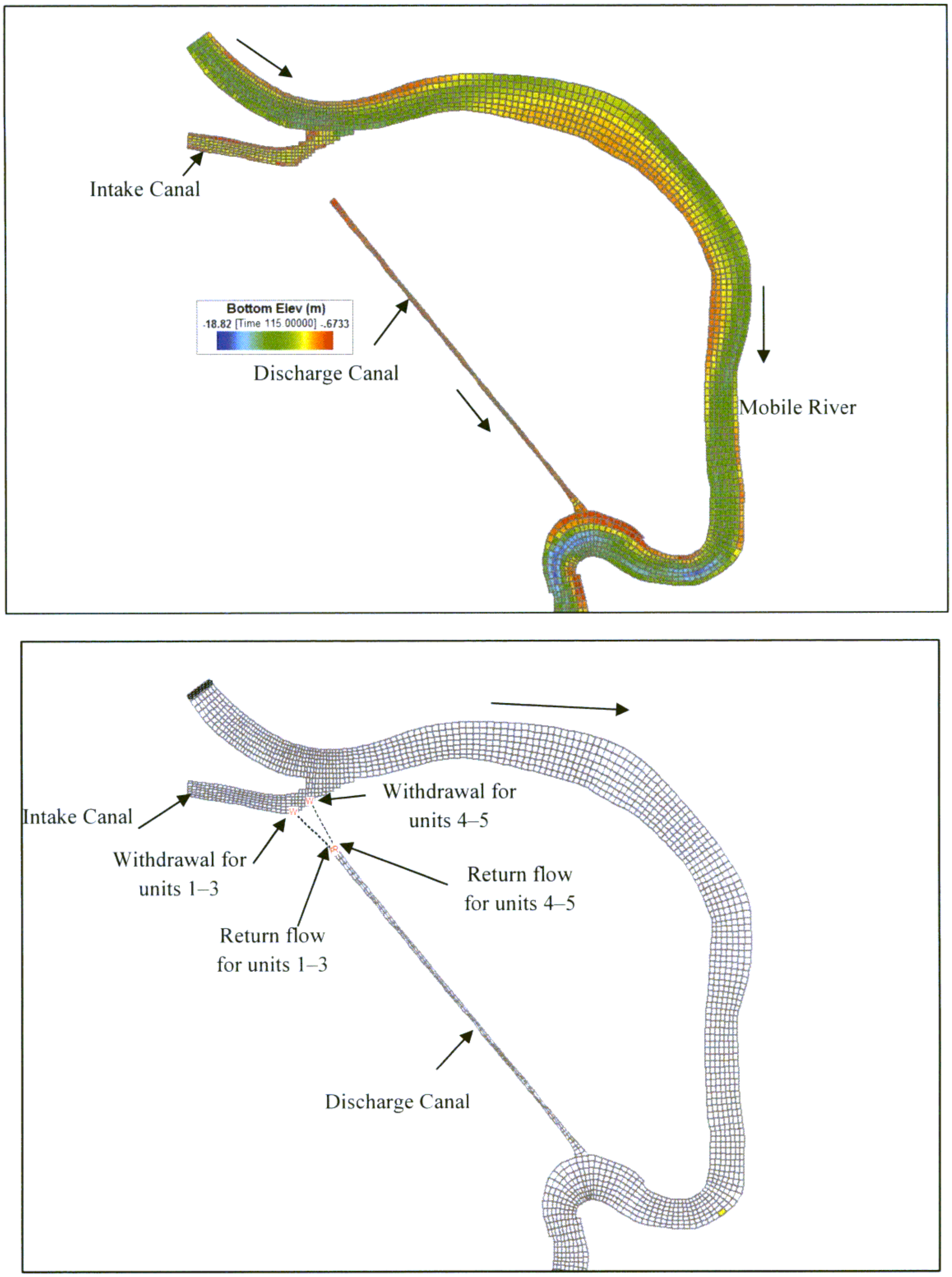


Figure 2.7 EFDC grids of the Mobile River near Plant Barry, intake canal and discharge canal of Plant Barry. The top and bottom graphs show bottom elevation changes of horizontal grids and locations of withdrawal and return flow boundaries for EFDC to model Plant Barry, respectively.

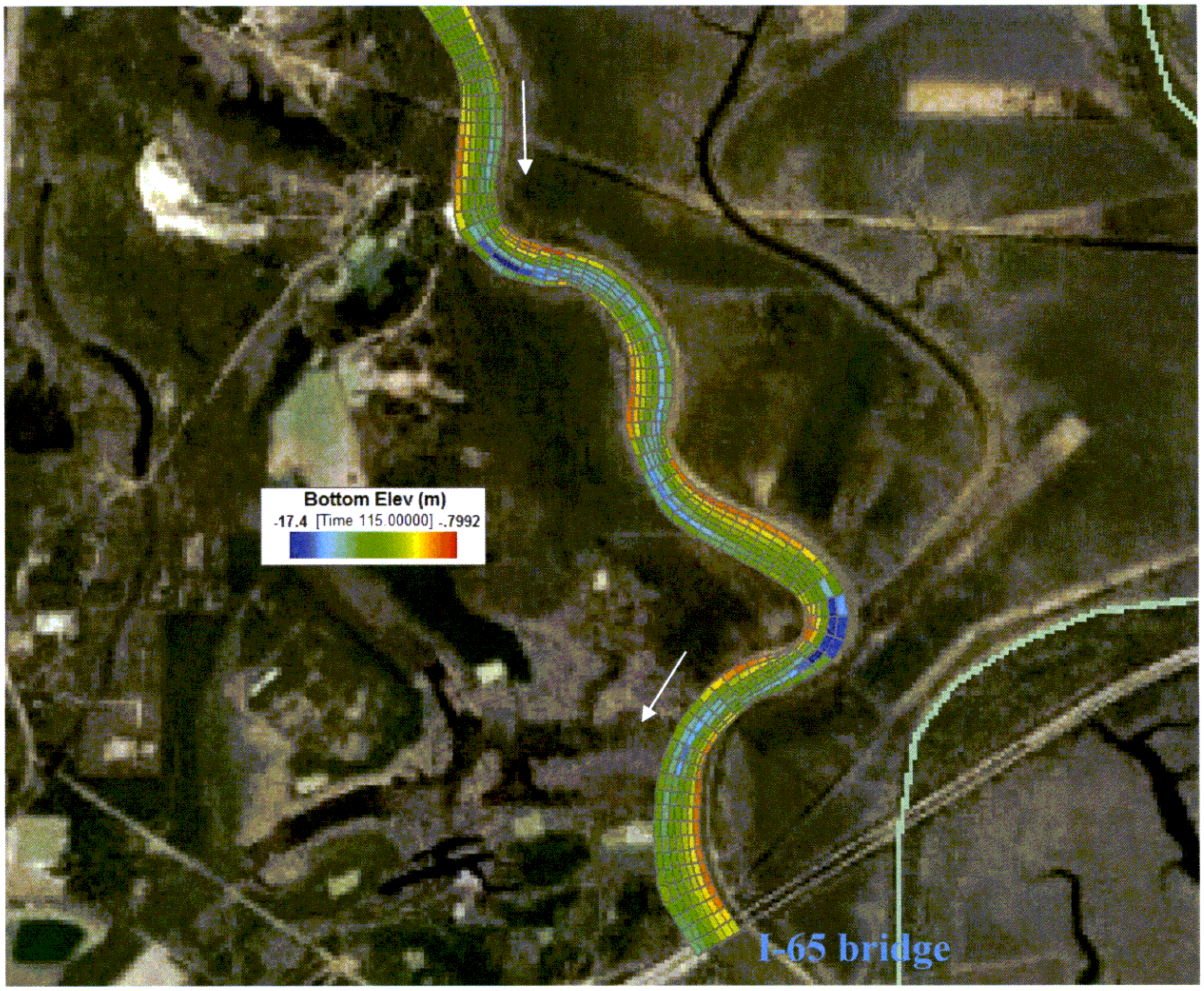


Figure 2.8 Model horizontal grids and bottom elevation changes near the downstream boundary of the EFDC Barry Model.

2.2 APC Monitoring Stations

Table 2.1 and Table 2.2 list geographic information (longitude and latitude) of APC's long-term monitoring stations (Figure 2.9 and Figure C.1) and macroinvertebrate plate monitoring stations along the Mobile River near Plant Barry (Figure 2.1), respectively. APC collected field observation data at these monitoring stations, such as water depths, water temperatures, and flow velocities. These monitoring data were used either as model boundary conditions or for model calibration to evaluate the model performance against observed (measured) data. Figure 2.10 shows the zoomed view of Barry EFDC model grids displaying the locations of APC's monitoring stations in the intake canal (BAIC), the discharge canal (BADC), the mixing zone (BAMZ), and at the downstream boundary (BADS) of the model.

APC established four long-term monitoring stations in 2011 on the Mobile River near Plant Barry for water temperature measurements that can be used as model boundary conditions. Water temperatures were measured at the shallow and deep depths near the USGS Bucks gaging station (Figure 2.9), and these observed temperatures were used as part of the upstream boundary conditions of the Barry EFDC model. There were two monitoring stations in the discharge canal to measure water temperatures at the discharge points for units 1–3 and units 4–5 separately. These observed temperatures were used to compute temperature increases between the cooling-water intake structures and thermal discharge points. Temperature increases were used as model boundary conditions for simulating withdrawals and return flows for Plant Barry. Water temperatures were also measured at the shallow and deep depths near the downstream boundary (Figure 2.9), and these observed temperatures were used as part of the downstream boundary conditions of the Barry EFDC model. The BAMZ monitoring stations that measured shallow-depth and deep-depth temperatures were relatively close to each other and within one horizontal grid resolution of the Barry EFDC model, therefore, they are considered as one monitoring station (Table 2.1).

APC established five long-term monitoring stations in 2011 on the Mobile River near Plant Barry for water temperature measurements that can be used for model calibration on simulated water temperatures. There were two monitoring stations in the intake canal, and they were located near the intake structures for units 1–3 and units 4–5, respectively (Figure 2.10). There were three temperature monitoring stations in the mixing zone of Plant Barry: the right bank and the left bank stations measured surface (shallow-depth) water temperatures, the mid-depth and deep depth station measured water temperatures at the middle depth and deep depth (near the river bottom). The mid-depth and deep depth station was at the same geographic location (Figure 2.10 and Table 2.1) but at different water depths. The exact locations (longitude and latitude or UTM northing and easting coordinates) of these five monitoring stations are listed in Table 2.1. Vertical temperature profiles were also measured at the intake canal, discharge canal, and mixing zone monitoring stations in 2010 during several field data collection trips.

In addition to long-term monitoring stations near the intake canal, discharge canal, and mixing zone of Plant Barry, and the downstream boundary of the Barry EFDC model, APC deployed another set of monitoring stations throughout the Mobile River for the macroinvertebrate study, and these stations also measured water temperatures that can be used for calibration and validation of the Barry EFDC model. Figure 2.11 shows locations and distributions of APC's macroinvertebrate plate monitoring stations (Station 3 – Station 18) overlaid on horizontal grids of the Barry EFDC model. Bottom elevations of model grids are shown as color contours on Figure 2.11. The plate thermistors at these monitoring stations only measured surface or shallow-depth water temperatures. The approximate depth of these shallow-depth temperature measurements were at -2.0 m (-6.5 ft) above msl. The exact locations (longitude and latitude or UTM northing and easting coordinates) of these 14 macroinvertebrate plate monitoring stations are listed in Table 2.2. Station 18 only had water temperature data observed in 2010 that are used to compare with modeled results in Appendix D. The other 13 stations had vertical temperature profiles and time-series data of shallow-depth water temperatures observed in both 2010 and 2011 for model calibration, *i.e.*, comparing model results with observed data. Vertical temperature profiles were also measured at these 13 monitoring stations during several APC field data collection trips in 2010 and 2011. APC has other four macroinvertebrate plate monitoring stations (stations 1–2 and C1–C2) that are located outside the simulation domain and are not used for the current modeling study.

There are four monitoring stations that APC used to measure water depth or water surface elevation. They were located at the upstream boundary (near the USGS Bucks gaging station, Figure 2.9), in the intake canal and mixing zone (near the mouth of the discharge canal, "BAMZ elevation" on Figure 2.10), and near the downstream boundary (Figure 2.9). Measured water surface elevation near the downstream boundary was used as one of the boundary conditions of the Barry EFDC model. Measured water surface elevations at the other three stations can be used for model calibration that will be described in Section 3.3.

Observed water temperature data provided by APC were analyzed and are summarized in Appendix C. Statistical analyses were done for the APC monitoring stations in the intake canal (BAIC), discharge canal (BADC), mixing zone (BAMZ), and near the downstream boundary (BADS). Statistical parameters such as minimum, maximum, 25% quartile, median (50% quartile), 75% quartile, average, and standard deviation of measured water temperatures at each station were calculated and tabulated (Table C.1 to Table C.4). For example, observed water temperatures at the intake canal (BAIC) ranged from 20.6 to 35.8 °C, with an average value of 28.5 °C. Observed water temperatures at the discharge canal (BADC) varied from 22.3 to 43.1 °C, with an average value of 32.8 °C. Temperatures at the left bank station in the mixing zone of Plant Barry varied from 20.5 to 41.7 °C, and temperatures at the right bank station varied from 20.4 to 39.7 °C. Monthly statistical parameters were also calculated for each temperature monitoring station (Table C.5 to Table C.16).

Table 2.1 Location information of APC's long-term monitoring stations for the Barry EFDC model.

Name	Description	Observation type and Parameters	Latitude (degrees)	Longitude (degrees)	UTM Easting (m)	UTM Northing (m)	I index [2]	J index
BAUS	Upstream [1]	Long term, temperature, **depth**	31.0125	-88.0178	402,845	3,431,431	69	359
BADS	Downstream (temperature)	Long term, temperature	30.91544	-87.96562	407,732	3,420,630	68	6
	Downstream (depth)	Long term, **depth**	30.91488	-87.96305	407,978	3,420,566	73	4
	Mixing Zone Left Bank	Long term, temperature	30.9823	-87.9947	405,013	3,428,068	75	144
BAMZ	Mixing Zone Right Bank	Long term, temperature	30.9827	-87.9963	404,865	3,428,119	68	145
	Mixing Zone Middle and Deep Depths	Long term, temperature, **depth**	30.9823	-87.99511	404,980	3,428,067	73	144
BAIC	Intake Canal Units 1-3	Temperature, **depth**	31.00713	-88.01208	403,385	3,430,832	59	329
	Intake Canal Units 4-5	Temperature	31.00756	-88.011252	403,465	3,430,879	62	324
BADC	Discharge Canal Units 1-3	Temperature	31.00522	-88.01006	403,576	3,430,619	3	166
	Discharge Canal Units 4-5	Temperature	31.00526	-88.00982	403,599	3,430,623	3	167

[1] It is the USGS streamflow gaging station: 02470629 Mobile River at river mile 31 at Bucks, AL. Further information can be found at the web site http://waterdata.usgs.gov/al/nwis/uv/?site_no=02470629&PARAmeter_cd=00065,00060.

[2] Each horizontal grid in EFDC model is organized or labeled by I and J index.

Table 2.2 Location information of APC's macroinvertebrate plate monitoring stations used for temperature calibration of the Barry EFDC model.

Station	Latitude (degrees)	Longitude (degrees)	UTM Easting (m)	UTM Northing (m)	I Index	J Index
Station 3	31.011350	-87.997210	404809.30	3431286.61	73	282
Station 4	31.006780	-87.988150	405669.68	3430772.39	74	256
Station 5	30.998030	-87.985440	405919.80	3429800.30	73	229
Station 6	30.989370	-87.986360	405823.45	3428841.27	69	203
Station 7	30.985700	-87.990010	405471.32	3428437.61	73	182
Station 8	30.985130	-87.996190	404880.64	3428379.70	69	154
Station 9	30.982300	-87.995020	404989.56	3428065.04	74	144
Station 10	30.975380	-87.995700	404917.76	3427298.66	69	127
Station 11	30.970800	-87.993960	405079.40	3426789.56	69	119
Station 13	30.964910	-87.986370	405798.47	3426130.31	70	105
Station 14	30.959890	-87.980080	406394.32	3425568.63	73	94
Station 16	30.949720	-87.975210	406849.60	3424437.39	73	77
Station 17	30.931170	-87.961430	408148.16	3422370.02	69	38
Station 18	30.916220	-87.965720	407723.93	3420716.64	69	7

Figure 2.9 Satellite image of the Mobile River near Plant Barry including APC's monitoring stations (BAUS, BAIC, BADC, BAMZ, and BADS, see Table 2.1).

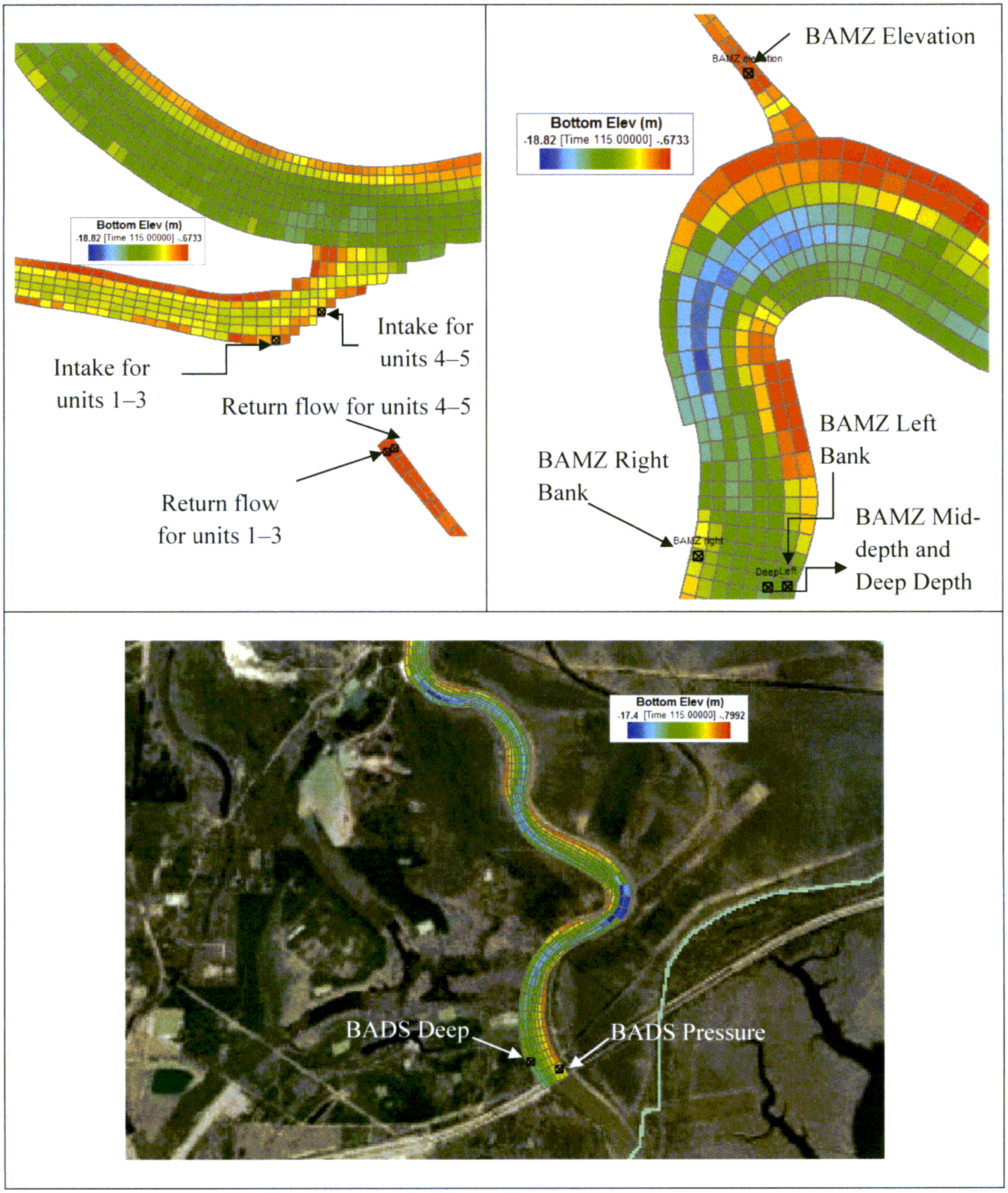


Figure 2.10 Zoomed view of APC's monitoring stations in the intake canal, discharge canal, mixing zone (BAMZ), and downstream (BADS) of Plant Barry with corresponding model grids for the Barry EFDC model.

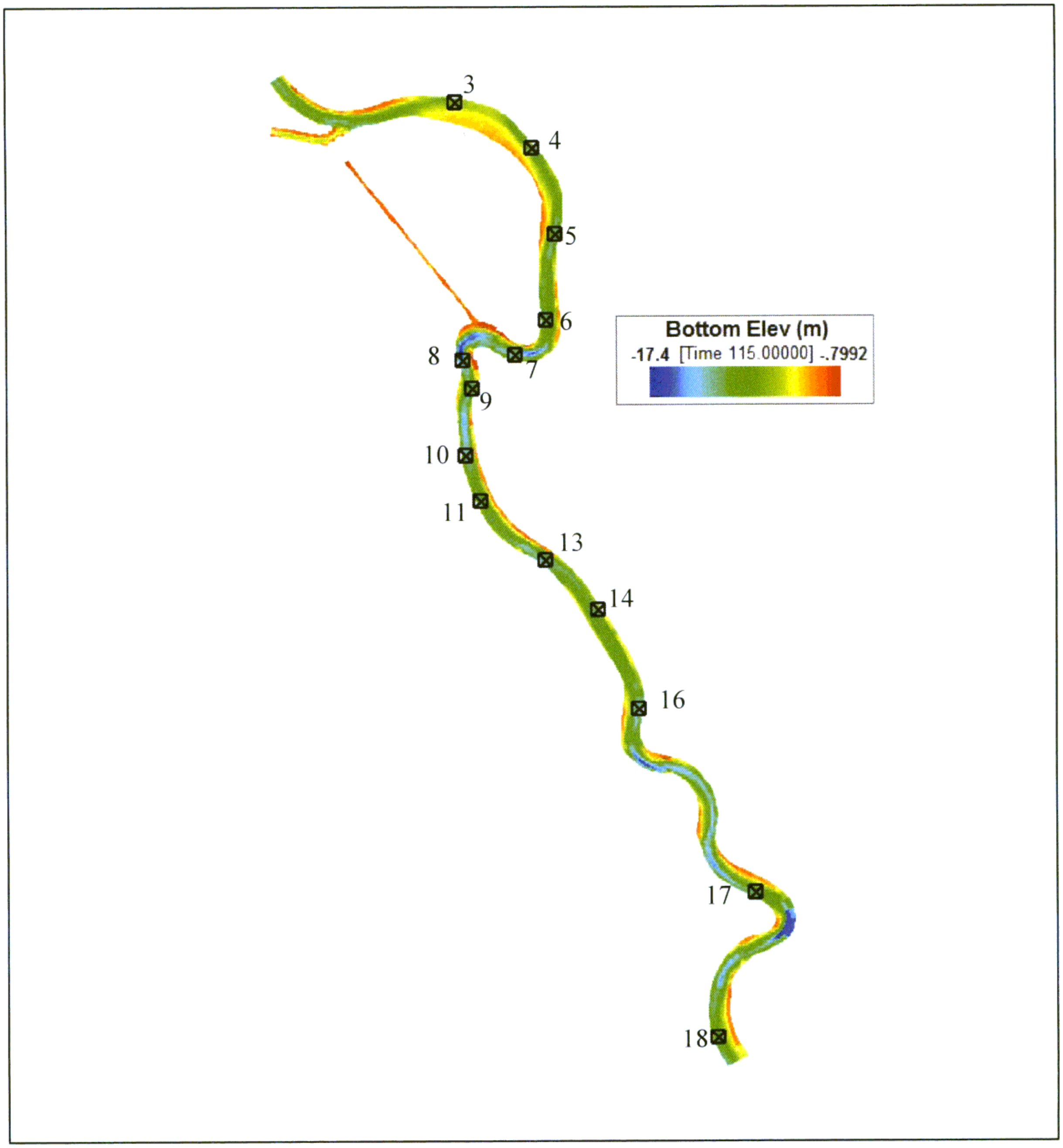


Figure 2.11 APC's macroinvertebrate plate monitoring stations 3 – 18 overlaid on EFDC model simulation domain with bottom elevation changes for the Barry EFDC model.

2.3 Model Input Data

The Barry EFDC model was run from April 26 to August 29, 2011 (Julian day 115 to 240). The model input data for the Barry EFDC model include several boundary conditions, e.g., meteorological data as atmospheric boundary for heat exchange through the water surface, flow and water temperature data at the upstream boundary, and water surface elevation and water temperature data at the downstream boundary. These input data are described and discussed below. A brief summary of input data file information is in Appendix B.

2.3.1 Meteorological Data

The meteorological parameters that are required to run the EFDC model successfully are as follows: air temperature (°C), atmospheric pressure (millibars), precipitation (m), relative humidity, wind speed (m/s), wind direction, solar radiation (W/m^2), cloud cover, and evaporation. The meteorological data are typically obtained from regional airports, weather stations managed by the Agricultural Weather Information Service (AWIS), and any local weather station near a power generating plant. The regional airport closest to Plant Barry is the Mobile Regional Airport (Figure 2.12).

The meteorological data for the Barry EFDC model were obtained from the Mobile Regional Airport. Hourly data for the airport were available from the Southeast Regional Climate Center (SERCC). The data obtained from the airport didn't include the solar radiation data that are required to run the EFDC model. Solar radiation data for the Mobile Regional Airport were purchased from AWIS. Therefore, a complete set of meteorological data for the Mobile Regional Airport were obtained. The second set of weather data was available from Fairhope Mesonet station and had free downloadable solar radiation and other meteorological data from AWIS. When we developed a preliminary working model for Plant Barry in 2010, meteorological data from Fairhope Mesonet station were used. For the most recent model runs and results reported here, meteorological data from the Mobile Regional Airport were used for both 2010 and 2011 simulations. The third data set only includes air temperature, rainfall, and relative humidity that were provided by APC and measured from a weather station near Plant Barry (Figure 2.12). The third data set is an incomplete meteorological data set that cannot be directly used for EFDC model runs and was only used for data comparison (Figure 2.13).

Figure 2.13 shows a time-series plot of hourly air temperature (°C) at the Mobile Regional Airport and Plant Barry from April 26 to August 29, 2011 (Julian day 115 to 240). Observed air temperatures at the airport matched well with air temperatures at Plant Barry measured by APC. Observed air temperatures at the Mobile Regional Airport were used for Barry EFDC model runs. Air temperatures measured at Plant Barry from April 26 to August 29, 2011, ranged from 8.72 to 38.11 °C (average 27.7 °C and standard deviation of 5.15 °C). Air temperatures measured at the Mobile Regional Airport from April 26 to August 29, 2011, ranged from 5 °C to 39.44 °C (average 25.92 °C and standard deviation of 5.41 °C). Air temperature of Mobile Regional Airport was eventually used because the air temperatures at Plant Barry were around 1 °C higher than air temperatures at the Mobile Regional Airport. The higher temperatures at Plant Barry might be affected by local environment and may not be representative for the EFDC model to compute heat exchange between the atmosphere and the water surface in the whole simulation domain (~ 11 miles of the Mobile River).

Figure 2.14 shows a time-series plot of hourly solar radiation (W/m^2) at the Mobile Regional Airport. Solar radiation at the Airport from April 26 to August 29, 2011, ranged from 0 (during night) to 1,088 W/m^2. The average solar radiation during the simulation period in 2011 was 232.6 W/m^2 with a standard deviation of 282.3 W/m^2.

We have obtained hourly air temperature and solar radiation data at Fairhope Mesonet station from January 1 to December 31, 2011, and at the Tuscaloosa Regional Airport from January 1 to October 24, 2011, for future model sensitivity analysis. Hourly weather data allows the EFDC model to compute heat exchange through the water surface (heating or warming during day and cooling during night) at a short time interval.

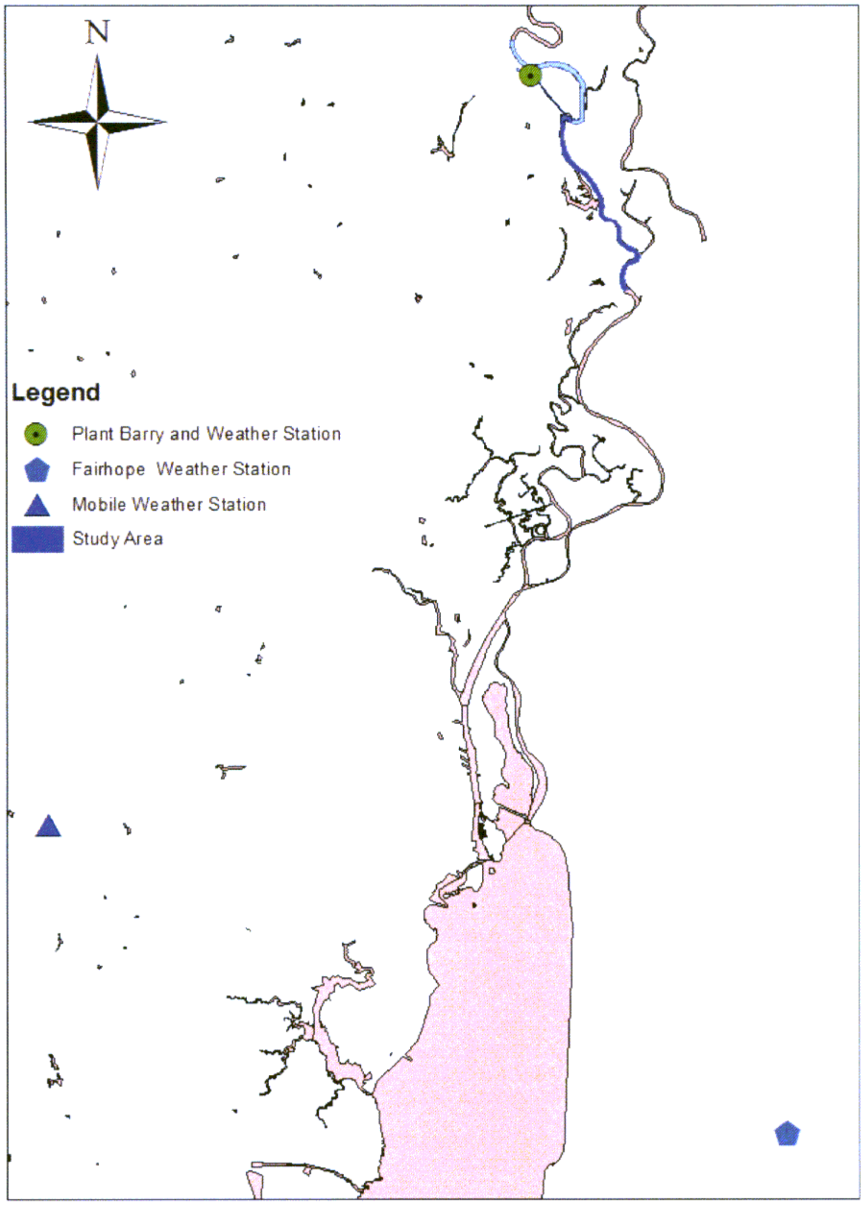


Figure 2.12 Locations of weather stations with available meteorological data in the study area.

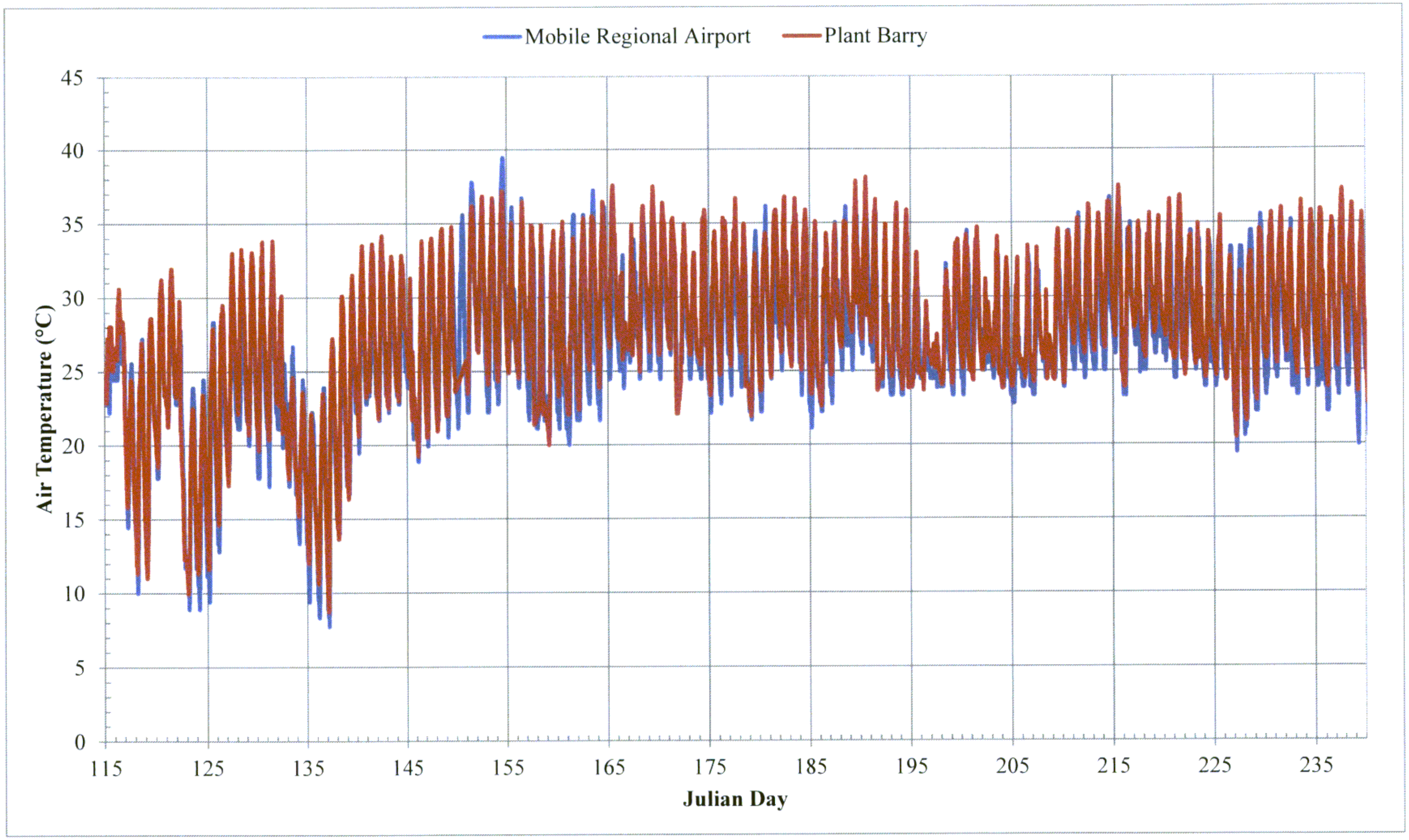


Figure 2.13 Time-series plot of observed air temperature (°C) at the Mobile Regional Airport and Plant Barry from April 26 to August 29, 2012 (Julian day 115 to 240).

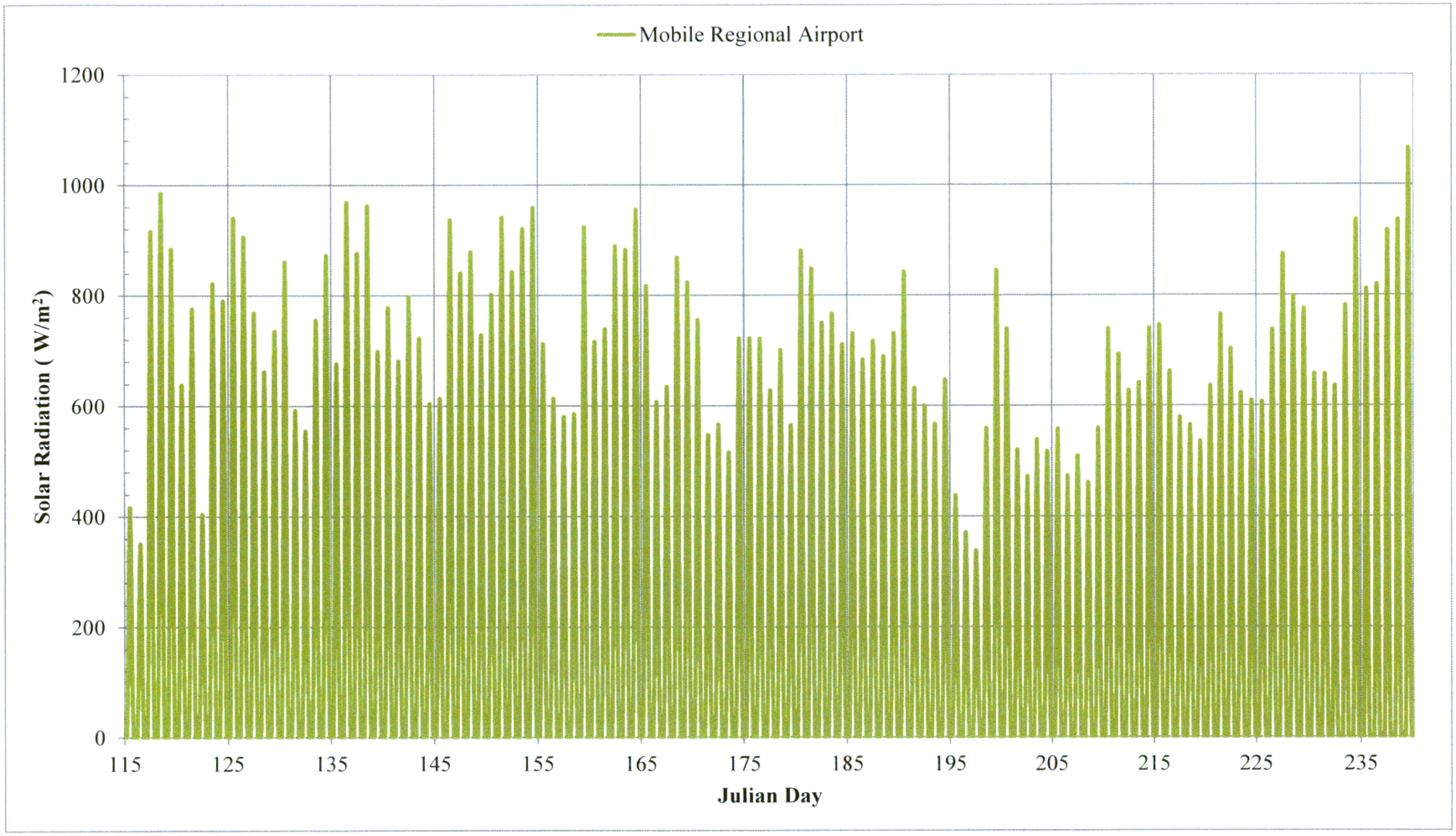


Figure 2.14 Time-series plot of solar radiation (W/m^2) at the Mobile Regional Airport from April 26 to August 29, 2012 (Julian day 115 to 240).

2.3.2 Flow and Temperature Input Data

The Barry EFDC model was run with the upstream boundary at the USGS gaging station at Bucks and the downstream boundary at the intersection of the Mobile River and I-65 bridge. Flow rates or discharges (m^3/s) and water temperatures at the USGS Bucks station were used as the upstream boundary. Observed data were available from the USGS gaging station 02470629, Mobile River at river mile 31.0 at Bucks, AL. For the downstream boundary, water surface elevations and water temperatures were provided as boundary conditions, and these data were collected by APC and available at the monitoring stations near the intersection of the Mobile River and I-65 bridge (Figure 2.10). Both upstream and downstream boundaries had time-dependent or unsteady time-series data for the Barry EFDC model.

Figure 2.15 shows a time-series plot of discharge (m^3/s) used as the upstream boundary condition as part of model input data. Flow data for the USGS gaging station at Bucks was missing from June 30, 2011, at 4:30 PM (Julian day 180.687) to July 7, 2011, at 11:30 AM (Julian day 187.4792). It is essential to provide the EFDC model with accurate boundary conditions. If the data in the missing period were not provided through the input data file, the EFDC model fills in the missing data by linear interpolation using the data just before and just after the missing period. Because the study area, the Mobile River from the USGS gaging station at Bucks to the intersection of the Mobile River and I-65 bridge, is typically affected by tides and waves from the downstream estuary (Mobile Bay), especially during summer periods when there are relatively low freshwater inflows from upstream watersheds (Figure 2.15), a linear interpolation scheme used by EFDC model would be a misrepresentation of real flow conditions.

A harmonic analysis (Boon and Kiley 1978) of the discharge at the USGS Bucks station was performed. The harmonic constituents of the tides were calculated for the period of Julian days 145 to 230 days (May 26 to August 19, 2011). This time period was chosen because a strong tidal effect was found on observed data during the period (Figure 2.15). Time series of observed data at the USGS gaging station at Bucks were affected by high inflow from the upstream watersheds from Julian day 115 (April 26, 2011) to Julian day 145 (May 26, 2011). Therefore, the period for harmonic analysis was chosen when the effect from upstream was minimum.

Table 2.3 shows the harmonic constituents calculated for the discharge time-series data from Julian day 145 to 230 (May 26 to August 19, 2011). From the harmonic analysis, it was found that the lunar diurnal constituents K1 and O1 are the dominant tides in the Mobile River study reach. The harmonic constituents were then used to predict the discharge time series in the missing data period. Figure 2.16 shows a comparison of time-series plots of observed flow rates (discharges in m^3/s) at the USGS Bucks gaging station and predicted discharges using the harmonic constituents from harmonic analysis from Julian day 145 to 230. Figure 2.17 only shows the comparison of observed and predicted flow rates in June and July 2011. From Figure 2.17 we can see that the time series of flow rates predicted by the harmonic constituents match well before and after the missing data period. Therefore, we can use predicted flow rates during the missing data period as the boundary condition to appropriately represent the hydrologic conditions at Bucks. Observed data and predicted flow rates for the missing data period were combined to create a continuous time-series data set (Figure 2.18) that was used as the upstream boundary at Bucks. Observed 15-minute flow rates (discharges) from the USGS gaging station at Bucks ranged from -489.88 m^3/s to 1,472.48 m^3/s (-17,300 to 52,000 cfs) in 2011 from April 26 to August 29, and the average discharge was 354.19 m^3/s (12,508 cfs).

Figure 2.19 shows a time-series plot of observed water temperatures (°C) at the upstream boundary, the USGS gaging station at Bucks. APC's thermistors measured water temperatures near the water surface and river bottom at the upstream boundary. Observed surface water temperatures ranged from 21.12 °C to 35.55 °C (70.1 °F to 96.0 °F) in 2011 from April 26 to August 29, and the average temperature was 29.7 °C (85.5 °F). Observed bottom water temperatures ranged from 21.2 °C to 32.55 °C (70.1 °F to 90.6 °F) with an average temperature of 29.1 °C (84.4 °F). Water temperatures observed near the surface and river bottom at Bucks display strong diurnal cycles and moderate temperature stratifications due to solar heating during the daytime periods.

Figure 2.20 shows a time-series plot of observed water surface elevation (m) as one of the downstream boundary conditions. The water surface elevation data were available in 5-minute intervals and measured through the BADS pressure station (Figure 2.10) operated and managed by APC. The BADS pressure station was located just slightly upstream of the intersection of the Mobile River and I-65 bridge (Figure 2.10). Observed water surface elevations at the BADS pressure station were directly used as the downstream boundary condition. Observed water surface elevations ranged from -0.28 m to 1.25 m (-0.92 ft. to 4.11 ft) above mean sea level from April 26 to August 29, 2011, and the average water surface elevation was 0.32 m (1.05 ft). A harmonic analysis on observed water surface elevations was conducted from Julian day 130 (May 11, 2011) to Julian day 240 (August 29, 2011).

Table 2.4 shows the harmonic constituents calculated for the water-surface elevation time-series data collected at the BADS pressure station (Figure 2.10) from Julian day 130 to 240 (May 26 to August 29, 2011). The harmonic analysis on the water-surface elevation time-series data (Table 2.4) indicates that the lunar diurnal constituents K1 and O1 were the dominant tides in the Mobile River study reach, which were the same dominant tides from the harmonic analysis of the discharge time-series data at the upstream boundary (Table 2.3). This means that changes and variations of discharges at the USGS Bucks gaging station were primarily controlled or affected by tides from the downstream during the summer period when freshwater inflow from upstream was relatively small in comparison to tidal influences. The harmonic constituents were then used to predict the water surface elevation time series during the missing data period for the 2010 EFDC model runs (Appendix D).

Figure 2.21 shows a time-series plot of observed surface and bottom temperatures (°C) as one of the downstream boundary conditions (at the intersection of the Mobile River and I-65 bridge). Surface temperatures were measured at the BADS right bank station (Figure 2.9), and the bottom temperatures were measured at the BADS deep depth station (Figure 2.9). The BADS right bank station and the BADS deep depth station are very close each other and are shown as one station on Figure 2.10 because both stations are located within the same horizontal grid.

There are some missing data of bottom temperatures during the simulation period from Julian day 213.3 to 240 (7:45 AM on August 2 to 12:00 AM or midnight on August 29, 2011). To accurately simulate temperature dynamics in the simulation domain, the input data of bottom temperatures at the downstream boundary should be specified or estimated as accurately as possible.

An Excel VBA program was developed to estimate bottom temperatures in the downstream boundary. From a data analysis of surface and bottom temperatures, it was found that the surface and bottom temperatures were almost the same during the nighttime periods. Therefore, estimated bottom temperatures from 7:15 PM in one day to 9:30 AM in the next day were assumed to be equal to observed surface temperatures. Differences or stratifications of the surface and bottom temperatures started to develop from 9:30 AM and ended at about 7:15 PM as data indicate (Figure 2.21). A linear interpolation was used between 9:30 AM and 7:15 PM of each day using estimated bottom temperatures at 9:30 AM and 7:15 PM. The minimum difference between the surface and bottom temperatures was assumed to be 0.2 °C during the daytime period. Figure 2.22 (a) shows a time-series plot of water temperatures observed at the surface layer and bottom layer and estimated for the bottom layer from Julian days 152 to 156 (June 2 to June 6). Figure 2.22 (a) shows that estimated temperatures at the bottom layer match reasonably well with observed temperatures at the bottom layer, to verify the estimation method proposed and used. Figure 2.22 (b) shows estimated bottom temperatures using observed surface temperature (°C) from Julian days 225 to 235 (August 14 to August 24) during the missing data period. Figure 2.23 shows a time-series plot of water temperatures as one of the downstream boundary conditions showing observed data at the surface layer and combined observed data and estimated temperatures at the bottom layer from Julian days 115 to 240 (simulation period from April 26 to August 29, 2011).

Table 2.3 Harmonic constituents calculated for the discharge time-series data measured at the upstream boundary.

Symbol	Description of constituents	Frequency (cpd) [1]	Amplitude (m^3/s)	Phase (degrees)
Q1	Larger Lunar elliptic diurnal constituent	0.89	32.281	20.360
O1	Lunar diurnal constituent	0.93	**169.051**	108.540
P1	Solar diurnal constituent	1.00	23.786	185.960
K1	Lunar diurnal constituent	1.00	**163.954**	159.960
2N2	Lunar elliptical semidiurnal second-order constituent	1.86	22.087	95.550
N2	Larger lunar elliptic semidiurnal constituent	1.90	4.248	114.110
M2	Principal lunar semidiurnal constituent	1.93	37.378	200.350
S2	Principal solar semidiurnal constituent	2.00	35.679	341.780
K2	Lunisolar semidiurnal constituent	2.01	33.980	125.390

[1] cpd stands for number of cycles per day.

Table 2.4 Harmonic constituents calculated for the water-surface elevation time-series data measured at the downstream boundary.

Symbol	Name	Frequency (cpd)	Amplitude (m)	Phase (degrees)
Q1	Larger Lunar elliptic diurnal constituent	0.89	0.031	237.46
O1	Lunar diurnal constituent	0.93	**0.157**	320.87
P1	Solar diurnal constituent	1.00	0.036	47.78
K1	Lunar diurnal constituent	1.00	**0.159**	11.95
2N2	Lunar elliptical semidiurnal second-order constituent	1.86	0.011	291.11
N2	Larger lunar elliptic semidiurnal constituent	1.90	0.006	49.35
M2	Principal lunar semidiurnal constituent	1.93	0.025	58.78
S2	Principal solar semidiurnal constituent	2.00	0.022	179.64
K2	Lunisolar semidiurnal constituent	2.01	0.017	292.76

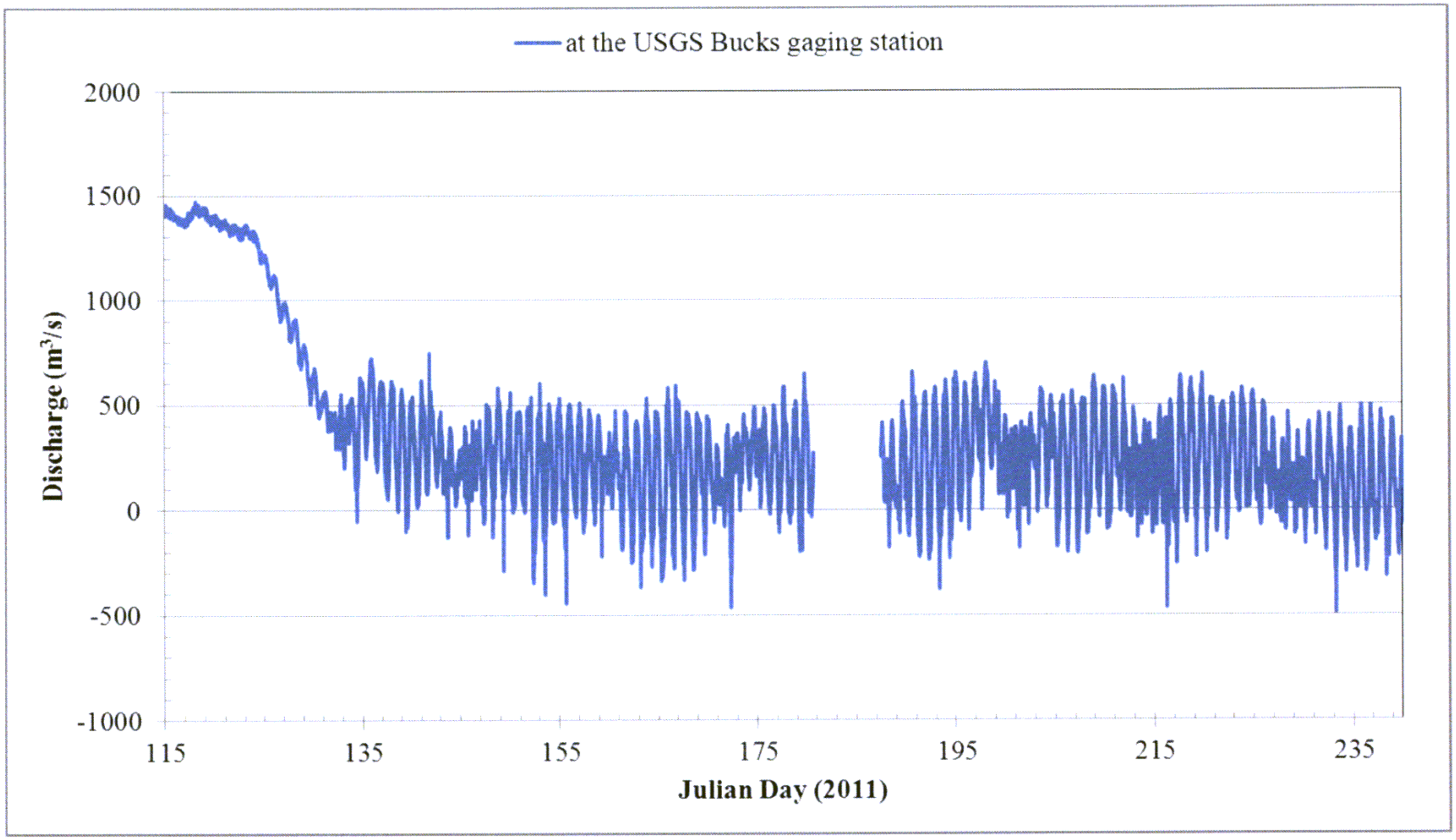


Figure 2.15 Time-series plot of flow rates (discharge in m^3/s) at the USGS Bucks gaging station from April 26 to August 29, 2012 (Julian day 115 to 240).

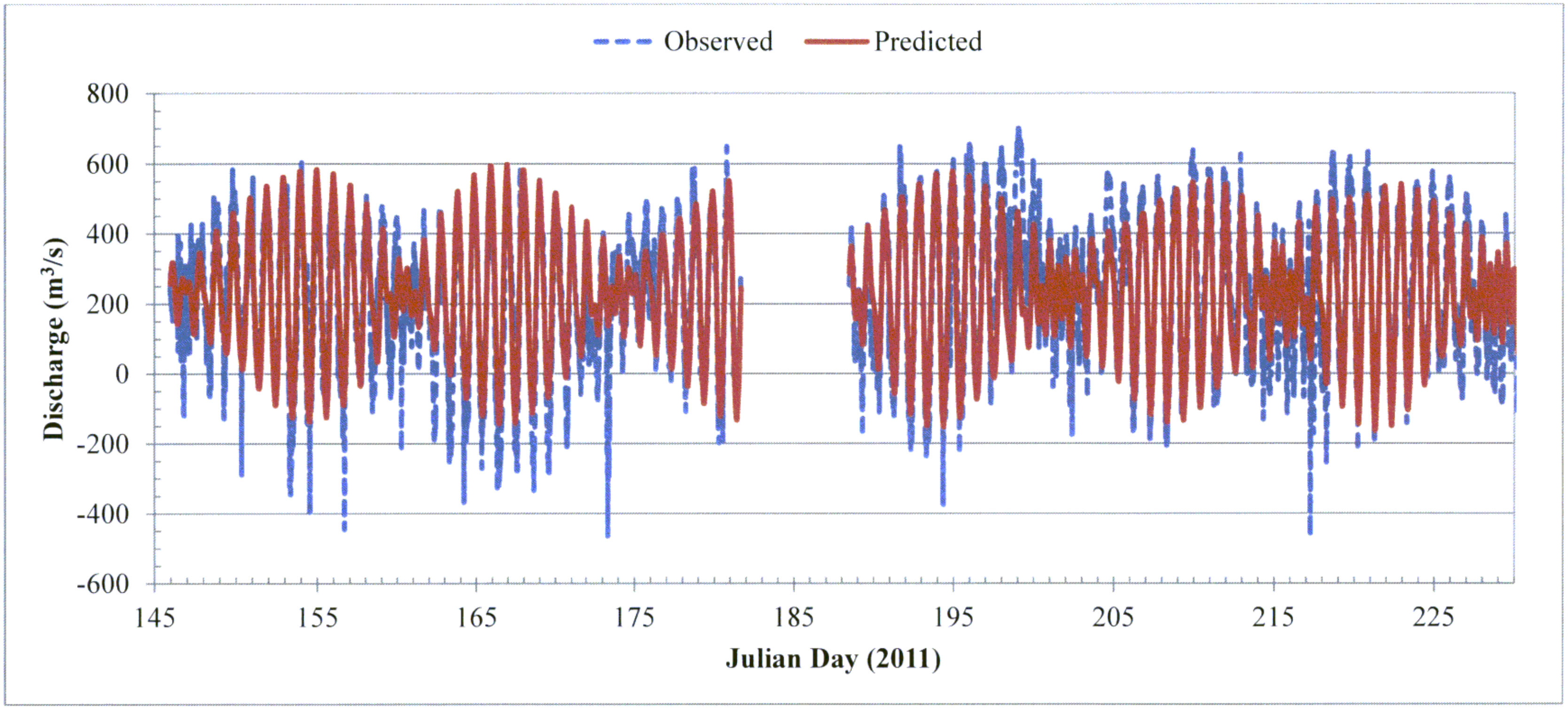


Figure 2.16 Time-series plot of observed flow rates (discharges in m^3/s) at the USGS Bucks gaging station and predicted discharges using the harmonic constituents from harmonic analysis from Julian day 145 to 230 (May 26 to August 19, 2011).

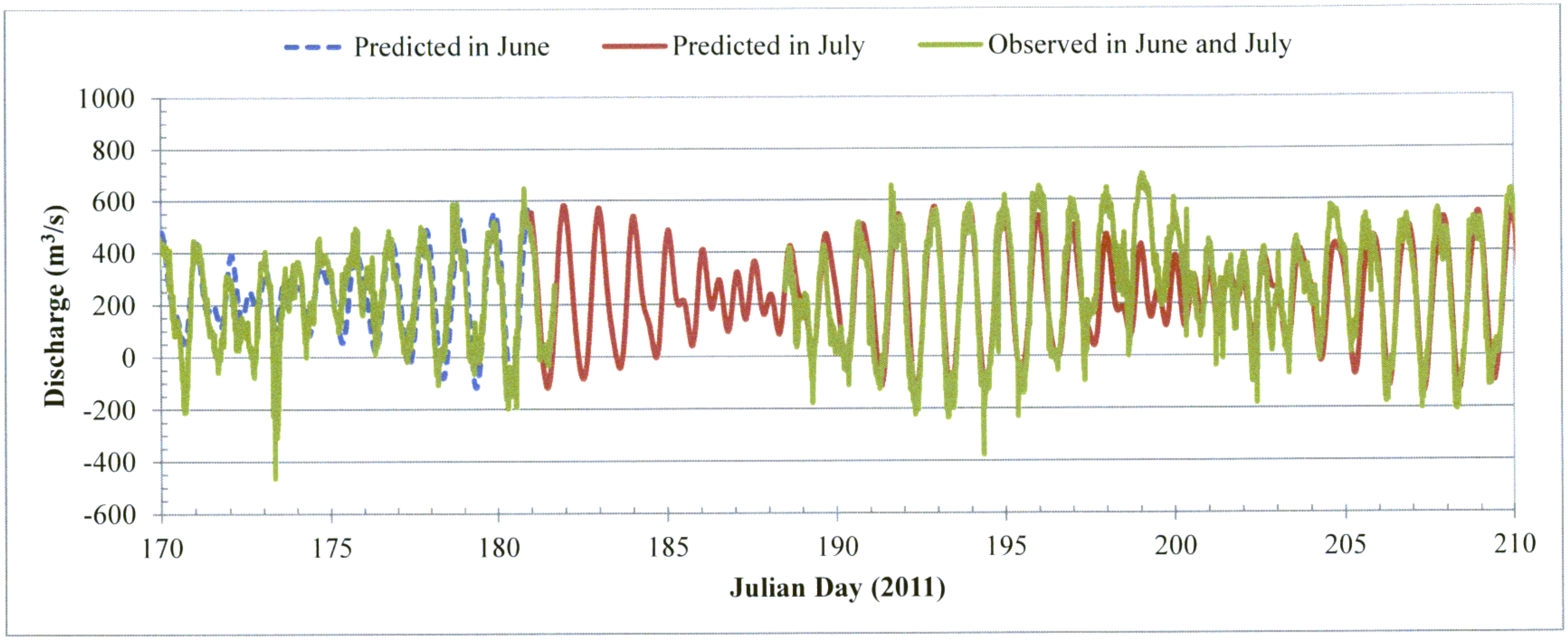


Figure 2.17 Time-series plot of observed and predicted flow rates (m^3/s) in June and July 2011 at the USGS Bucks gaging station.

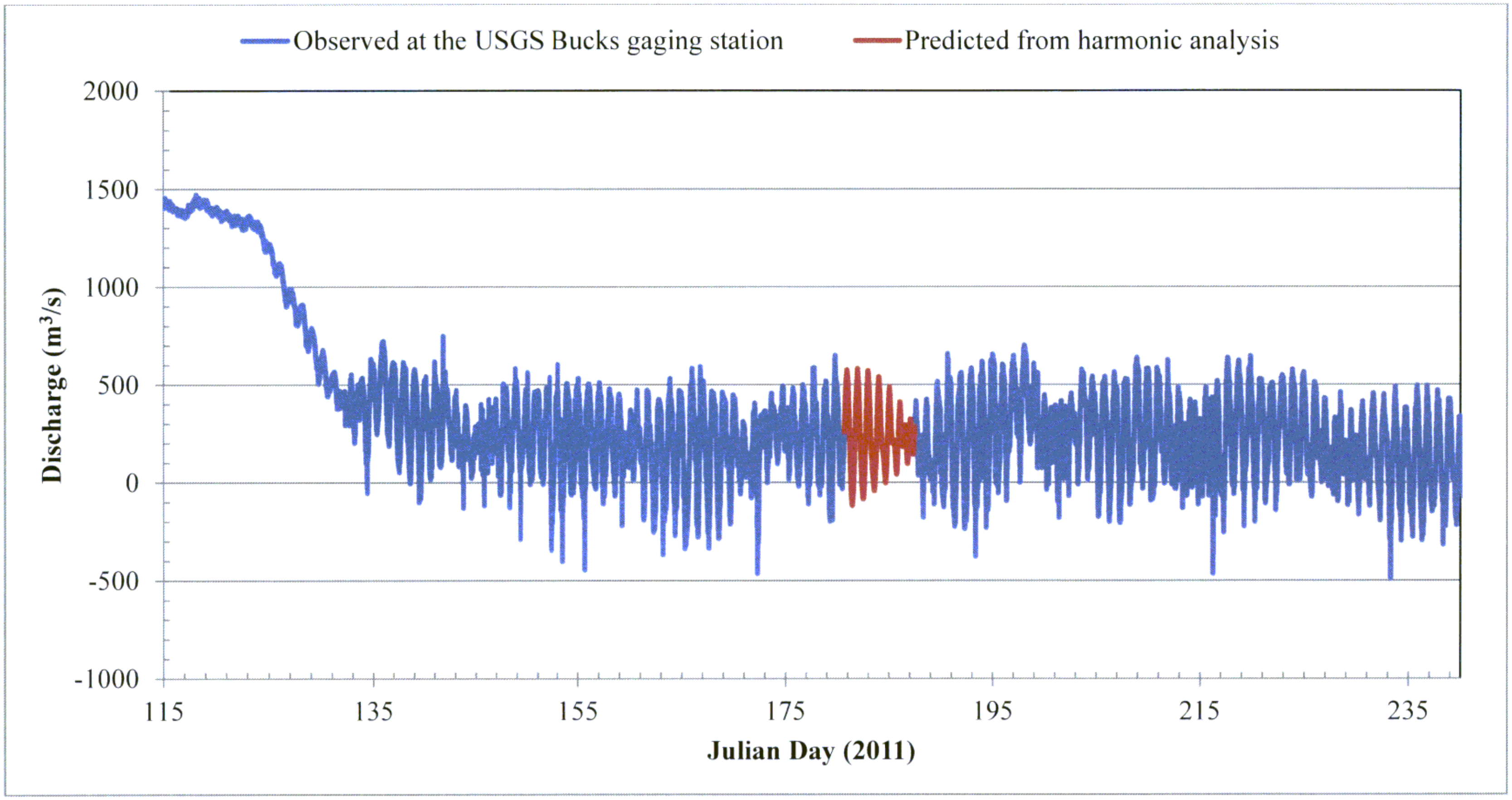


Figure 2.18 Time-series plot of flow rates (m^3/s) as one of the upstream boundary conditions for the Barry EFDC model, which include observed data and predicted flow rates using harmonic analysis.

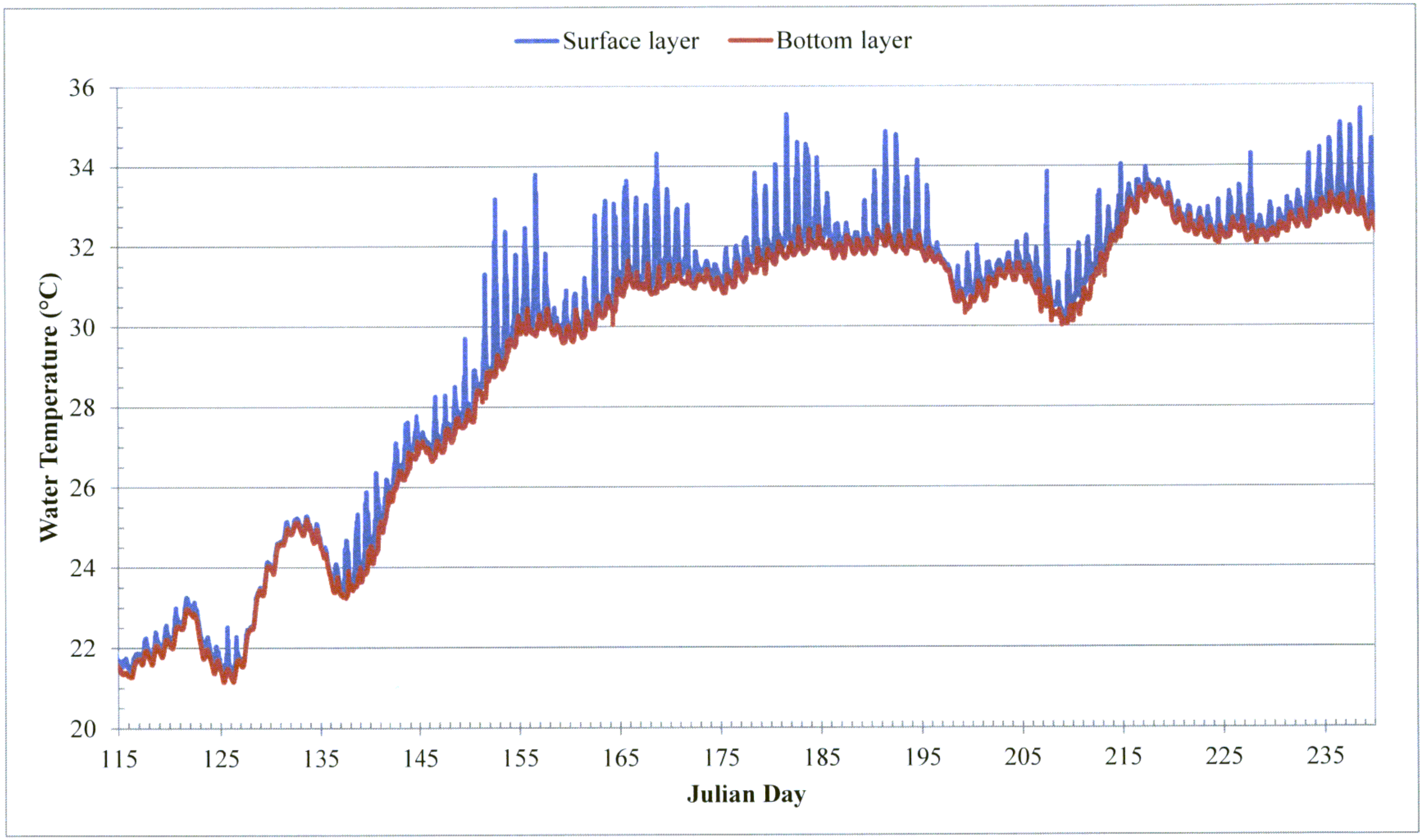


Figure 2.19 Time-series plot of observed surface and bottom water temperatures (°C) for the upstream boundary at the USGS Bucks gaging station from April 26 to August 29, 2012 (Julian day 115 to 240).

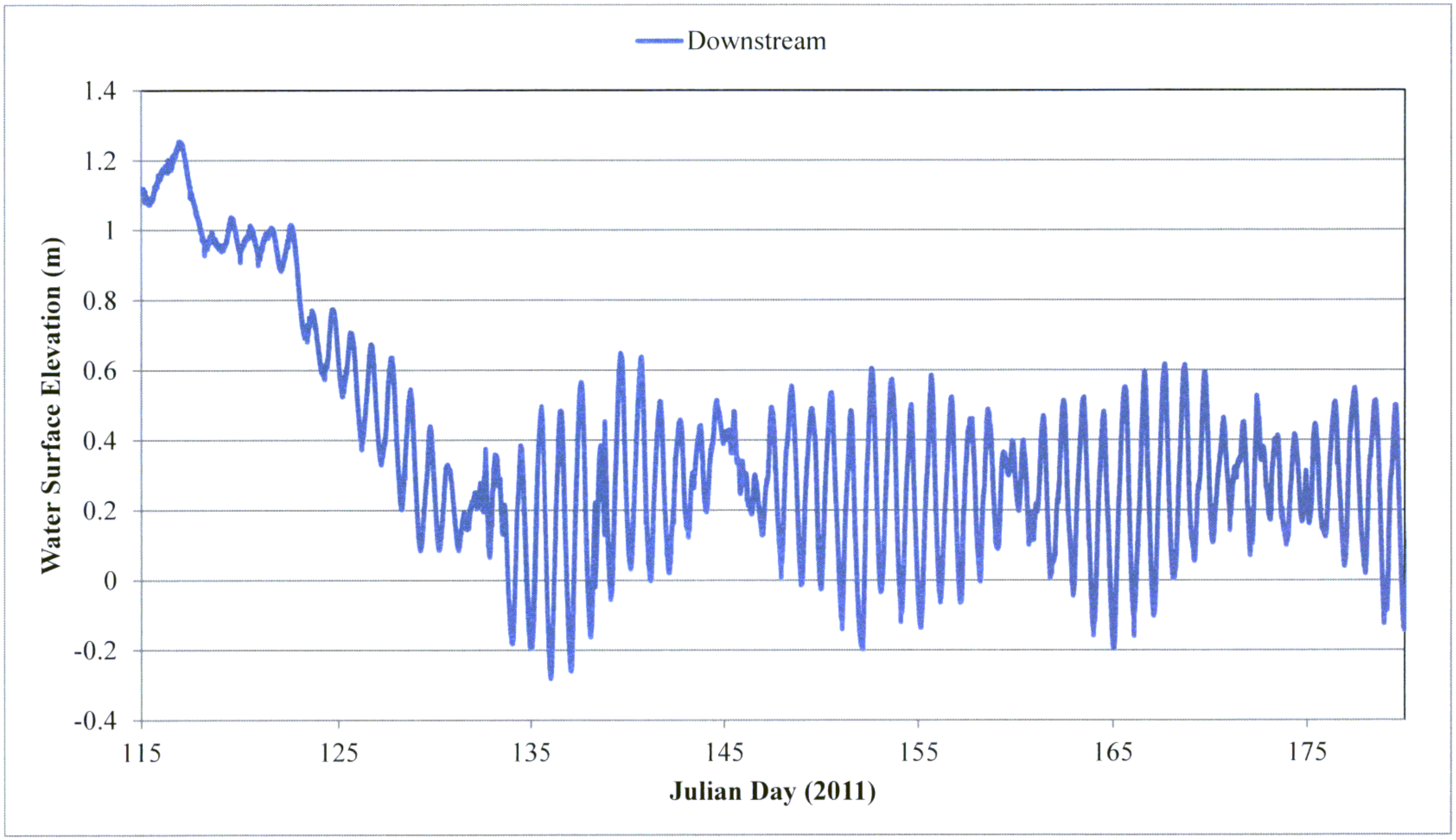


Figure 2.20 Time-series plot of observed water surface elevation (m) at the downstream boundary location (Intersection at I-65) from April 26 to August 29, 2012 (Julian day 115 to 240).

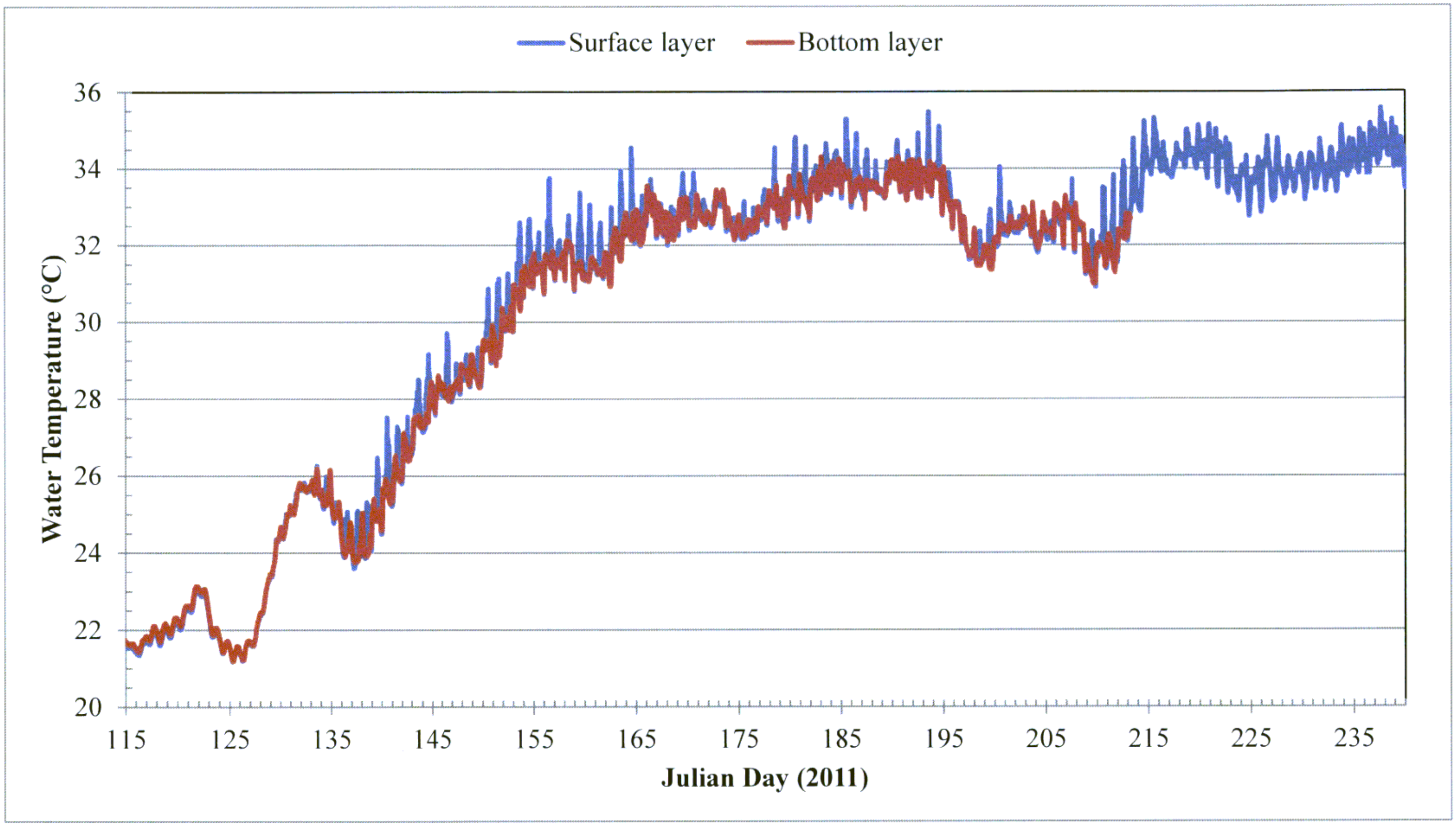


Figure 2.21 Time-series plot of observed surface and bottom water temperatures (°C) at the downstream boundary location from April 26 to August 29, 2012 (Julian day 115 to 240).

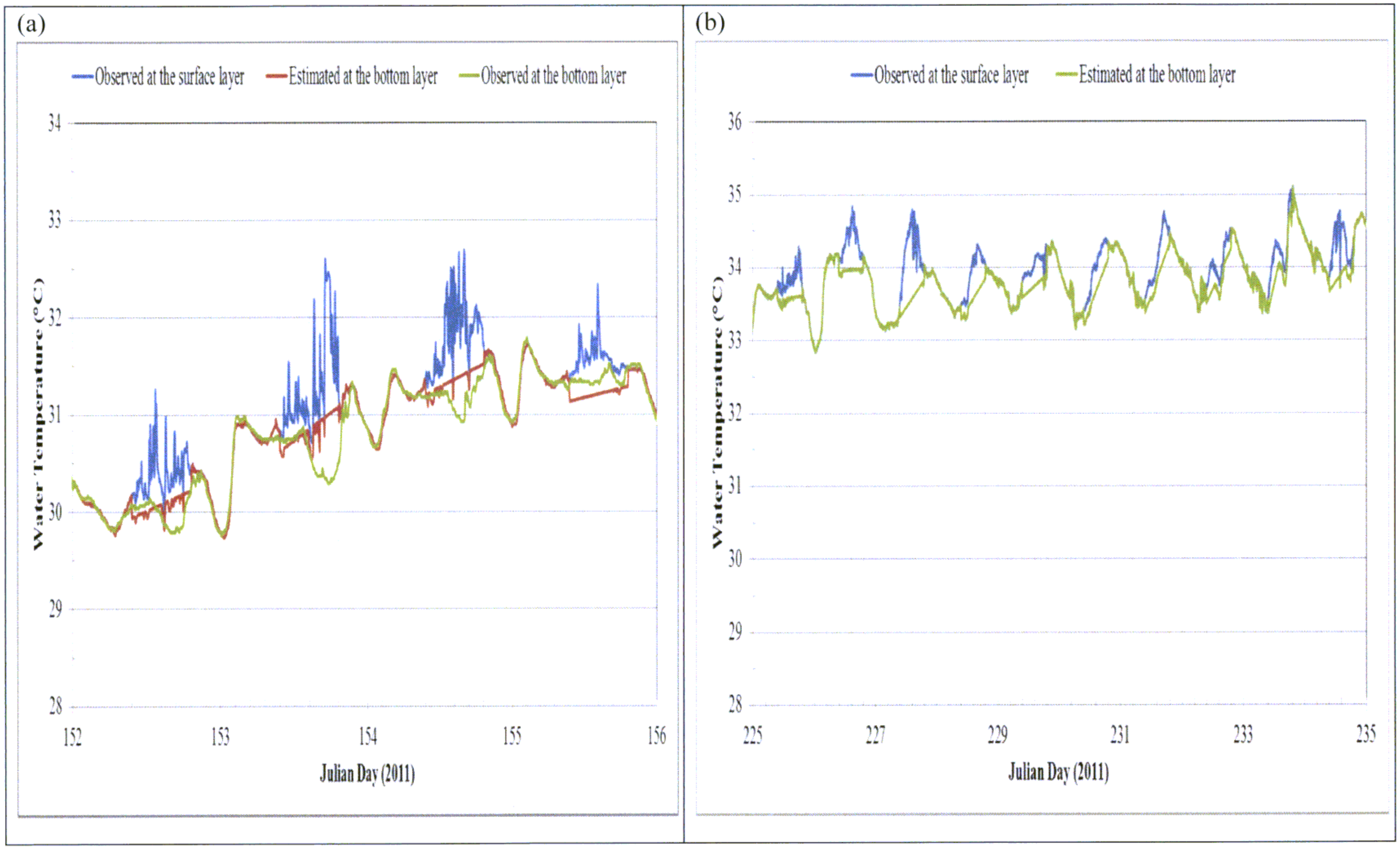


Figure 2.22 Time-series plots of water temperatures at the downstream boundary showing observed at the surface layer and observed and estimated at the bottom layer for (a) Julian days 151 to 155 (validation of the estimation method) and (b) Julian days 225 to 235 (prediction during the missing data period).

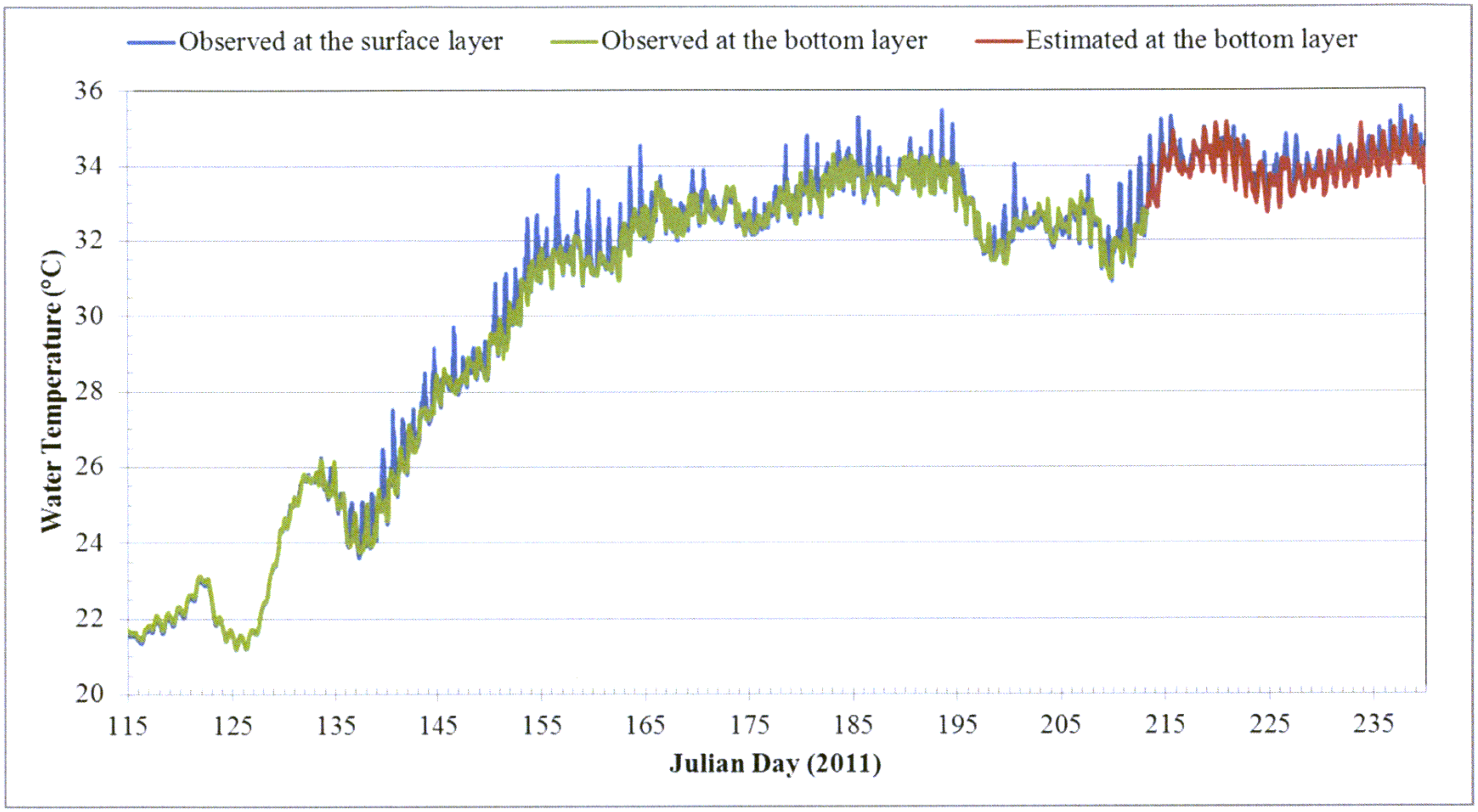


Figure 2.23 Time-series plot of water temperatures as the downstream boundary condition showing observed at the surface layer and observed and estimated at the bottom layer.

2.3.3 Power Plant Operational Data

Operational data for Plant Barry were available from April 1 to September 2, 2011. The inflows (withdrawals) to Plant Barry were recorded from April 1, 2011, and temperatures (in °F) of return flows at discharge points were recorded from April 18, 2011. There are five power generating units in Plant Barry (units 1, 2, 3, 4, and 5). The cooling water for units 1–3 was withdrawn through one intake structure and for units 4–5 through a separate intake structure in the intake canal (Figure 2.10). The amount of cooling water withdrawn from the intake canal through each intake structure is the same as the amount of heated water discharged into the discharge canal (or return flow). It means (assumed) there were no water losses through the plant. The total flow rates of the withdrawal and return flow for units 1–3 were calculated as the summation of flow rates for units 1, 2, and 3, and were used as input data in the Barry EFDC model. The same computation was performed for units 4–5. The cooling water withdrawn from the intake canal and heated water discharged through the discharge canal back into the Mobile River were represented as withdrawal and return flow boundary conditions in the Barry EFDC model (Figure 2.7, labeled as "W" and "R" on Figure 2.10). Two withdrawal and return flow boundaries were used in the Barry EFDC model: one for units 1–3 and another for units 4–5. The flow rates provided by APC were in million gallons per day (MGD) and were converted into m^3/s for model input.

Figure 2.24 and Figure 2.25 show time-series plots of 5-minute withdrawal flow rates (m^3/s) and temperature increases (°C) through Plant Barry for units 1–3 and units 4–5 as part of model input data. Withdrawal flow rates of cooling water were measured by APC and varied with thermal power plant operations. In the Barry EFDC model cooling-water withdrawal from each intake structure was assumed to be withdrawn from the bottom three layers and then discharged into the surface layer in the discharge canal. The opening of the intake structure for both units 1–3 and 4–5 is from about -6.0 to -2.4 m above msl. The temperature increase at each time step was calculated as the difference of measured water temperatures between the discharge point and the intake (withdrawal) structure. Water temperatures near each intake structure and discharge point were recorded by APC from April 18 to September 21, 2011. During the simulation period, recorded withdrawal flow rates (discharges) for units 1–3 ranged from 2.5 to 20.5 m^3/s (57 to 467.9 MGD) from April 26 to August 29, 2011. Computed or observed temperature increases through units 1–3 of Plant Barry ranged from 0.8 to 9.3 °C (33.4 to 48.6 °F). Observed withdrawal flow rates (discharges) for units 4–5 ranged from 5.6 to 29.3 m^3/s (127.9 to 669.0 MGD), and the average flow rate was 27.2 m^3/s (621.1 MGD) from April 26 to August 29, 2011. Computed or observed temperature increases through units 4–5 of Plant Barry ranged from 0.3 to 13.4 °C (32.6 to 56.2 °F).

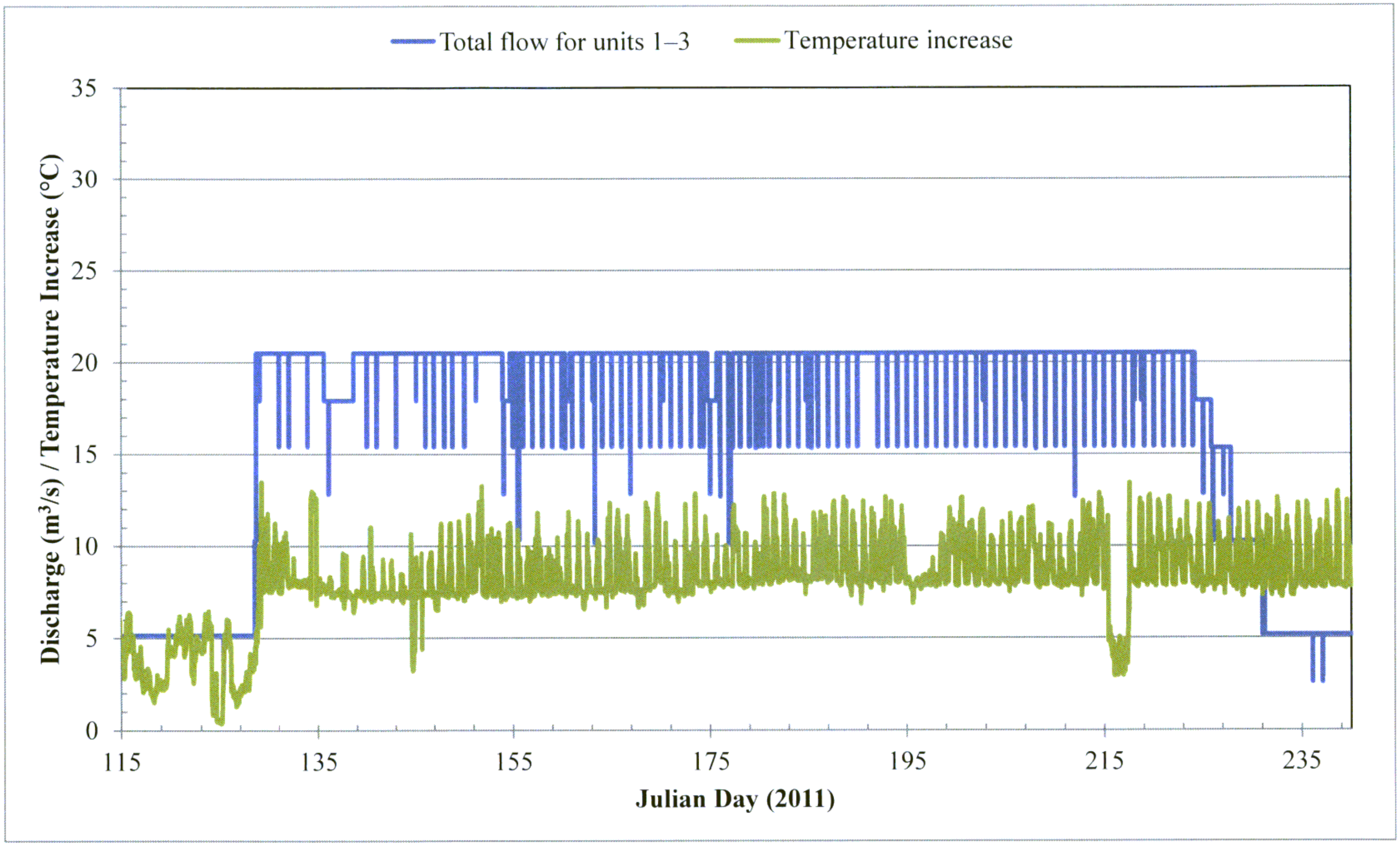


Figure 2.24 Time-series plot of withdrawal flow rate or discharge (m^3/s) from the intake canal to Plant Barry and temperature increase (^oC) between withdrawal and discharge of Plant Barry for units 1–3.

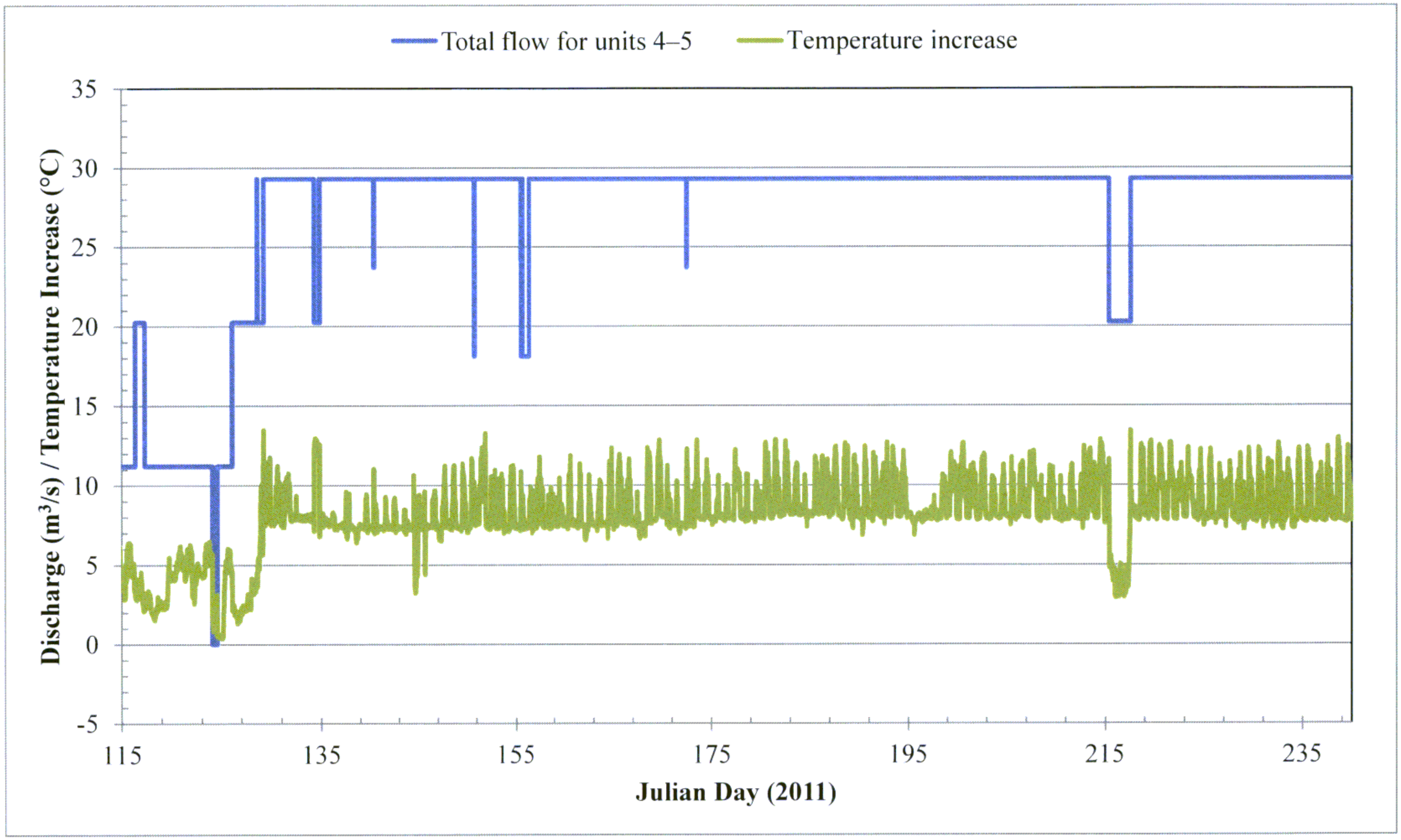


Figure 2.25 Time-series plot of withdrawal flow rate or discharge (m^3/s) from the intake canal to Plant Barry and temperature increase (°C) between withdrawal and discharge of Plant Barry for units 4–5.

Chapter 3 Simulation Results after Model Calibration

3.1 Model Parameters

With above model input data presented in Chapter 2 and assumed initial conditions, the Barry EFDC model was run from Julian day 115 to 240 in 2011 (April 26 to August 29, 2011). Meteorological data used for the Barry EFDC model were from the Mobile Regional Airport and were used for model runs in 2010 and 2011. Updated model results for 2010 are presented in Appendix D. The time step of the model simulation was specified as 5 seconds. Most of the parameters used in the EFDC model were kept unchanged in most of the EFDC applications. For example, the parameters related to the Mellor-Yamada turbulence model are treated as constant, and their values are the same as the ones in other hydrodynamic models, such as the Princeton Ocean Model (Blumberg and Mellor 1987) and the Estuary, Coastal and Ocean Model (ECOM) (HydroQual 1995). A parameter that is adjusted frequently in hydrodynamic modeling is the bottom roughness coefficient, which has a typical value of 0.02 m. In this study, the roughness coefficient for Mobile River was calibrated as 0.01 m. Another parameter that was adjusted in hydrodynamic models is the dimensionless horizontal momentum coefficient. The dimensionless horizontal momentum coefficient was calibrated to be 0.2 for the Barry EFDC model.

In the Barry EFDC model, the horizontal momentum diffusion (HMD) coefficient (also called horizontal eddy viscosity in other literature), A_H, is calculated by using the Smagorinsky formula (Smagorinsky 1963).

$$A_H = C\Delta x\Delta y \left[\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial v}{\partial y}\right)^2 + \frac{1}{2}\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right)^2\right]^{1/2} \quad (1)$$

where C = horizontal mixing constant, Δx or DX = model grid size in x direction, and Δy or DY = model grid size in y direction. The empirical parameter, C, has typical values about 0.10–0.20, and in the Barry EFDC model, C = 0.2 was used (Figure 3.1). The horizontal momentum diffusion coefficient, A_H, represents the horizontal turbulence mixing in a water body, and A_H computed from equation (1) is linked to (a) the dimensionality of the model (b) model grid resolution (Δx and Δy), and (c) the numerical scheme of the model. Finer model grid resolution leads to smaller A_H; and a highly diffusive numerical scheme to compute velocity derivatives in equation (1) also contributes to the diffusivity of the model and leads to smaller A_H needed in the EFDC model.

Vertical eddy viscosity is the parameter that is responsible for vertical mixing. Measured surface and bottom water temperatures (discussed in Appendix C) were relatively weakly stratified at all APC monitoring stations (except ones in the mixing zone) along the Mobile River near Plant Barry, therefore, there was relatively little vertical mixing along depth. Relatively strong stratifications at the monitoring station in the mixing zone were primarily due to the addition of heated water from the discharge canal. In the Barry EFDC model, the calibrated value for vertical eddy viscosity was 1×10^{-5} m^2/s, which is still much larger than the molecular diffusivity (1×10^{-9} m^2/s).

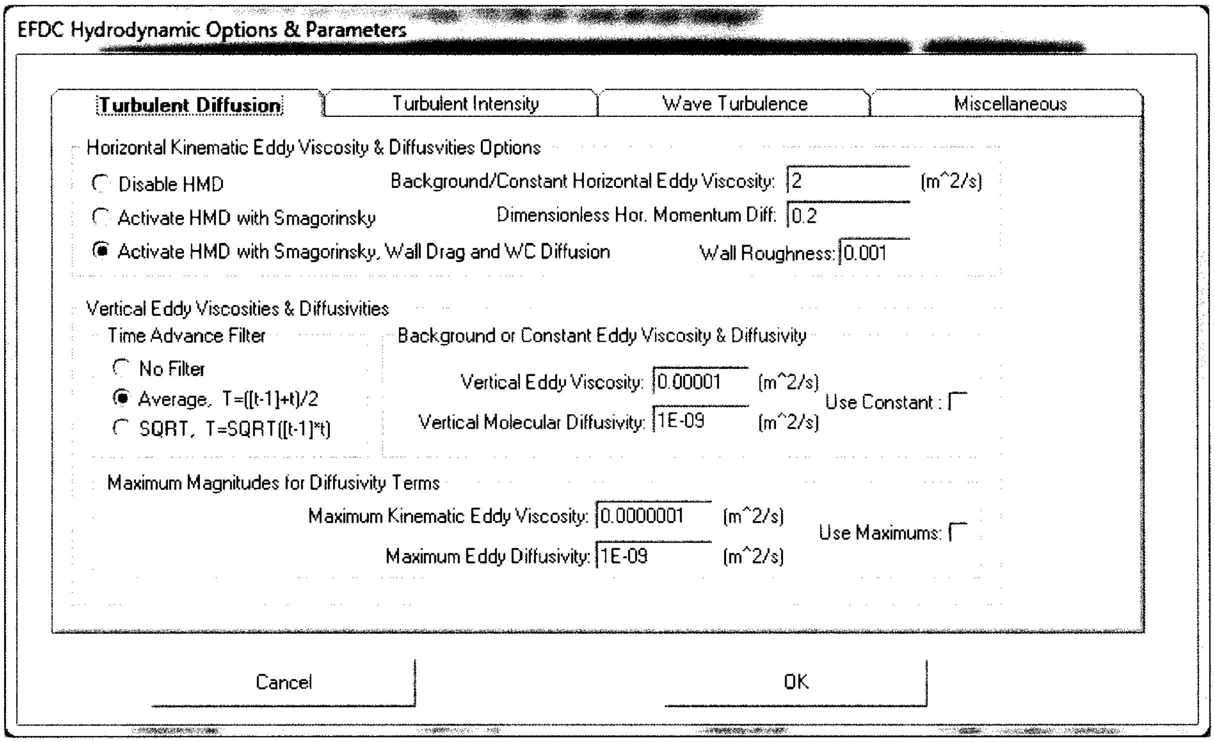


Figure 3.1 Hydrodynamic model options and parameter values for the Barry EFDC model calibration runs.

Figure 3.2 shows various model parameters that control heat exchange between water and the atmosphere or riverbed. Solar radiation absorption in the water column is the main contributor to the heat source term in a natural water body. The attenuation coefficient (m^{-1}) for solar radiation is a function of the water itself, total suspended solids (TSS), and chlorophyll-*a* concentration. For the current Barry EFDC model study, the EFDC model does not simulate TSS and phytoplankton or chlorophyll-*a* concentration. The light attenuation (extinction) coefficient in the Barry EFDC model was assumed to be 1.2 m^{-1}, which is equivalent to the assumed Secchi depth (Zs) of about 1.5 m [attenuation coefficient ~ 1.84/Zs, (Hondzo and Stefan 1993)].

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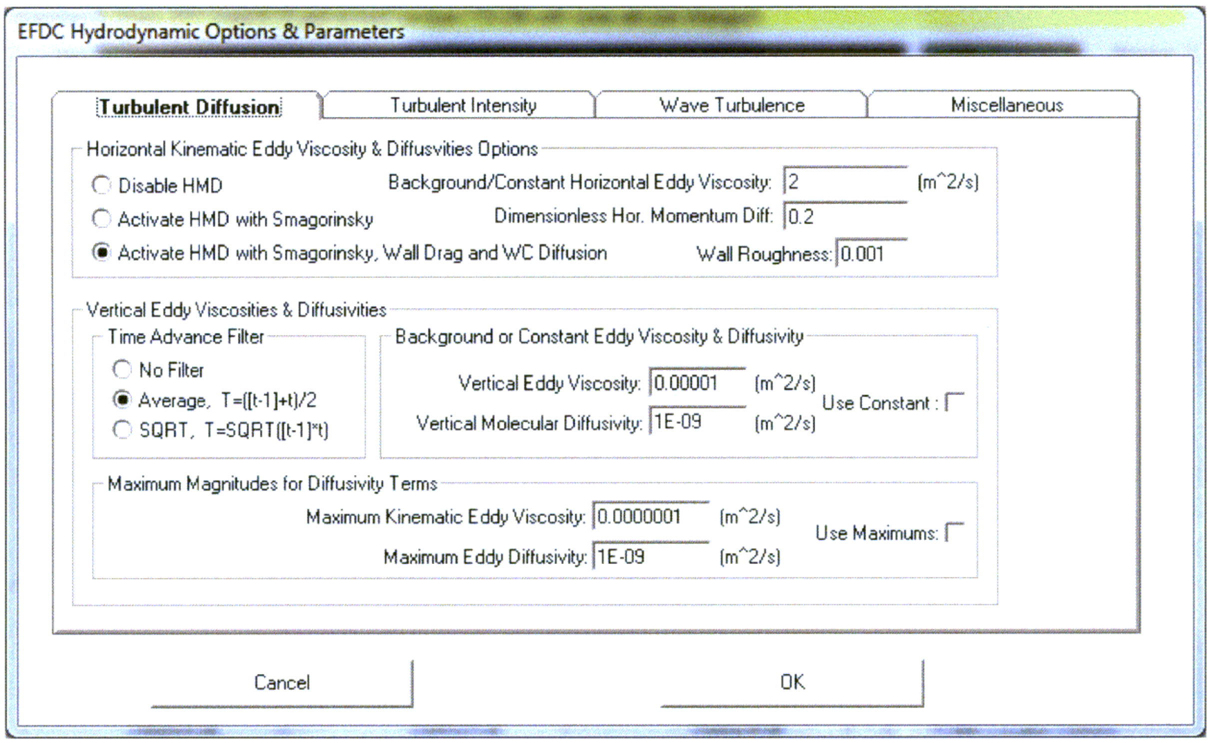

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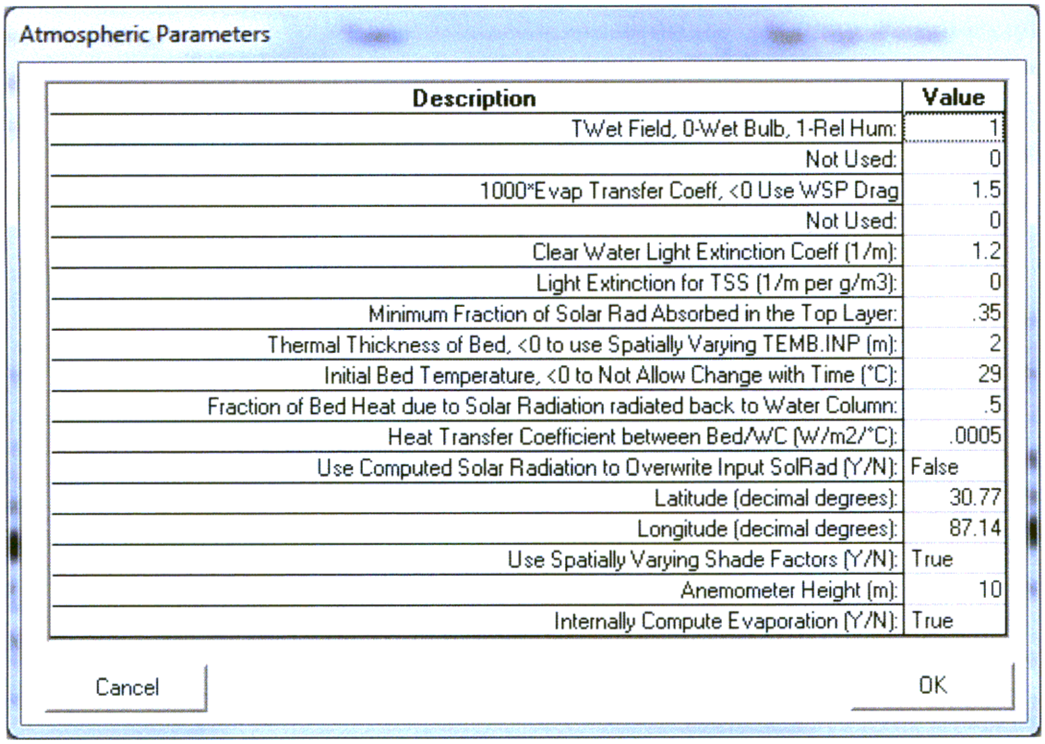


Atmospheric Parameters

Description	Value
TWet Field, 0-Wet Bulb, 1-Rel Hum:	1
Not Used:	0
1000*Evap Transfer Coeff, <0 Use WSP Drag	1.5
Not Used:	0
Clear Water Light Extinction Coeff (1/m):	1.2
Light Extinction for TSS (1/m per g/m3):	0
Minimum Fraction of Solar Rad Absorbed in the Top Layer:	.35
Thermal Thickness of Bed, <0 to use Spatially Varying TEMB.INP (m):	2
Initial Bed Temperature, <0 to Not Allow Change with Time (°C):	29
Fraction of Bed Heat due to Solar Radiation radiated back to Water Column:	.5
Heat Transfer Coefficient between Bed/WC (W/m2/°C):	.0005
Use Computed Solar Radiation to Overwrite Input SolRad (Y/N):	False
Latitude (decimal degrees):	30.77
Longitude (decimal degrees):	87.14
Use Spatially Varying Shade Factors (Y/N):	True
Anemometer Height (m):	10
Internally Compute Evaporation (Y/N):	True

Figure 3.2 Heat transfer parameters and values used for the Barry EFDC model calibration runs.

For all model runs, the Barry EFDC model was run for freshwater, i.e., we did not activate one of the EFDC model options to simulate salinity in the Mobile River. The data analysis on conductivity and water temperature measured in 2010 and 2011 was performed. Salinity was calculated using theoretical equations (Lewis 1980) with measured conductivity and water temperature data as input variables. Computed salinity values were almost 0.0 ppt in the simulation domain based on conductivity data that APC collected in 2010 and 2011.

3.2 Model Error Parameters

To evaluate model performance (accuracy), a statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water surface elevations or water temperatures at the intake canal, discharge canal, upstream boundary, mixing zone, and macroinvertebrate plate monitoring stations (stations 3–18) are given in Table 3.1 through Table 3.12. We developed the following statistical parameters: minimum, maximum, 25% quartile, median (50% quartile), 75% quartile, average, and standard deviation of the differences between observed data and modeled values. The statistical summary in Table 3.1 through Table 3.12 indicates that the model predicts water temperatures well at the intake canal, discharge canal, mixing zone (left bank, right bank, mid-depth, deep depth) and macroinvertebrate plate monitoring stations for the calibration period from April 26 to August 29, 2011. These statistical results of error parameters will be further discussed in Section 3.3 when the graphic comparison between observed and modeled time-series plots of water surface elevations and temperatures at different monitoring stations is discussed.

Several statistical parameters were used to further evaluate model performance and are summarized in Table 3.4, Table 3.13, Table 3.14, and Table 3.15. These parameters are (a) observed mean, (b) modeled mean, (c) mean error (ME), (d) mean absolute error (MAE), (e) root-mean-square error (RMSE), (f) relative error (RE) in percent, (g) relative RMSE error (RRE) in percent, and (h) Nash-Sutcliffe Coefficient (Ns).

The ME is the mean of differences between observed and predicted values:

$$ME = \frac{1}{N}\sum_{n=1}^{N}(O^n - P^n) \tag{2}$$

where N is number of observation and predication data pairs, O^n is the value of the nth observed data, and P^n is the value of the nth predicted data. The MAE is defined as the mean of absolute differences between observed and predicted values:

$$MAE = \frac{1}{N}\sum_{n=1}^{N}|O^n - P^n| \tag{3}$$

The RMSE is a good measure of model accuracy that is commonly used to evaluate model performance. The RMSE is defined as the square root of the mean square errors or differences between observed and predicted values:

$$RMSE = \sqrt{\frac{1}{N}\sum_{n=1}^{N}(O^n - P^n)^2} \tag{4}$$

The relative error RE is the ratio of the MAE to the observed mean and is expressed as percent:

$$RE = \frac{MAE}{Observed\ Mean}\times 100 = \frac{\frac{1}{N}\sum_{n=1}^{N}|O^n - P^n|}{\overline{O}}\times 100 \tag{5}$$

$$\overline{O} = \frac{1}{N}\sum_{n=1}^{N}O^n = observed\ mean.$$

The relative RMSE error is often used in hydrodynamic and water quality modeling and is defined as the ratio of RMSE to the observed change (range) expressed as percent:

$$RRE = \frac{RMSE\ error}{Observed\ Change} \times 100 = \frac{\sqrt{\frac{1}{N}\sum_{n=1}^{N}(O^n - P^n)^2}}{O_{\max} - O_{\min}} \times 100 \qquad (6)$$

where O_{max} and O_{min} are the maximum and minimum values of observations, respectively.

The Nash-Sutcliffe model efficiency coefficient (Nash and Sutcliffe 1970) is typically used to assess the predictive power of hydrological models. It is defined as:

$$Ns = 1 - \frac{\sum_{n=1}^{N}(O^n - P^n)^2}{\sum_{n=1}^{N}(O^n - \bar{O})^2} \qquad (7)$$

The Nash-Sutcliffe efficiency can range from -∞ to 1. An efficiency of 1 (Ns = 1) corresponds to a perfect match of modeled values to observed data. An efficiency of 0 (Ns = 0) indicates that the model predictions are as accurate as the mean of the observed data, whereas as efficiency less than zero (Ns < 0) occurs when the observed mean is a better predictor than the model. The closer the model efficiency is to 1, the more accurate the model is.

Table 3.13 lists statistical error parameters (ME, MAE, RMSE, RE, and RRE) for model predictions on water temperatures at the intake canal (near the intake structures of units 1–3 and units 4–5), BAMZ left bank, BAMZ right bank, BAMZ mid-depth, and BAMZ deep depth monitoring stations. The root-mean-square errors (RMSEs) for water temperatures at the intake canal (middle depth) for units 1–3 and units 4–5 are 0.32 °C and 0.29 °C, respectively. The RMSEs for water temperatures at the mixing zone left bank, right bank, mid depth, and deep depth monitoring stations are 0.83, 1.07, 0.76, and 0.88 °C, respectively. The relative errors of water temperature predictions, the ratios of MAEs (mean absolute errors) to the observed means, are less than 2.5% for all the monitoring stations. Relative RMSE or RRE (Equation 6), the ratio of RMSE error to the observed range of water temperatures, are less than 6.3% for all the monitoring stations (Table 3.13).

Absolute differences between observed mean and modeled mean temperatures ranged from 0.01 to 0.57 °C with an average value of 0.26 °C. The Nash-Sutcliffe coefficient (Nash and Sutcliffe 1970), *Ns*, was also calculated and used to evaluate EFDC model performance against observed data. Legates and McCabe (1999) demonstrated that *Ns* is a parameter to measure goodness-of-fit between modeled and observed data. Bennis and Crobeddu (2007) concluded that for hydrograph simulation, a good agreement between simulated values and measured data is achieved when *Ns* exceeds 0.7. Table 3.13 shows that the Nash-Sutcliffe coefficients for all the monitoring stations ranged from 0.95 to 0.99 (the optimum value is 1.0), which indicates that modeled water temperatures matched well with observed water temperatures at these monitoring stations.

3.3 Modeled Water Surface Elevations

Figure 3.3 shows a time-series plot of measured and modeled water surface elevation (m) at the Plant Barry upstream (BAUS) monitoring station from April 26 to August 29 (Julian day 115 to 240), 2011. Water surface elevation measured at Bucks was not a model boundary condition and can be used to evaluate the model performance. The BAUS monitoring station is located at the USGS Bucks gaging station (Table 2.1). The average absolute difference or error (|Observed - Modeled|) between observed and modeled water surface elevations at the USGS Bucks gaging station is 0.04 m with a maximum difference of 0.49 m (Table 3.1).

Figure 3.4 shows a time-series plot of observed and modeled water surface elevation (m) at the intake canal monitoring station (Table 2.1) from April 26 to August 29 (Julian day 115 to 240). The average absolute difference or error (|Observed - Modeled|) between observed and modeled water surface elevations at the intake canal monitoring station (BAIC) is 0.04 m with a maximum difference of 0.50 m (Table 3.2). Seventy-five percent of the absolute differences between observed and modeled water surface elevations are less than 0.06 m (Table 3.2).

Figure 3.5 shows a time-series plot of observed and modeled water surface elevation (m) at the mixing zone (BAMZ) monitoring station from April 26 to August 29 (Julian day 115 to 240). Water surface elevations at the mixing zone were measured near the mouth of the discharge canal (Figure 2.10, labeled as BAMZ elevation). The average difference or error (Observed – Modeled) between observed and modeled water surface elevations at the mixing zone monitoring station is -0.07 m (or observed is slightly less than modeled, Figure 3.5) with a maximum difference of 0.34 m (Table 3.3).

Table 3.4 summarizes statistics for model performance evaluation on water surface elevations (m) at the upstream boundary, intake canal, and mixing zone monitoring stations. The modeled mean of water surface elevations in the mixing zone is slightly larger than observed mean as shown in Figure 3.5. The Nash-Sutcliffe coefficients for three monitoring stations are greater than 0.94. Overall agreement between observed and modeled water surface elevations is very good at all three monitoring stations.

Table 3.1 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water surface elevations (m) at the USGS Bucks gaging station.

Statistical Parameters	Observed - Modeled	|Observed - Modeled|
Minimum	-0.29	0.00
25% Quartile	-0.04	0.02
Median	-0.01	0.04
75% Quartile	0.03	0.06
Maximum	0.49	0.49
Average	-0.01	0.04
Standard Deviation	0.06	0.04

Table 3.2 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water surface elevation (m) in the intake canal of Plant Barry (BAIC).

Statistical Parameters	Observed-Modeled	|Observed - Modeled|
Minimum	-0.20	0.00
25% Quartile	-0.02	0.02
Median	0.01	0.04
75% Quartile	0.05	0.06
Maximum	0.50	0.50
Average	0.01	0.04
Standard Deviation	0.06	0.04

Table 3.3 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water surface elevation (m) in the mixing zone of Plant Barry (BAMZ).

Statistical Parameters	Observed-Modeled	|Observed - Modeled|
Minimum	-0.29	0.00
25% Quartile	-0.10	0.04
Median	-0.06	0.06
75% Quartile	-0.04	0.10
Maximum	0.34	0.34
Average	-0.07	0.07
Standard Deviation	0.05	0.04

Table 3.4 Statistics for model performance evaluation on water surface elevations (m) at the upstream boundary, intake canal, and mixing zone monitoring stations.

Parameter/location	Upstream (Bucks)	Intake Canal	Mixing Zone
Starting Date/Time	4/26/11 12:15 AM	4/26/11 1:00 AM	4/26/11 12:05 AM
Ending Date/Time	8/28/11 11:45 PM	8/28/11 11:00 PM	8/28/11 11:45 PM
Number of Data Pairs	11,348	2,974	35,997
Nash-Sutcliffe Efficiency	0.978	0.977	0.944
RMSE (m)	0.059	0.059	0.082
Mean Error (m)	0.005	-0.014	0.066
Relative Error (%)	10.05	9.80	20.18
Mean Absolute Error (m)	0.044	0.043	0.070
Relative RMS (%)	3.04	3.04	4.50
Data Mean (m)	0.436	0.438	0.342
Model Mean (m)	0.442	0.429	0.407

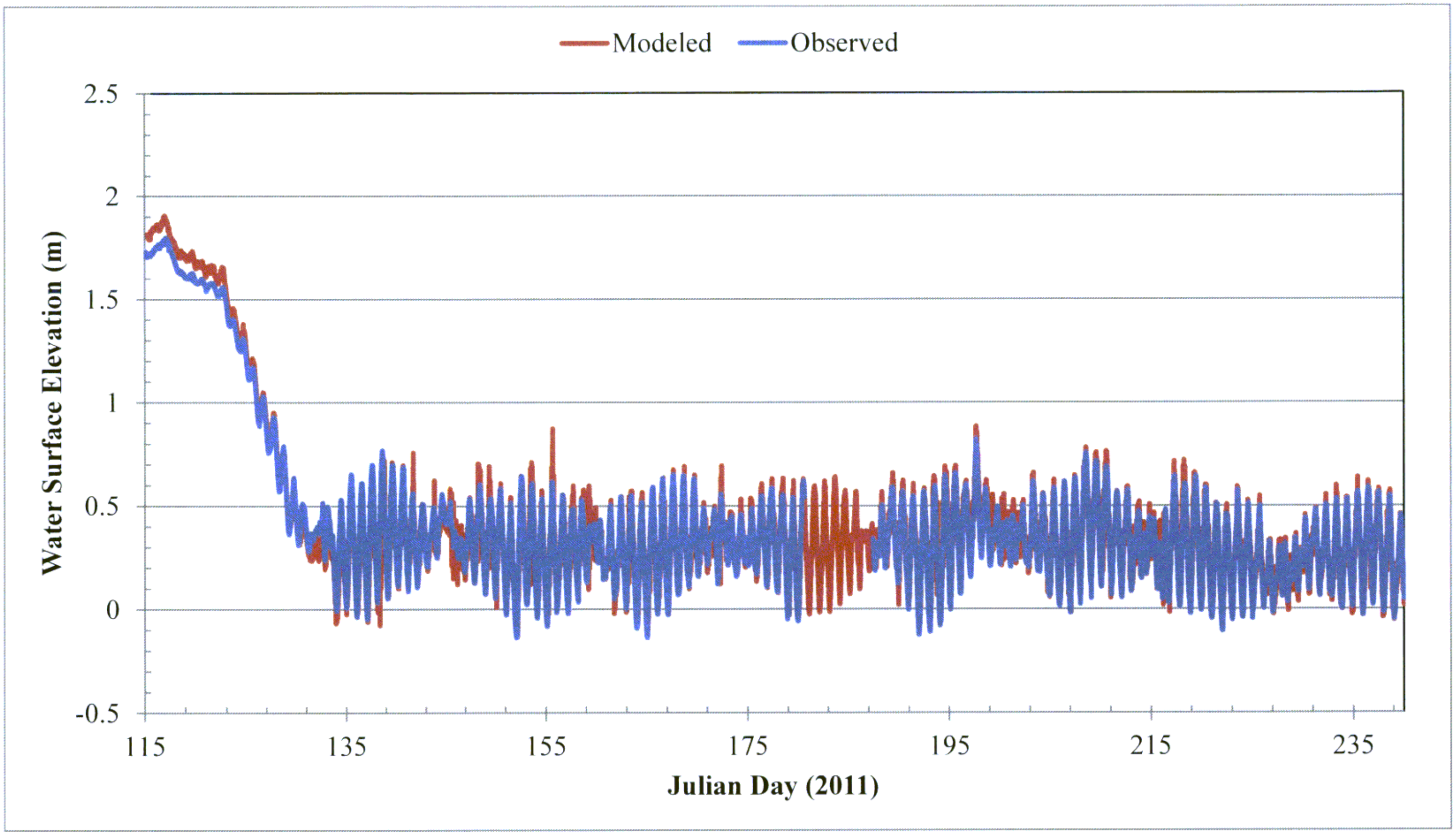


Figure 3.3 Time-series plot of observed and modeled water surface elevations (m) at the Plant Barry **upstream (BAUS)** monitoring station from April 26 to August 29 (Julian day 115 to 240), 2011.

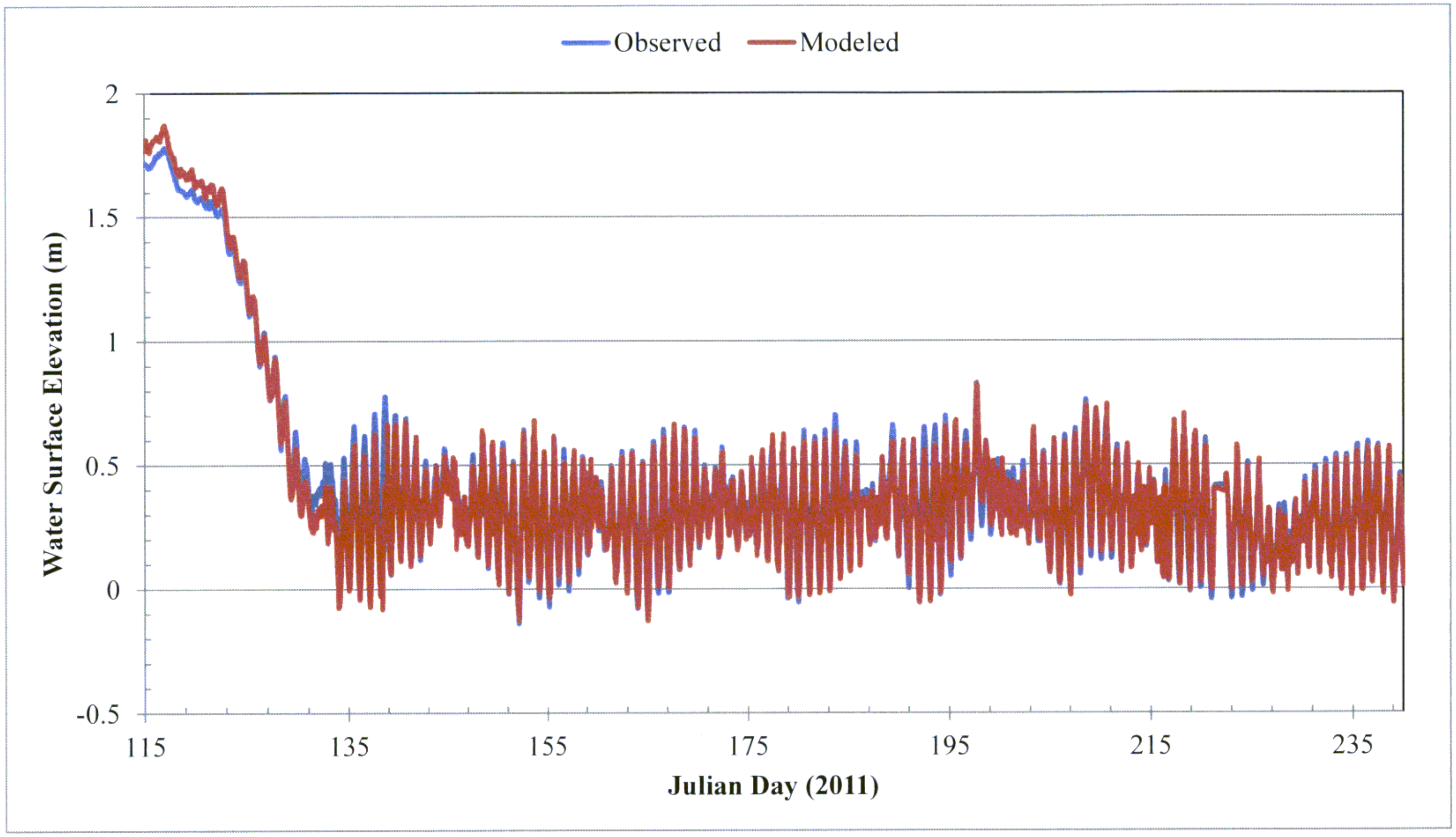


Figure 3.4 Time-series plot of observed and modeled water surface elevations (m) at the **intake canal** monitoring station from April 26 to August 29 (Julian day 115 to 240), 2011.

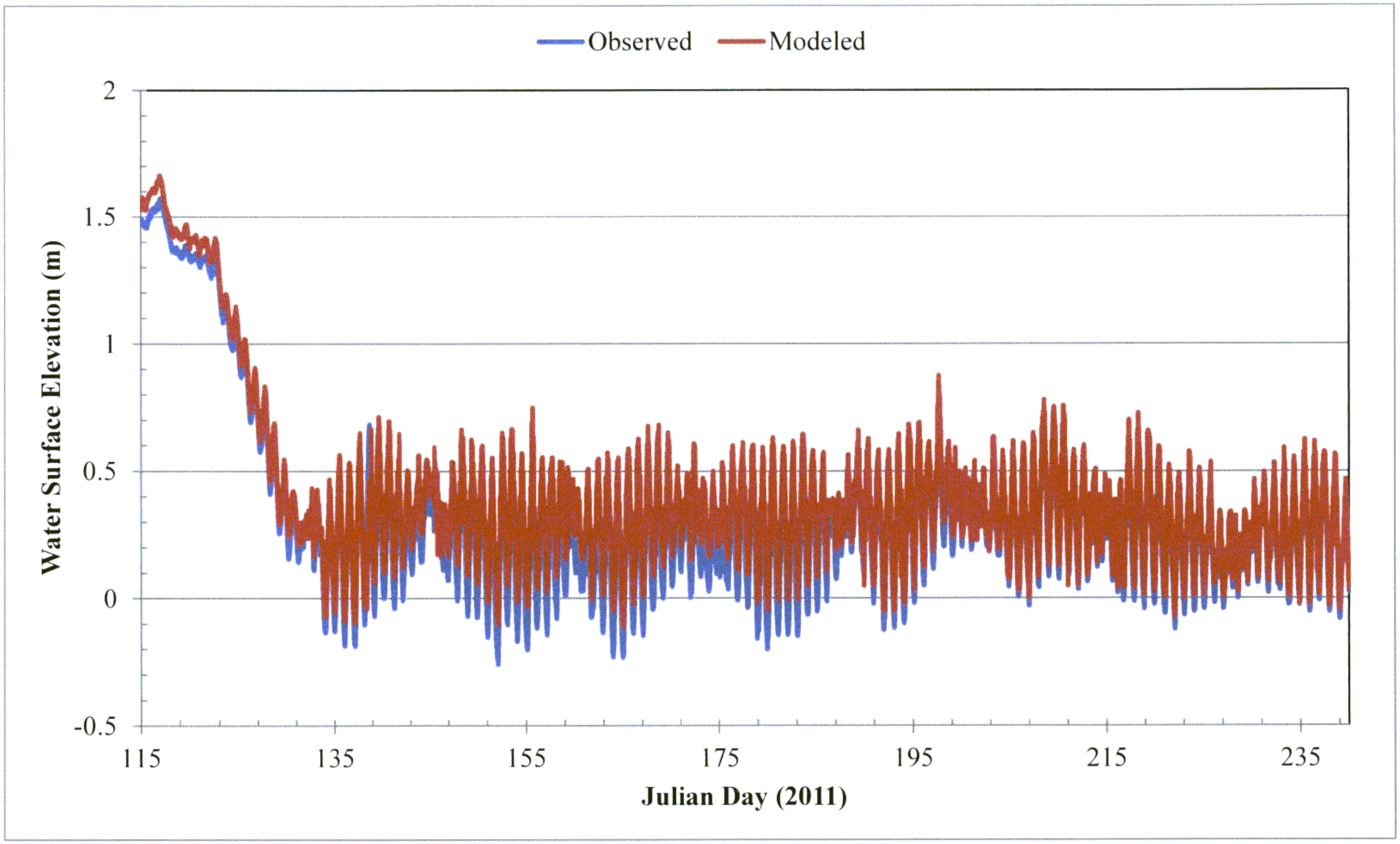


Figure 3.5 Time-series plot of observed and modeled water surface elevations (m) at the **mixing zone (BAMZ)** monitoring station from April 26 to August 29 (Julian day 115 to 240), 2011.

3.4 Modeled Water Temperatures

Figure 3.6 shows a time-series plot of measured (observed) and modeled water temperatures (°C) at the middle depth of the intake canal (BAIC) near the intake structure of units 1–3 from April 26 to August 29, 2011. The width of the intake structure for units 1-3 is about 66 ft (6 bays, each bay is 11 ft wide). The elevation of the opening of the intake structure for unit 1–3 intake is from -17.5 ft (-5.3 m) to -8.0 ft (-2.4 m) above mean sea level, therefore, the total depth from which water was withdrawn through the units 1–3 intake was about 2.9 m. Average and median absolute errors (|Observed-Modeled|) between observed and modeled water temperatures near the intake of units 1–3 are 0.19 °C and 0.11 °C (Table 3.5), respectively.

Figure 3.7 shows a time-series plot of observed and modeled water temperature (°C) at the middle depth of the intake canal (BAIC) near the intake structure of units 4–5 from April 26 to August 29, 2011. The cells used for the temperature comparison in the Barry EFDC model is Layer 3 of grid I =62, J= 324 (Table 2.1). The width of the intake structure for units 4–5 is about 55 ft (5 bays). The elevation of the opening of the intake structure for units 4–5 is from -19.7 ft (-6.0 m) to -8 ft (-2.4 m). The total depth from which water was withdrawn through the units 4–5 intake was about 3.6 m. Average and median absolute errors (|Observed – Modeled|) between observed and modeled water temperatures near the intake of units 4–5 are 0.15 °C and 0.07 °C (Table 3.5), respectively. Five-minute time series of observed and modeled water temperatures were used to calculate the statistical error parameters. The overall agreement between observed and modeled intake temperatures was excellent.

Figure 3.8 shows a time-series plot of observed and modeled water temperature (°C) at the middle depth of the discharge canal (BADC) from April 26 to August 29, 2011. Average and median absolute differences (|Observed – Modeled|) between observed and modeled water temperatures in the discharge canal are 0.38 °C and 0.25 °C (Table 3.6), respectively. Observed water temperatures in the discharge canal monitoring station ranged from 21.84 to 47.28 °C from April 26 to August 29, 2011. In comparison to the large variation or wide range of observed temperatures, the overall agreement between observed and modeled temperature was excellent. One of the reasons is because modeled intake temperatures matched well with observed intake temperatures (Table 3.13 and Figure 3.7). Temperature increases derived using measured temperatures between the intake canal and the discharge canal were used as model input. Figure 3.8 was not intended to demonstrate model accuracy but demonstrates that the Barry EFDC model did correctly apply the temperature increase model boundary between withdrawal and return flow to model Plant Barry.

Figure 3.9 shows a time-series plot of observed and modeled water temperatures (°C) at the shallow depth (Layer 6 in the Barry EFDC model) of the left bank monitoring station in the mixing zone (BAMZ) from April 26 to August 29, 2011. The overall agreement between observed and measured temperature was good. Both observed and modeled water temperatures at the shallow depth exhibit diurnal fluctuations due to surface solar heating because temperatures were measured at 3 ft (0.9 m) below the water surface. Average and median errors (|Observed – Modeled|) between measured (observed) and modeled water temperatures at the shallow depth of the left bank monitoring station in the mixing zone are -0.20 °C and -0.25 °C

(Table 3.7), respectively. The 75% quartile of the absolute error is 0.88 °C, which means 75% of the absolute error is less than 0.88 °C. Figure 3.9 shows that observed temperatures had more variations and the model is slightly underpredicted.

Figure 3.10 shows a time-series plot of observed and modeled water temperatures (°C) at the shallow depth of the right bank monitoring station in the mixing zone (BAMZ) from April 26 to August 29, 2011. The diurnal fluctuations measured or simulated at 3 ft (0.9 m) below the water surface are distinct at the right bank station in the mixing zone as well as the left bank station in the mixing zone. Average and median absolute errors (|Observed-Modeled|) between observed and modeled water temperatures at the shallow depth of the right bank monitoring station in the mixing zone are 0.77 °C and 0.53 °C (Table 3.7), respectively. The overall agreement between observed and measured temperature at the right bank of the mixing zone was good even though errors are slightly larger than ones at the intake monitoring stations (Table 3.5).

Figure 3.11 shows a time-series plot of observed and modeled water temperatures at the middle depth monitoring station in the mixing zone (BAMZ) from April 26 to August 29, 2011. The mid-depth temperatures had relatively smaller variations compared to temperatures measured at the shallow depths of the left bank and right bank stations. Average and median absolute errors (|Observed – Modeled|) between observed and modeled mid-depth water temperatures in the mixing zone are 0.53 °C and 0.32 °C (Table 3.8), respectively.

Figure 3.12 shows a time-series plot of observed and modeled water temperatures at the deep depth monitoring station in the mixing zone (BAMZ) from April 26 to August 29, 2011. The deep-depth (near bottom) temperatures had very small variations compared to temperatures measured at the shallow depths (left and right bank stations), which are also smaller than ones in the mid-depth station in the mixing zone. Average and median absolute error (|Observed – Modeled|) between observed and modeled deep-depth water temperatures in the mixing zone are 0.64 °C and 0.44 °C (Table 3.8), respectively.

Time-series plots of observed and modeled water temperatures (°C) at the shallow depth of the macroinvertebrate plates from Station 3 to Station 17 (Figure 2.11) are presented in Figure 3.13 to Figure 3.25. The temperature data associated with the macroinvertebrate plates were not measured continuously but deployed for 4 weeks during each of three seasons (spring, summer, and fall). Spring data were measured from May 9 to June 7, 2011. Summer data were measured from June 12 to August 9, 2011, and fall data were measured from September 19 to October 18, 2011. Because the model simulation period was from April 26 to August 29, 2011, only the spring and summer data sets were used for the model calibration. The approximate depth of these temperature measurements at the macroinvertebrate plate stations was -6.5 ft (-2.0 m) below msl, and typically water surface elevations in the simulation domain ranged from 0 to 0.5 m above msl (Figure 3.3 to Figure 3.5). Therefore, temperatures measured at the macroinvertebrate plates are compared with modeled temperatures at the surface or top layers (Layer 6) at corresponding grids of the Barry EFDC model. Overall, the agreement between observed and modeled temperatures at all macroinvertebrate plate stations was good (Table 3.9 to Table 3.12). Stations 3, 4, 5, and 6 (Figure 2.11) are located on the Mobile River between the intake canal and discharge canal; stations 7, 8, 9, and 10 (Figure 2.11) are located on the Mobile River in the mixing zone of Plant Barry; and other stations are downstream of the mixing zone (Figure 2.11).

Figure 3.13 shows a time-series plot of observed and modeled temperatures at Station 3 (macroinvertebrate plate). Average and median absolute errors (|Observed-Modeled|) between observed and modeled temperatures at Station 3 are 0.27 °C and 0.16 °C (Table 3.9), respectively. Figure 3.14 shows a time-series plot of observed and modeled surface-layer temperatures at Station 4 (Figure 2.11). Average and median absolute errors between observed and modeled temperatures at Station 4 are 0.29 °C and 0.12 °C (Table 3.9), respectively. Figure 3.15 shows a time-series plot of observed and modeled surface-layer temperatures at Station 5. Average and median absolute errors between observed and modeled temperatures at Station 5 are 0.42 °C and 0.16 °C (Table 3.9), respectively. Figure 3.16 shows a time-series plot of observed and modeled surface-layer temperatures at Station 6. Average and median absolute errors between observed and modeled temperatures at Station6 are 0.60 °C and 0.20 °C (Table 3.9), respectively.

Figure 3.17 shows a time-series plot of observed and modeled surface temperatures at Station 7 (macroinvertebrate plate). Average and median absolute errors between observed and modeled temperatures at Station 7 were 0.94 °C and 0.40 °C (Table 3.10), respectively. Figure 3.18 shows a time-series plot of observed and modeled surface-layer temperatures at Station 8 (Figure 2.11). Average and median absolute errors between observed and modeled temperatures at Station 8 are 0.72 °C and 0.56 °C (Table 3.10), respectively. Figure 3.19 shows a time-series plot of observed and modeled surface-layer temperatures at Station 9. Average and median absolute errors between observed and modeled temperatures at Station 9 are 0.73 °C and 0.47 °C (Table 3.10), respectively. Figure 3.20 shows a time-series plot of observed and modeled surface temperatures at Station 10. Average and median absolute errors between observed and modeled temperatures at Station 10 are 0.46 °C and 0.28 °C (Table 3.10), respectively.

Figure 3.21 shows a time-series plot of observed and modeled surface-layer temperatures at Station 11 (macroinvertebrate plate). Average and median absolute errors between observed and modeled temperatures at Station 11 are 0.60 °C and 0.51 °C (Table 3.11), respectively. Figure 3.22 shows a time-series plot of observed and modeled surface temperatures at Station 13 (Figure 2.11). Average and median absolute errors between observed and modeled temperatures at Station 13 are 0.43 °C and 0.32 °C (Table 3.11), respectively. Figure 3.23 shows a time-series plot of observed and modeled surface temperatures at Station 14. Average and median absolute errors between observed and modeled temperatures at Station 14 are 0.41 °C and 0.27 °C (Table 3.11), respectively.

Figure 3.24 shows a time-series plot of observed and modeled surface temperatures at Station16 (macroinvertebrate plate). Average and median absolute errors between observed and modeled temperatures at Station 16 are 0.45 °C and 0.27 °C (Table 3.12), respectively. From Julian day 144 to 157 in the spring season and from Julian day 199 to 220 in the summer season, the temperature data might have a possible error because data didn't show any diurnal variations, and these data were not plotted on Figure 3.24 and were not used in error parameter computation. Figure 3.25 shows a time-series plot of observed and modeled surface temperatures at Station 17 (Figure 2.11). Average and median absolute errors between observed and modeled temperatures at Station 17 are 0.37 °C and 0.29 °C (Table 3.12), respectively.

For 2011 model simulations, the root-mean-square errors (RMSEs) for water temperatures at the 13 macroinvertebrate plate monitoring stations ranged from 0.44 °C to 1.41 °C with an average value of 0.75 °C. The relative errors (the ratio of mean absolute error to the observed mean) are less than 3.1% for stations 3 to 17. Absolute differences (errors) between observed means and modeled means for all 13 monitoring stations ranged from 0.05 °C to 0.55 °C, with an average value of 0.263 °C. The Nash-Sutcliffe coefficients (Ns) for these 13 monitoring stations ranged from 0.88 to 0.98, which are much larger than 0.7 (Bennis and Crobeddu 2007) and indicate that modeled water temperatures matched reasonably well with observed water temperature at these 13 monitoring stations associated with macroinvertebrate plates. The Nash-Sutcliffe coefficient Ns > 0.7 is a good agreement criterion between simulated values and measured data as suggested by Bennis and Crobeddu, 2007.

Table 3.5 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) near the intake structures of units 1–3 and units 4–5 in the **intake canal (BAIC)** of Plant Barry.

	Intake Units 1-3		Intake Canal Units 4-5	
Statistical Parameters	Observed - Modeled	|Observed - Modeled|	Observed - Modeled	|Observed - Modeled|
Minimum	-0.77	0.00	-1.03	0.00
25% Quartile	-0.14	0.05	0.00	0.03
Median	-0.07	0.11	0.05	0.07
75% Quartile	0.01	0.20	0.10	0.13
Maximum	3.02	3.02	3.15	3.15
Average	-0.01	0.19	0.09	0.15
Standard Deviation	0.32	0.26	0.27	0.25

Table 3.6 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the **discharge point of units 4–5** in the discharge canal of Plant Barry.

Statistical Parameters	Observed - Modeled	|Observed - Modeled|
Minimum	-3.20	0.00
25% Quartile	0.12	0.15
Median	0.24	0.25
75% Quartile	0.41	0.45
Maximum	4.23	4.23
Average	0.33	0.38
Standard Deviation	0.46	0.42

Table 3.7 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the shallow depths of the left and right bank monitoring stations in the **mixing zone (BAMZ)**.

Statistical Parameters	BAMZ left bank		BAMZ right bank	
	Observed - Modeled	|Observed - Modeled|	Observed - Modeled	|Observed - Modeled|
Minimum	-3.67	0.00	-3.55	0.00
25% Quartile	-0.67	0.23	-0.27	0.20
Median	-0.25	0.52	0.14	0.53
75% Quartile	0.17	0.88	0.77	1.12
Maximum	3.84	3.84	5.04	5.04
Average	-0.20	0.63	0.26	0.77
Standard Deviation	0.81	0.54	1.04	0.75

Table 3.8 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water temperature (°C) at the mid-depth and deep-depth monitoring stations in the **mixing zone (BAMZ)**.

Statistical Parameters	BAMZ mid-depth		BAMZ deep-depth	
	Observed - Modeled	|Observed - Modeled|	Observed - Modeled	|Observed - Modeled|
Minimum	-3.10	0.00	-3.38	0.00
25% Quartile	-0.66	0.14	-0.90	0.17
Median	-0.22	0.32	-0.39	0.44
75% Quartile	-0.05	0.75	-0.12	0.91
Maximum	2.26	3.10	1.41	3.38
Average	-0.37	0.53	-0.57	0.64
Standard Deviation	0.66	0.54	0.67	0.60

Table 3.9 Statistical summary of the absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the macroinvertebrate monitoring **stations 3, 4, 5 and 6.**

Statistical Parameters	Station 3	Station 4	Station 5	Station 6
Minimum	0.00	0.00	0.00	0.00
25% Quartile	0.08	0.06	0.07	0.06
Median	0.16	0.12	0.16	0.20
75% Quartile	0.30	0.30	0.54	0.92
Maximum	4.23	3.93	4.08	5.71
Average	0.27	0.29	0.42	0.59
Standard Deviation	0.34	0.43	0.58	0.77

Table 3.10 Statistical summary of the absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the macroinvertebrate monitoring **stations 7, 8, 9, and 10**.

Statistical Parameters	Station 7	Station 8	Station 9	Station 10
Minimum	0.00	0.00	0.00	0.00
25% Quartile	0.12	0.27	0.22	0.12
Median	0.40	0.56	0.47	0.28
75% Quartile	1.58	1.01	0.93	0.63
Maximum	5.96	4.35	4.33	4.05
Average	0.94	0.72	0.73	0.46
Standard Deviation	1.04	0.61	0.73	0.49

Table 3.11 Statistical summary of the absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the macroinvertebrate monitoring **stations 11, 13, and 14**.

Statistical Parameters	Station 11	Station 13	Station 14
Minimum	0.00	0.00	0.00
25% Quartile	0.25	0.17	0.12
Median	0.52	0.32	0.27
75% Quartile	0.84	0.58	0.59
Maximum	4.15	2.52	2.78
Average	0.61	0.43	0.40
Standard Deviation	0.47	0.36	0.37

Table 3.12 Statistical summary of the absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (°C) at the macroinvertebrate plate monitoring **stations 16 and 17**.

Statistical Parameters	Station 16	Station 17
Minimum	0.00	0.00
25% Quartile	0.13	0.13
Median	0.27	0.29
75% Quartile	0.61	0.52
Maximum	2.04	1.89
Average	0.45	0.37
Standard Deviation	0.45	0.31

Table 3.13 Statistics for model performance evaluation on water temperature (°C) at the intake canal (near intake structures for units 1–3 and units 4–5), BAMZ left bank, BAMZ right bank, BAMZ mid-depth, and BAMZ deep monitoring stations.

Location	Layers	Observed Mean [1]	Modeled Mean	ME	MAE	RMSE	RE (%)	RRE (%)	Ns
Intake units 1–3	mid-depth	29.562	29.572	-0.010	0.185	0.318	0.626	2.187	0.957
Intake units 4–5	mid-depth	29.674	29.586	0.088	0.146	0.287	0.491	2.028	0.994
BAMZ left	shallow	31.054	31.253	-0.199	0.633	0.834	2.039	4.063	0.963
BAMZ right bank	shallow	30.863	30.605	0.258	0.769	1.071	2.490	5.649	0.965
BAMZ mid-depth	mid-depth	30.025	30.399	-0.374	0.528	0.757	1.758	5.245	0.964
BAMZ deep	deep depth	29.669	30.239	-0.570	0.637	0.878	2.148	6.322	0.946
Discharge Canal 4–5	mid-depth	37.737	37.408	0.329	0.384	0.567	1.018	2.229	0.991

Note: [1] - Absolute difference between observed mean and modeled mean ranged from 0.01 to 0.57 °C with an average value of 0.26 °C.

Table 3.14 Statistics for model performance evaluation on water temperatures (°C) at the macroinvertebrate plate monitoring stations (Station 3 – Station 17).

Station ID	Layer	Starting Date/Time	Ending Date/Time	# Pairs	Ns [1]	RMSE [2]	ME	Rel. Error [3]	MAS	Rel. RMS	Observed Average	Modeled Average
Station 3	Layer 6	5/9/2011 14:25	8/8/2011 12:44	16,101	0.98	0.44	0.22	0.95	0.27	3.14	28.91	29.13
Station 4	Layer 6	5/9/2011 14:29	8/8/2011 13:10	16,082	0.98	0.52	0.14	1.01	0.29	3.83	29.05	29.19
Station 5	Layer 6	5/9/2011 16:00	8/8/2011 13:35	16,078	0.96	0.72	-0.06	1.44	0.42	5.31	29.38	29.33
Station 6	Layer 6	5/9/2011 16:35	8/9/2011 7:00	16,303	0.93	0.97	-0.29	1.98	0.60	6.22	29.98	29.69
Station 7	Layer 6	5/9/2011 16:14	8/9/2011 7:30	16,516	0.88	1.41	0.00	3.10	1.20	11.24	29.89	30.32
Station 8	Layer 5	5/9/2011 16:35	8/9/2011 7:55	16,518	0.92	0.95	-0.17	2.39	0.73	6.47	30.34	30.17
Station 9	Layer 5	5/10/2011 8:35	8/9/2011 8:25	16,125	0.89	1.04	0.55	2.43	0.73	7.68	29.99	30.54
Station 10	Layer 5	5/10/2011 9:34	8/9/2011 10:59	16,147	0.96	0.68	-0.26	1.53	0.46	4.65	30.34	30.08
Station 11	Layer 6	5/10/2011 9:34	8/9/2011 10:45	16,144	0.95	0.77	0.45	2.01	0.61	5.41	30.31	30.76
Station 13	Layer 6	5/10/2011 9:34	8/9/2011 10:30	16,141	0.97	0.57	0.13	1.43	0.43	4.01	30.25	30.38
Station 14	Layer 6	5/10/2011 10:04	8/9/2011 10:04	16,118	0.97	0.56	0.17	1.35	0.41	4.20	30.17	30.34
Station 16	Layer 6	5/10/2011 10:35	7/11/2011 10:24	16,107	0.97	0.64	0.37	1.65	1.13	5.85	27.37	27.74
Station 17	Layer 6	5/10/2011 10:49	8/9/2011 9:14	16,108	0.98	0.48	0.19	1.22	0.37	4.06	30.07	30.26

Note: [1] - dimensionless, [2] – in °C except relative errors, and [3] – in % for relative (rel.) errors.

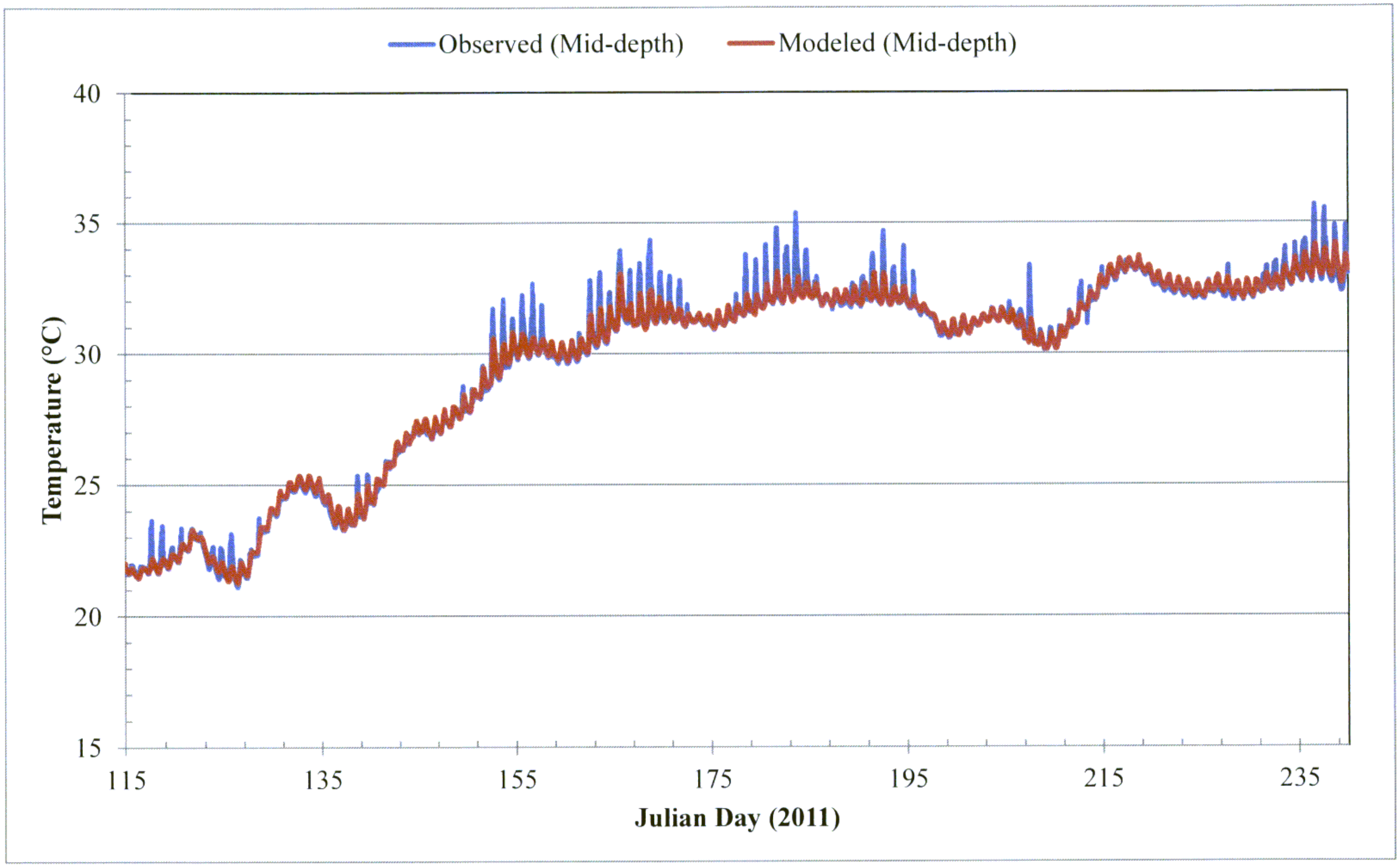


Figure 3.6 Time-series plot of observed and modeled water temperatures (°C) at the middle depth near the intake of units 1–3 in the **intake canal** (BAIC) from April 26 to August 29 (Julian day 115 to 240), 2011.

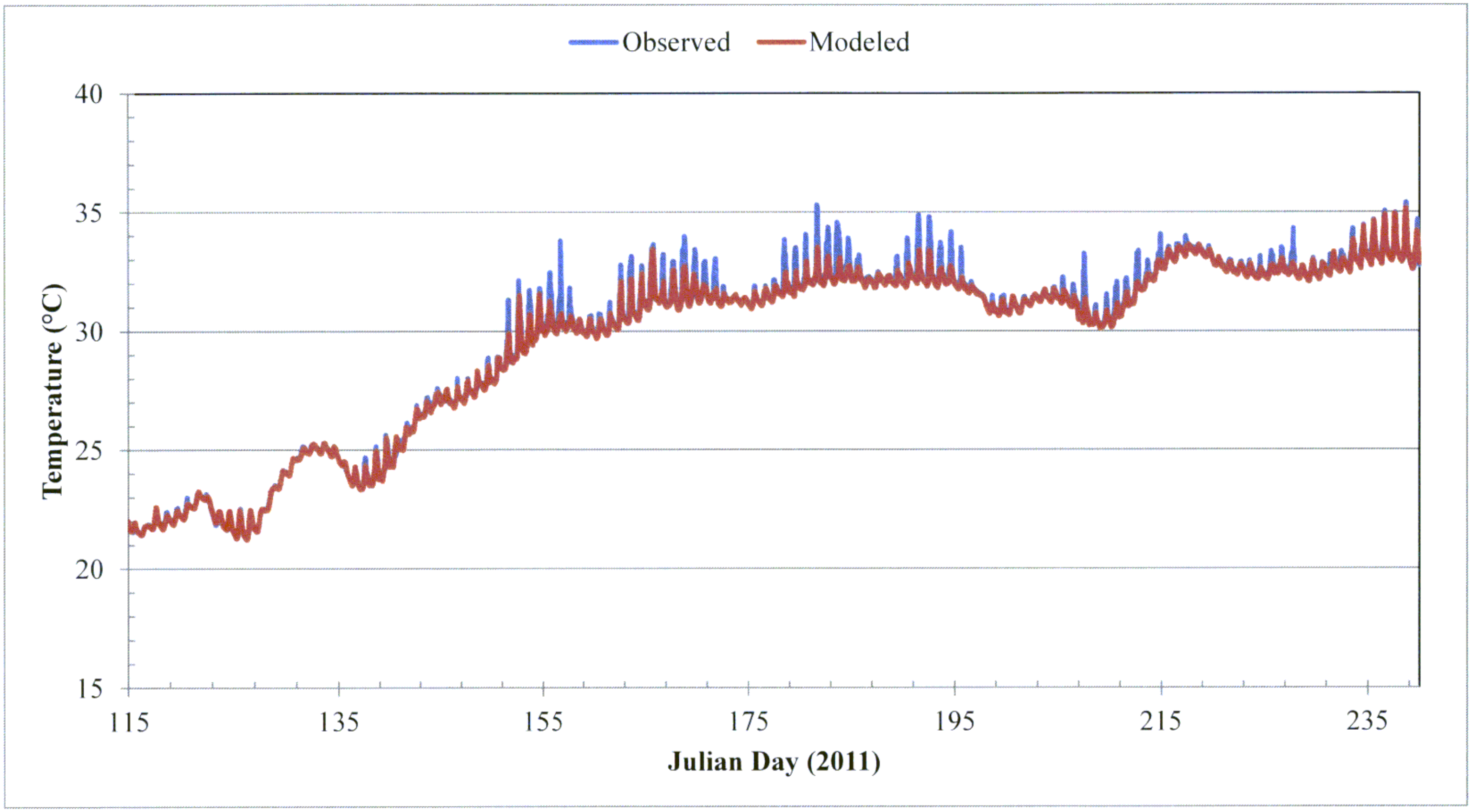


Figure 3.7 Time-series plot of observed and modeled water temperatures (°C) at the middle depth near the intake of units 4–5 in the **intake canal** (BAIC) from April 26 to August 29 (Julian day 115 to 240), 2011.

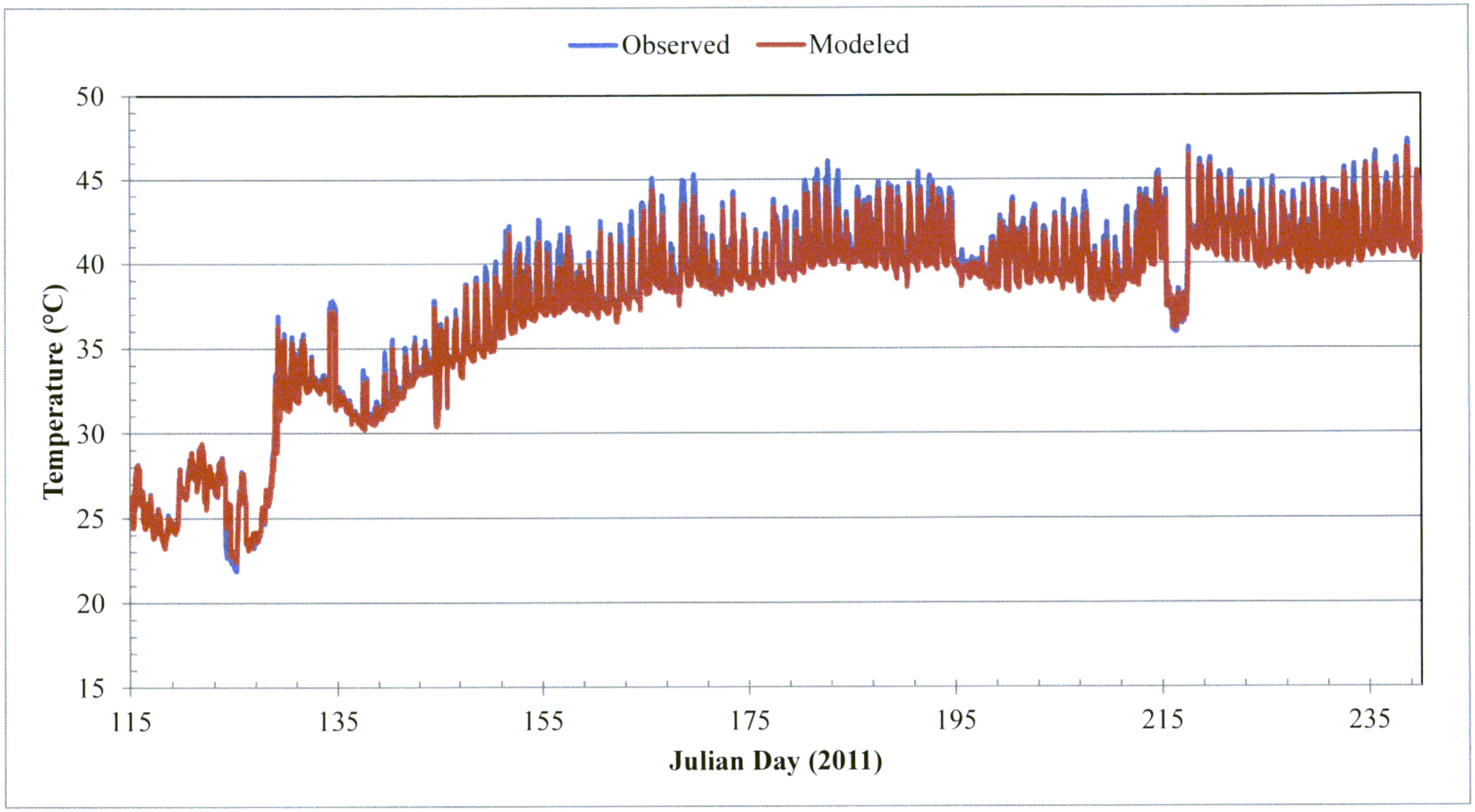


Figure 3.8 Time-series plot of observed and modeled water temperatures (°C) at the middle depth station in the **discharge canal** (BADC) from April 26 to August 29 (Julian day 115 to 240), 2011.

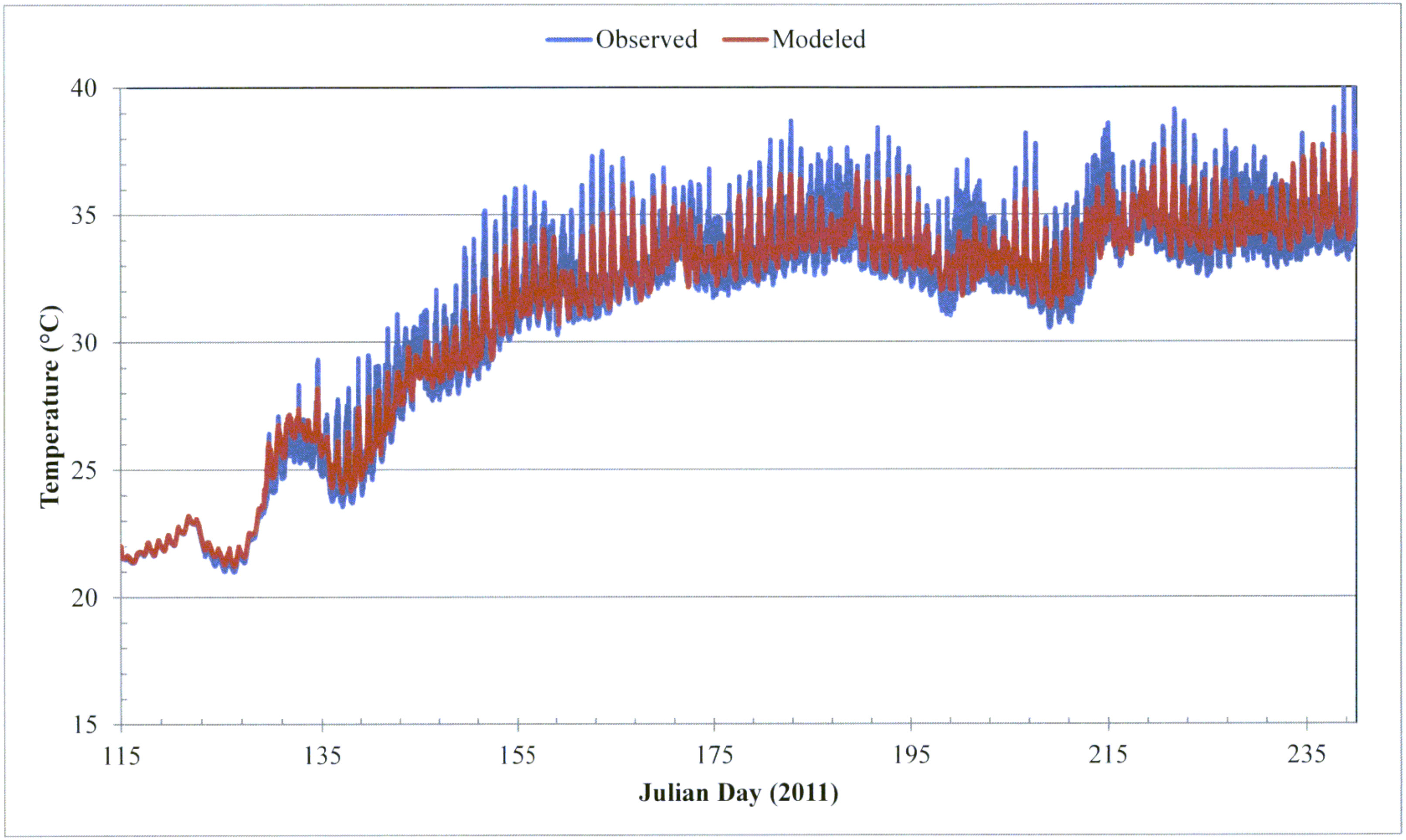


Figure 3.9 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the left bank station in the mixing zone** (BAMZ) from April 26 to August 29 (Julian day 115 to 240), 2011.

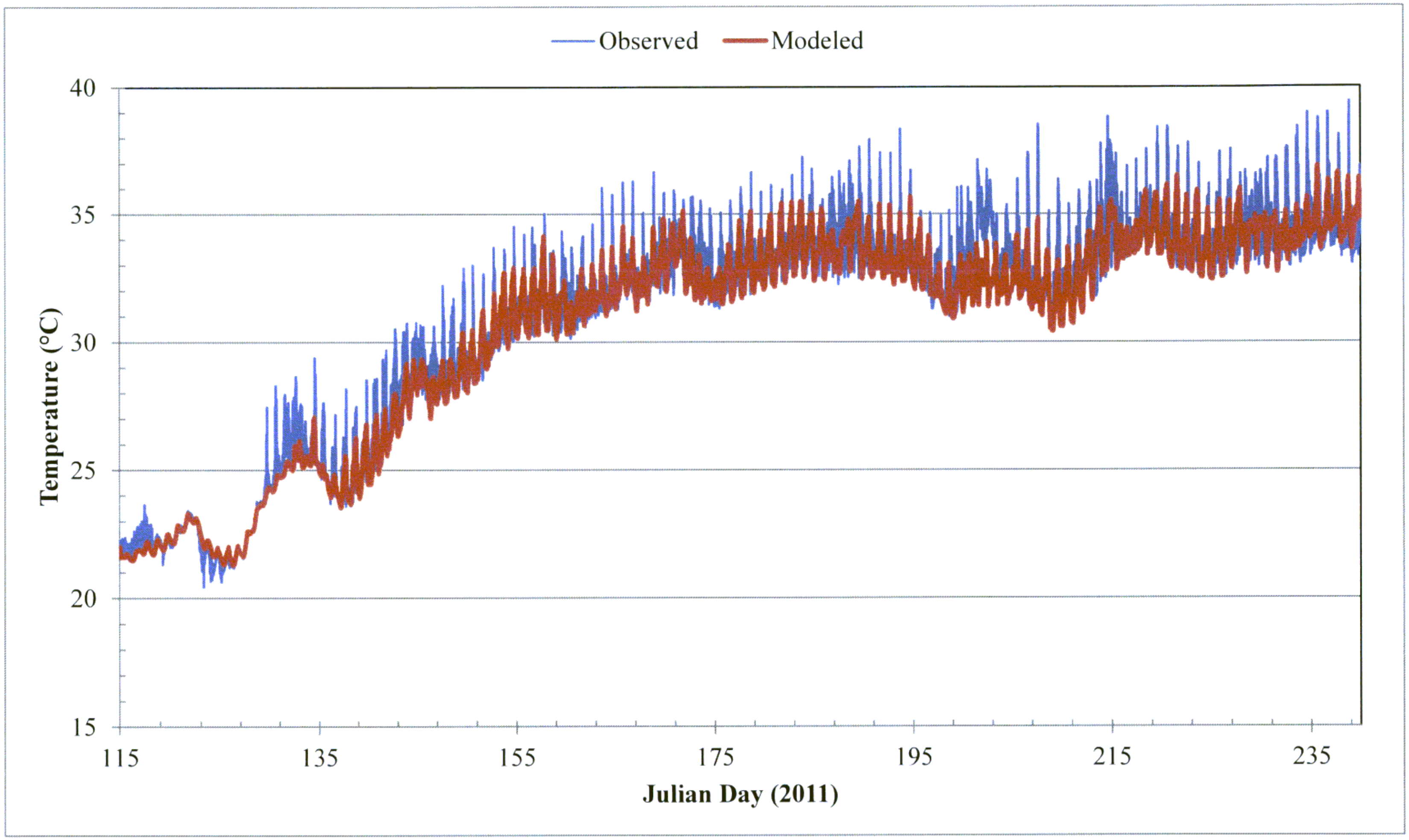


Figure 3.10 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the right bank station in the mixing zone** (BAMZ) from April 26 to August 29 (Julian day 115 to 240), 2011.

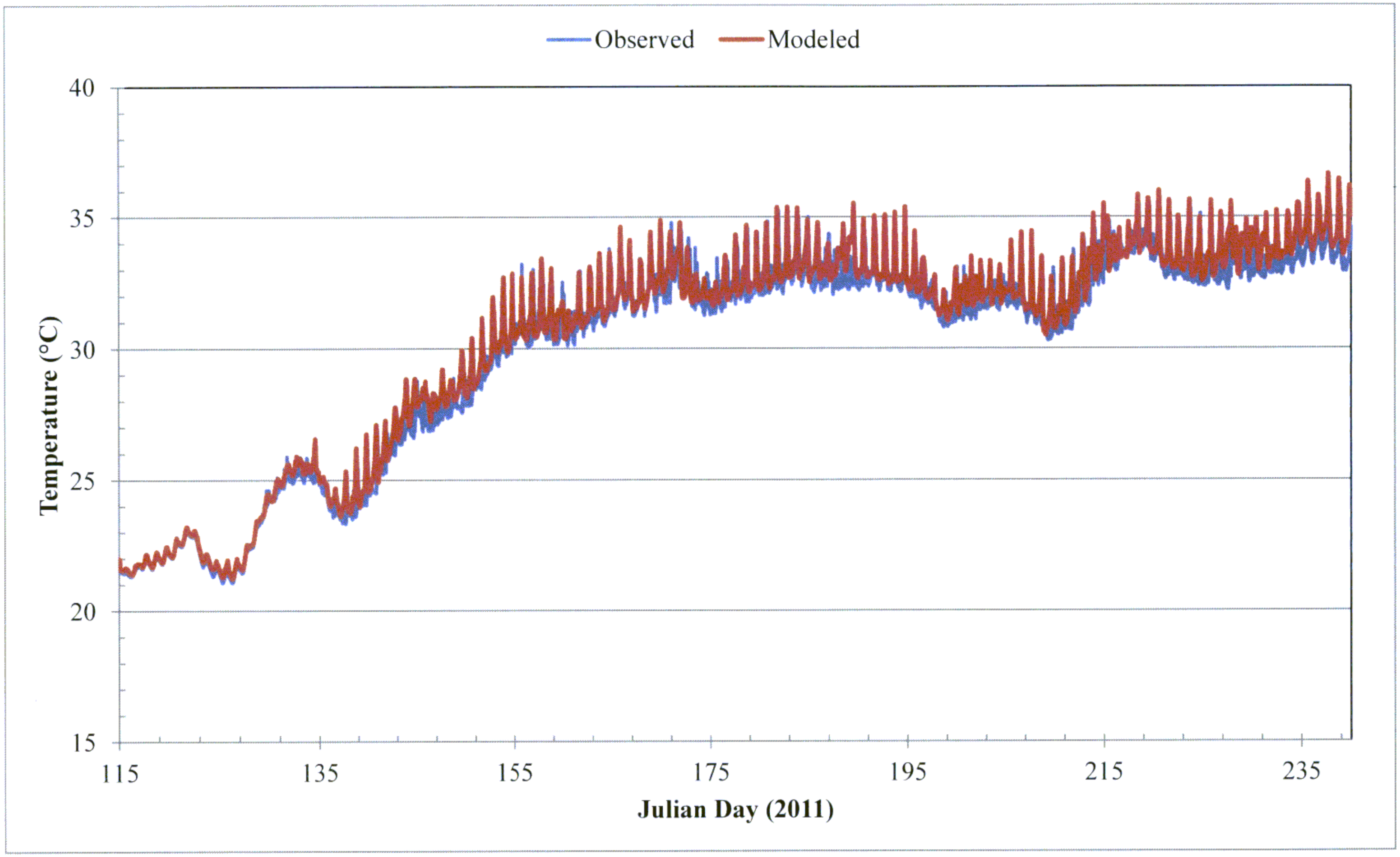


Figure 3.11 Time-series plot of observed and modeled water temperatures (°C) at the **middle depth station in the mixing zone** (BAMZ) from April 26 to August 29 (Julian day 115 to 240), 2011.

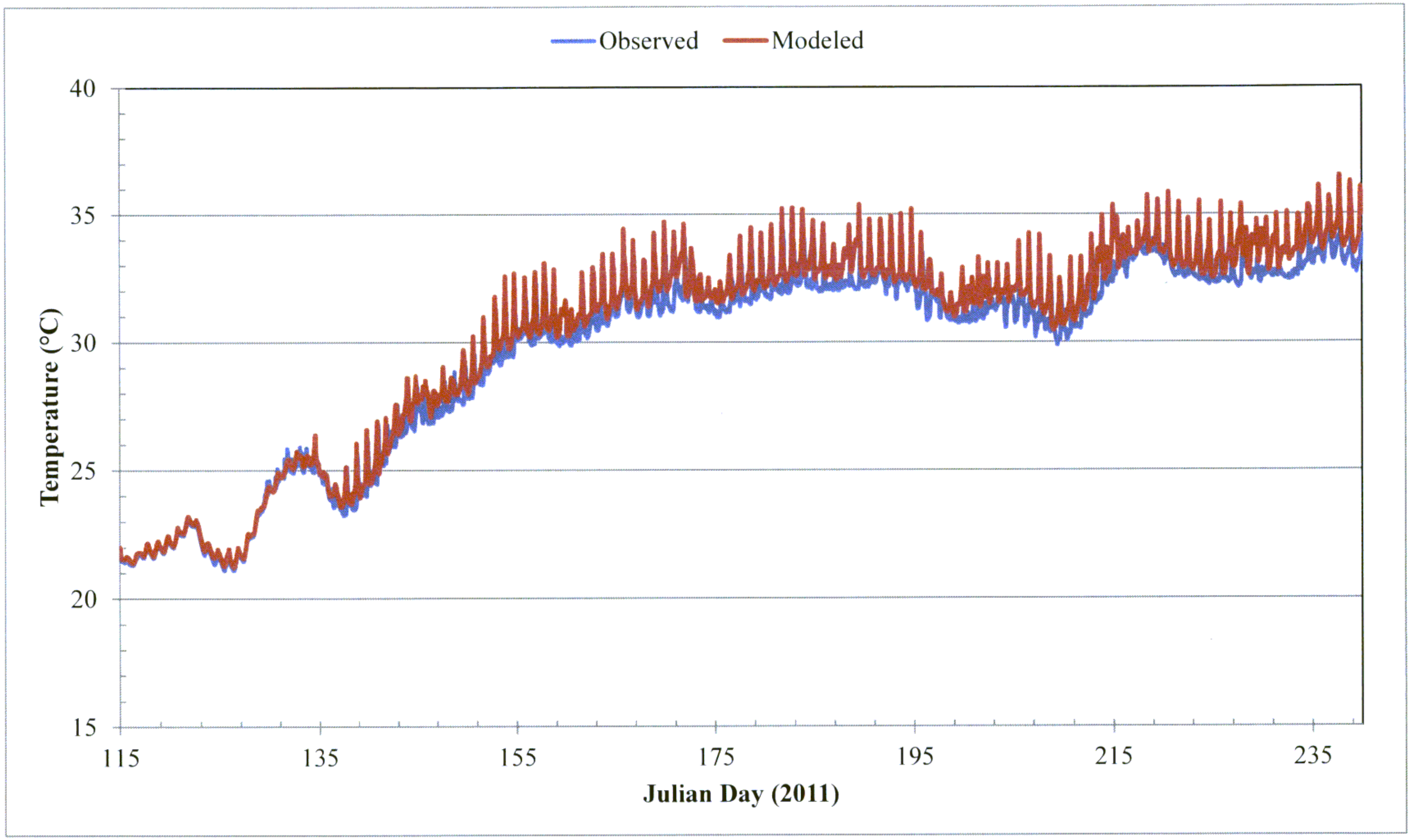


Figure 3.12 Time-series plot of observed and modeled water temperatures (°C) at the **deep depth station in the mixing zone** (BAMZ) from April 26 to August 29 (Julian day 115 to 240), 2011.

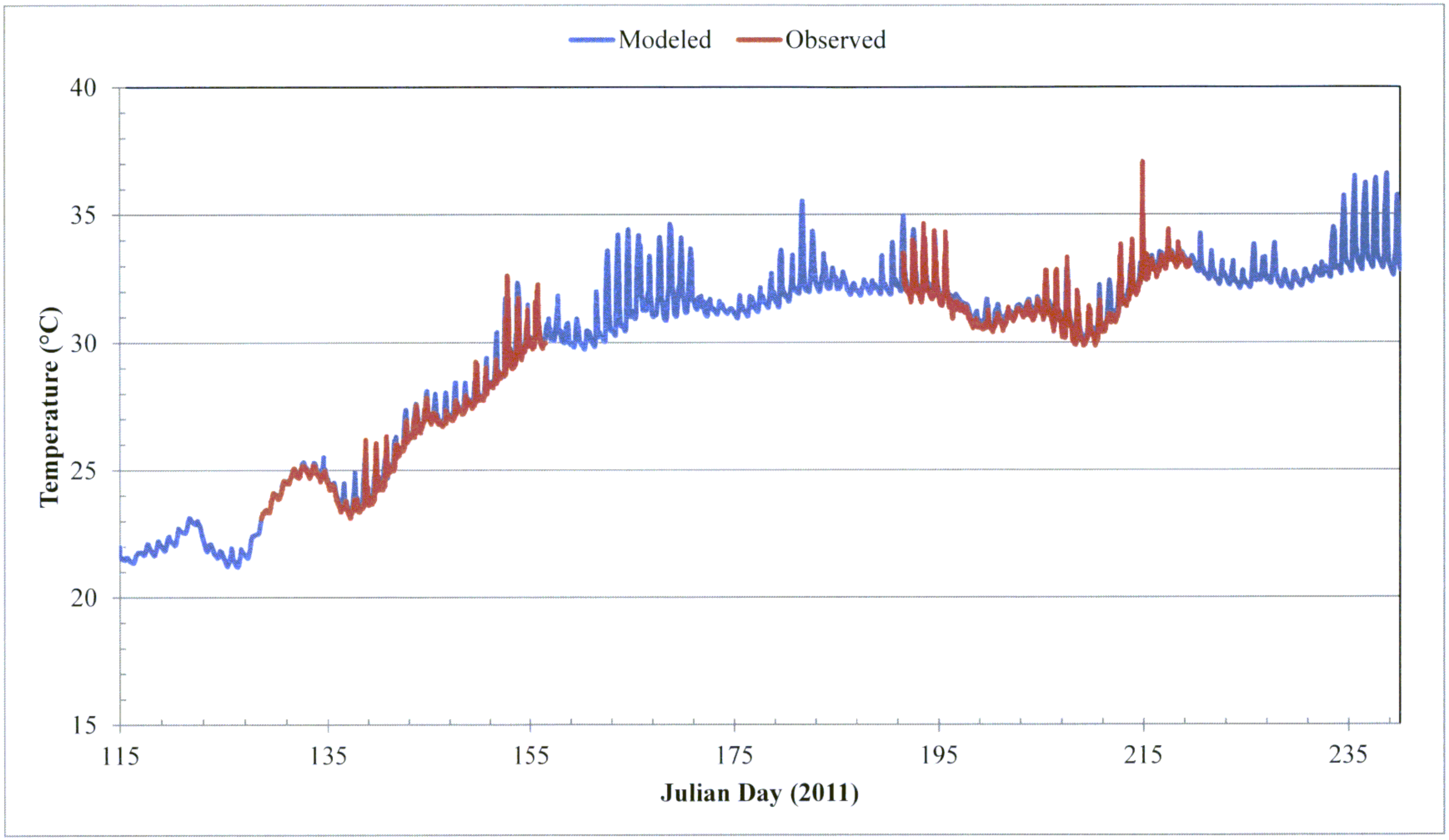


Figure 3.13 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 3** from April 26 to August 29 (Julian day 115 to 240), 2011.

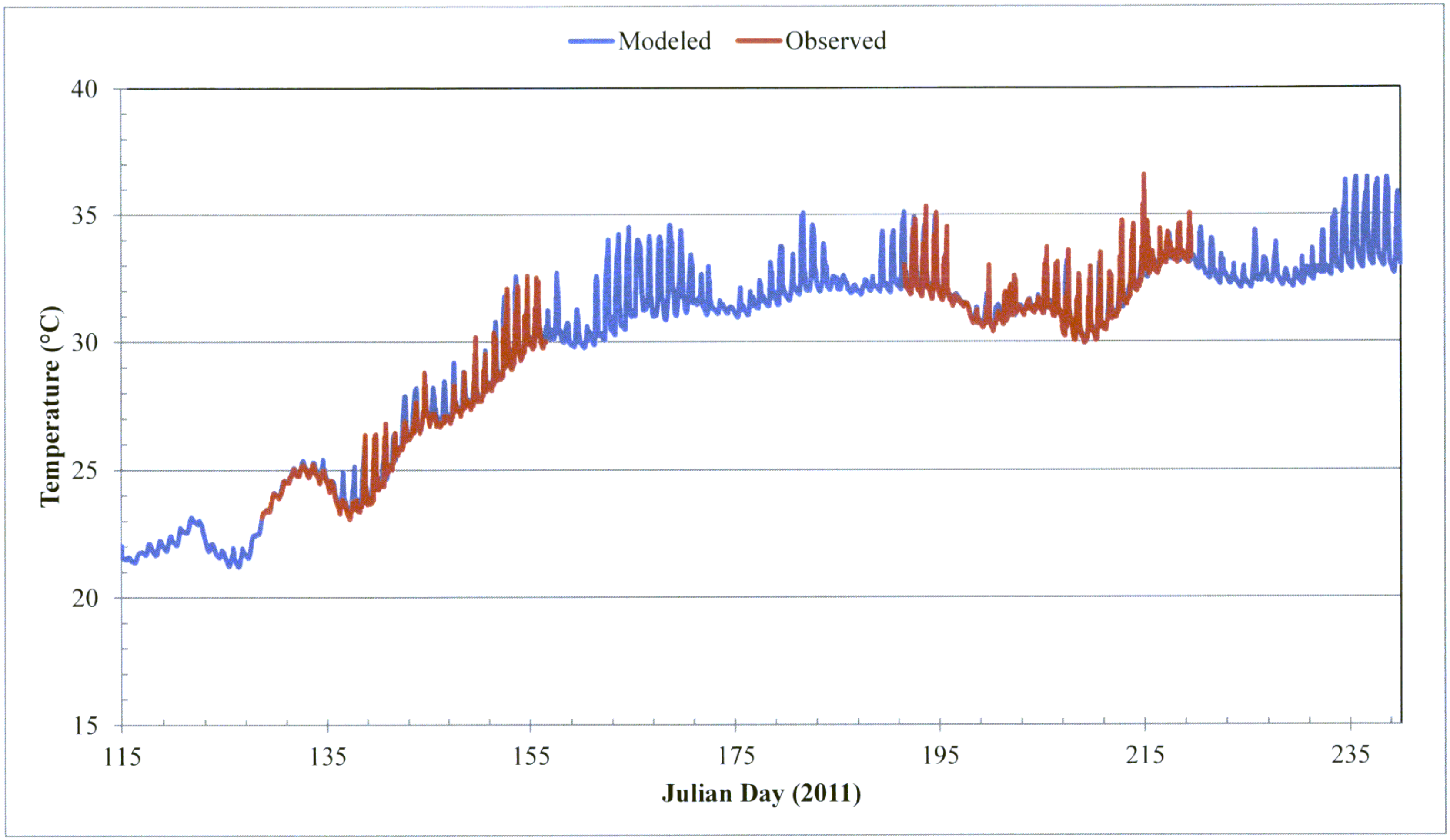


Figure 3.14 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 4** from April 26 to August 29 (Julian day 115 to 240), 2011.

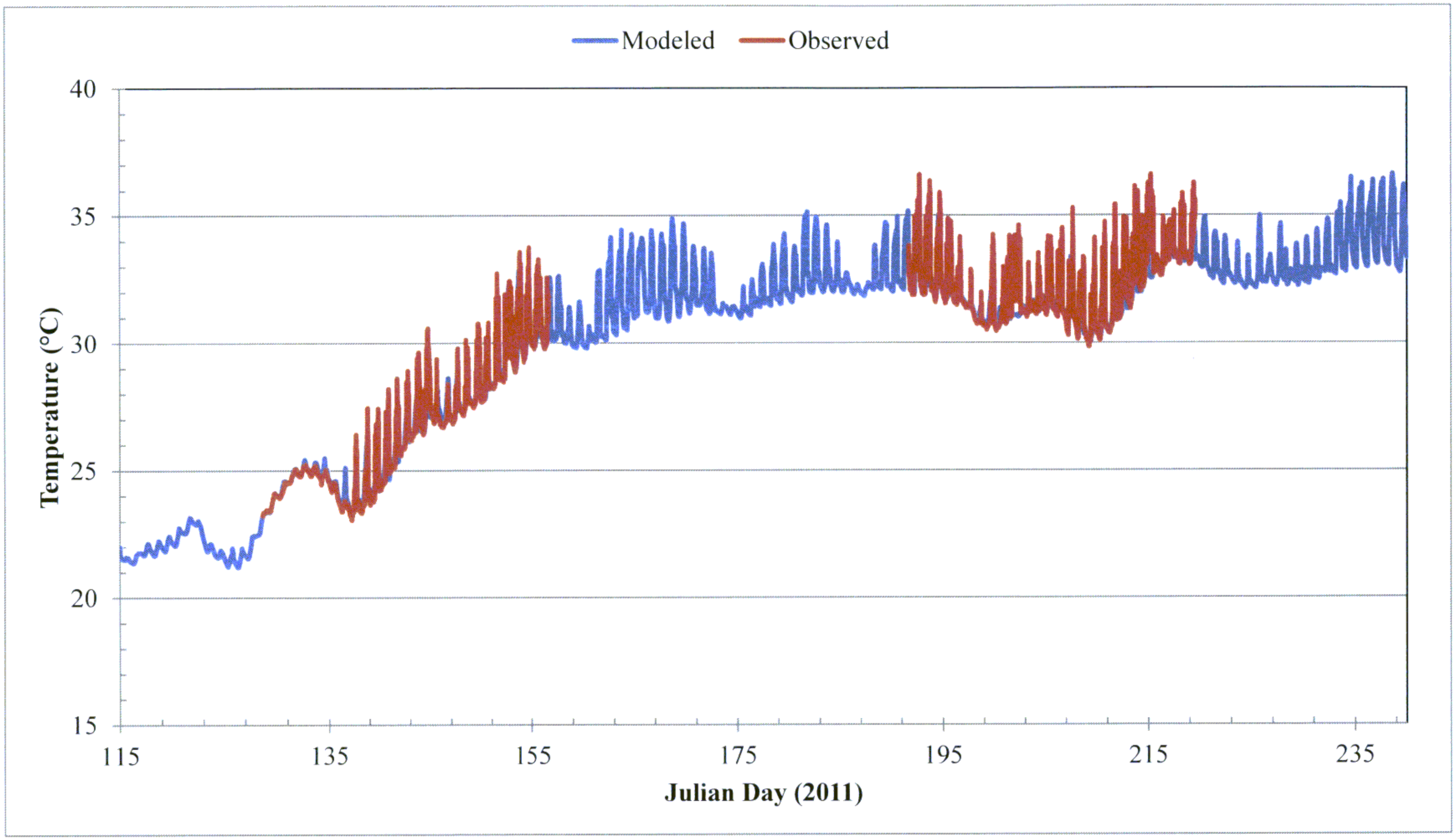


Figure 3.15 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 5** from April 26 to August 29 (Julian day 115 to 240), 2011.

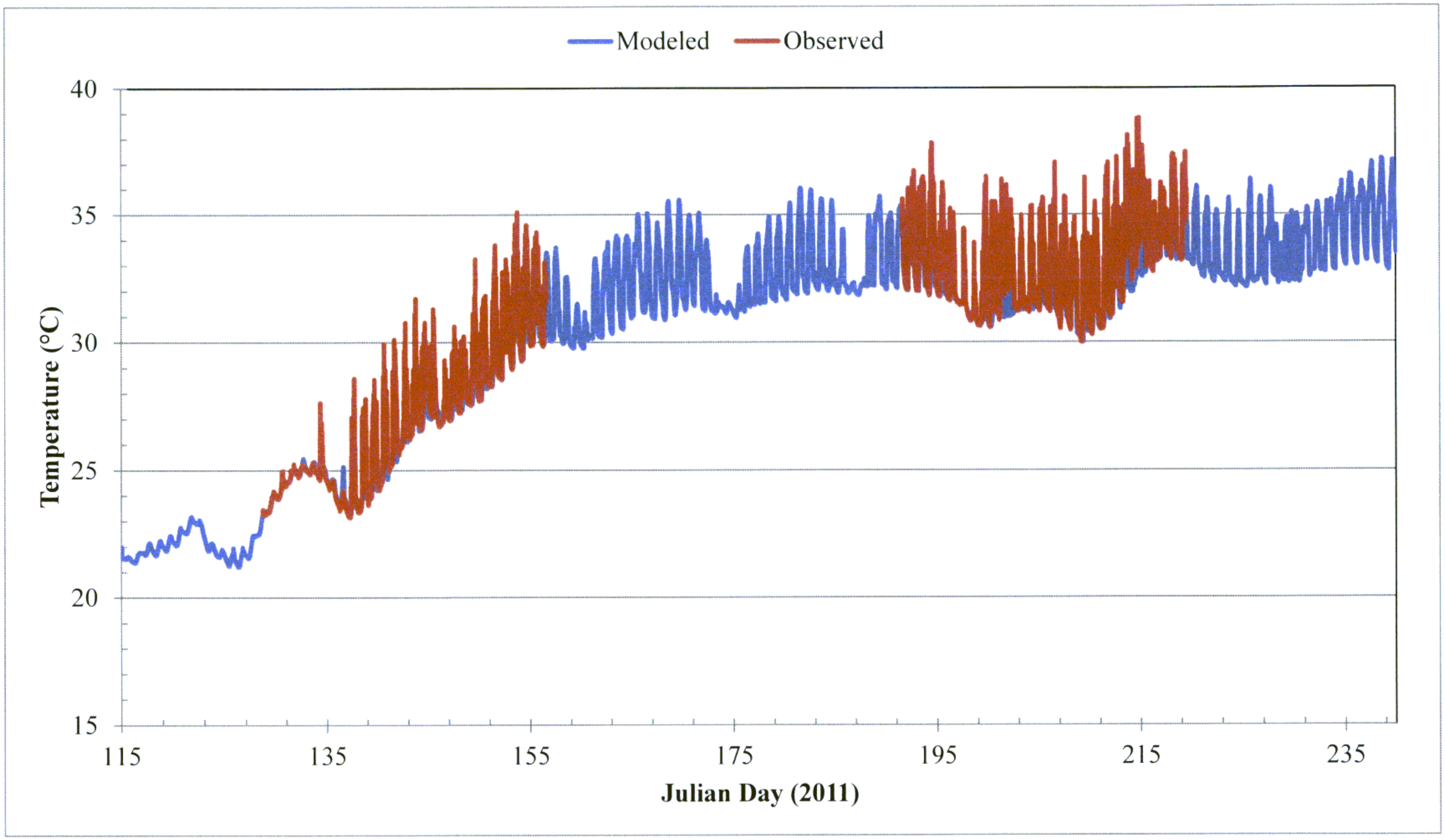


Figure 3.16 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 6** from April 26 to August 29 (Julian day 115 to 240), 2011.

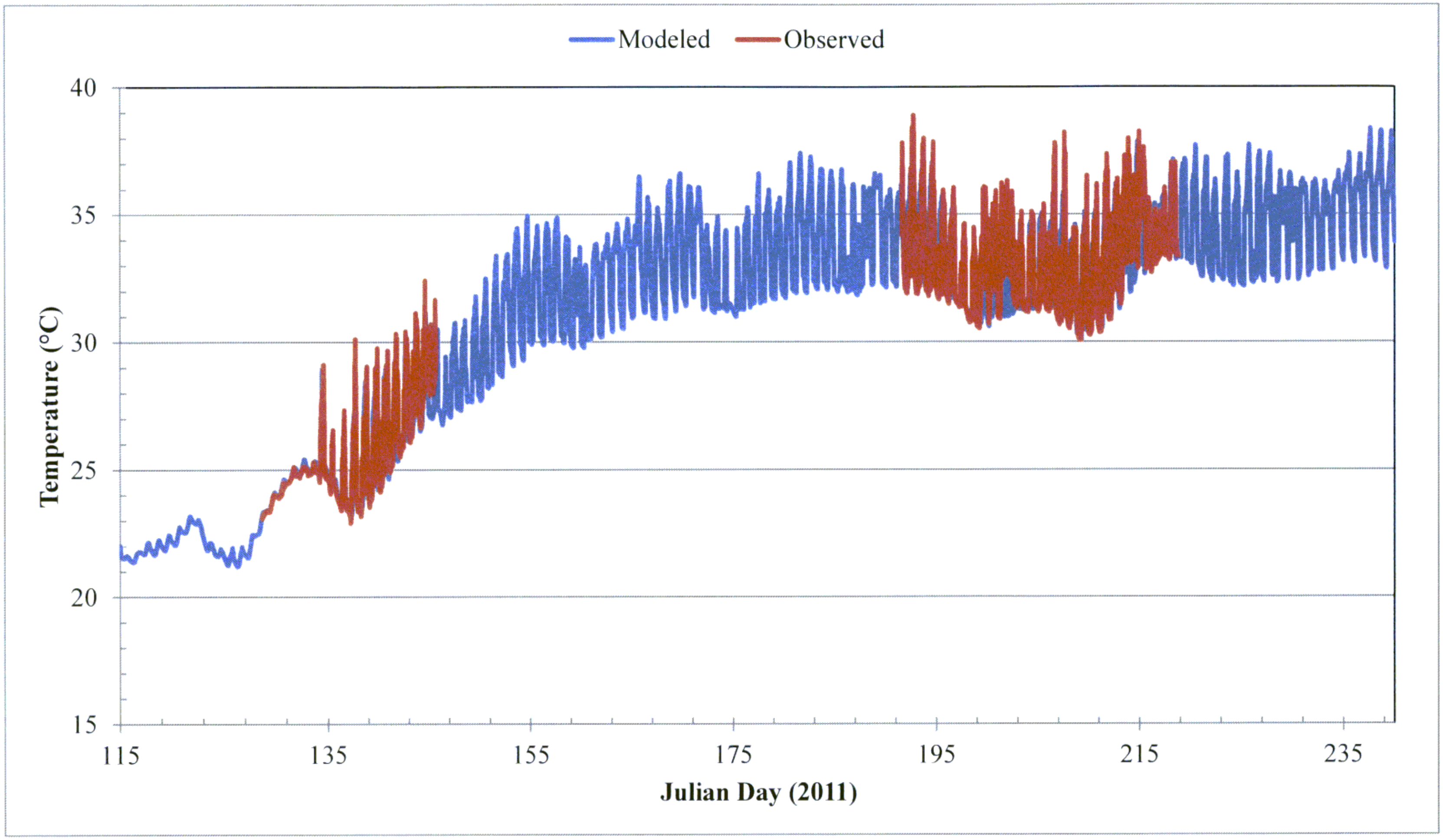


Figure 3.17 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 7** from April 26 to August 29 (Julian day 115 to 240), 2011.

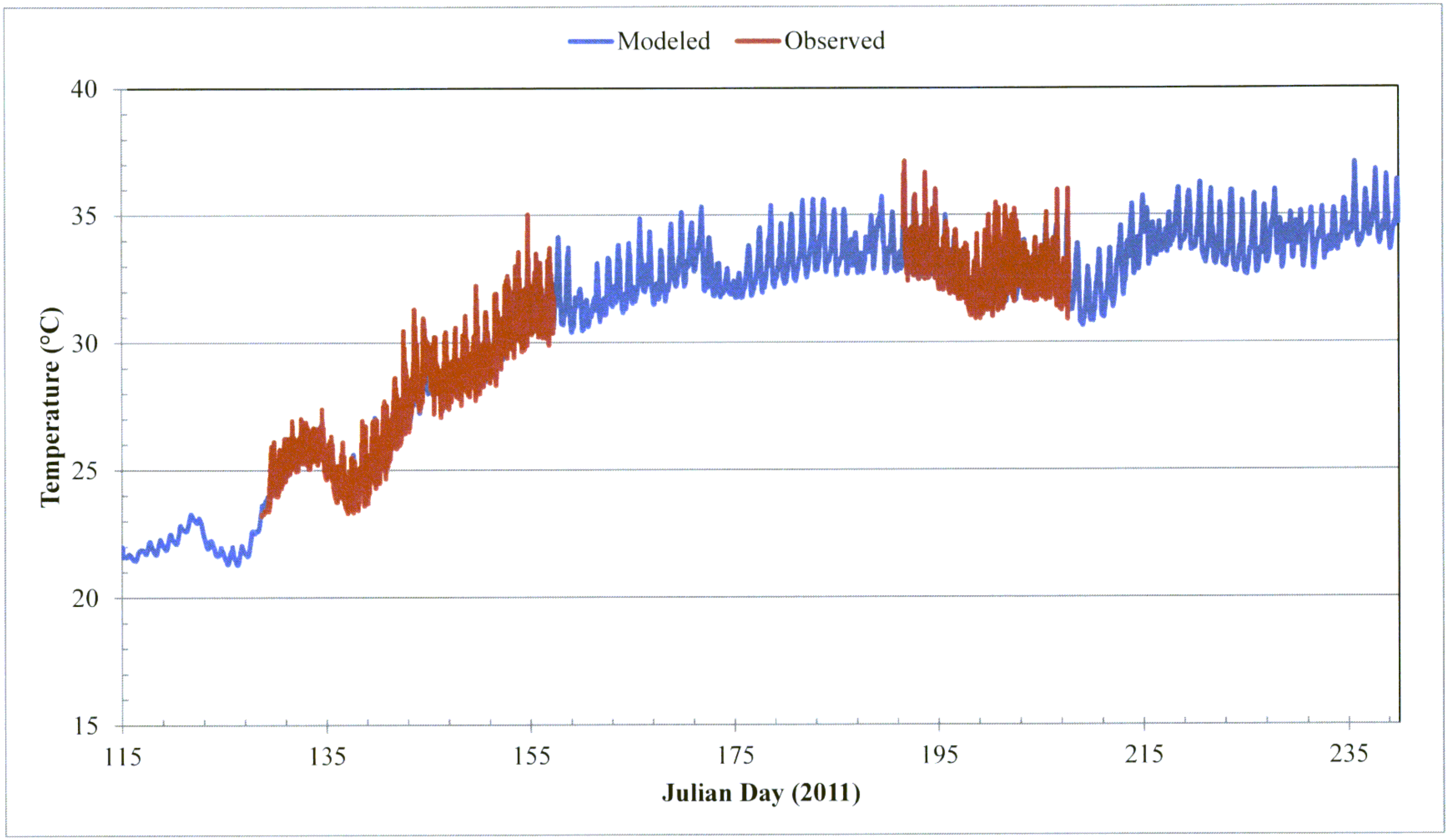


Figure 3.18 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 8** from April 26 to August 29 (Julian day 115 to 240), 2011.

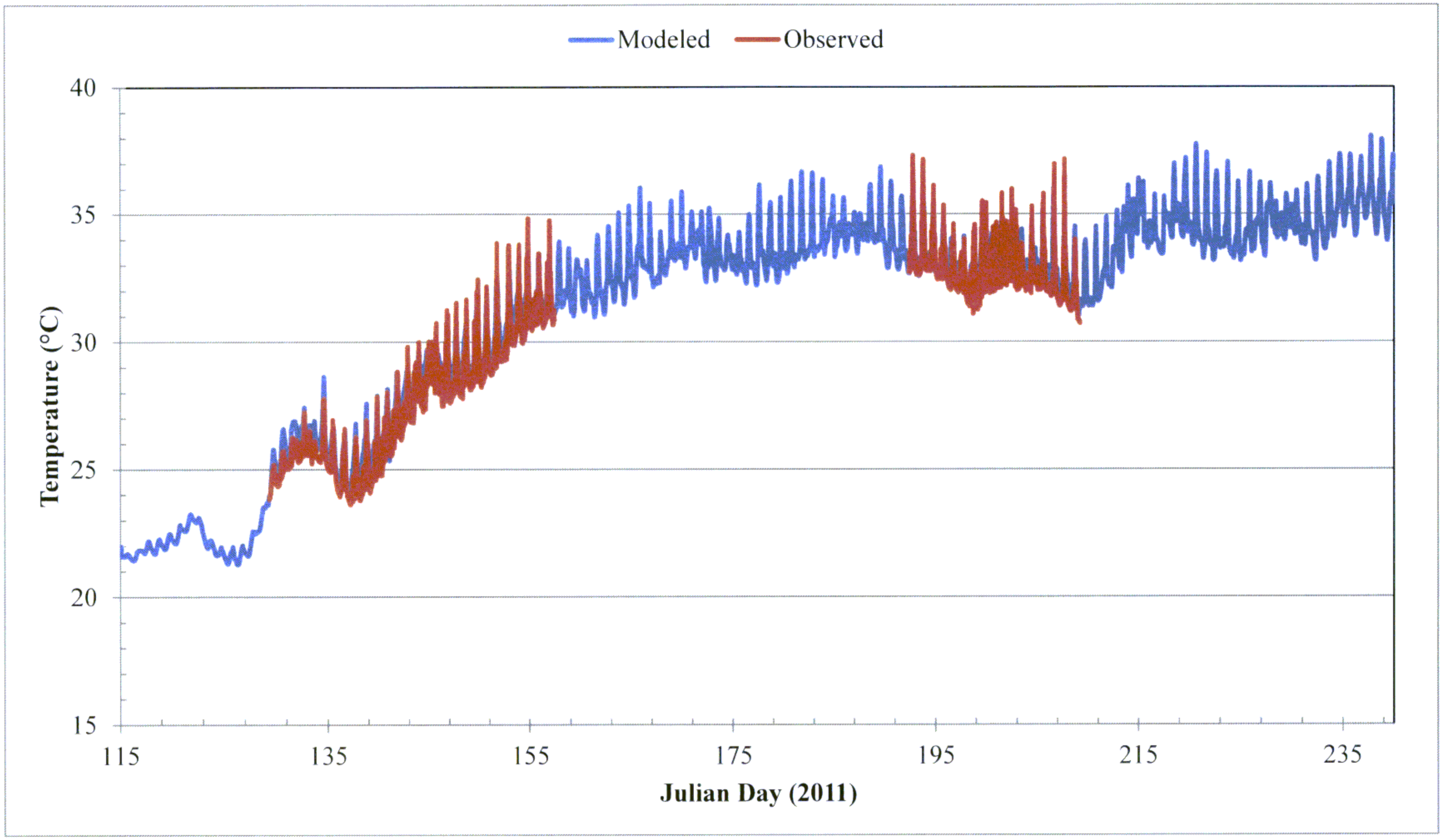


Figure 3.21 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 11** from April 26 to August 29 (Julian day 115 to 240), 2011.

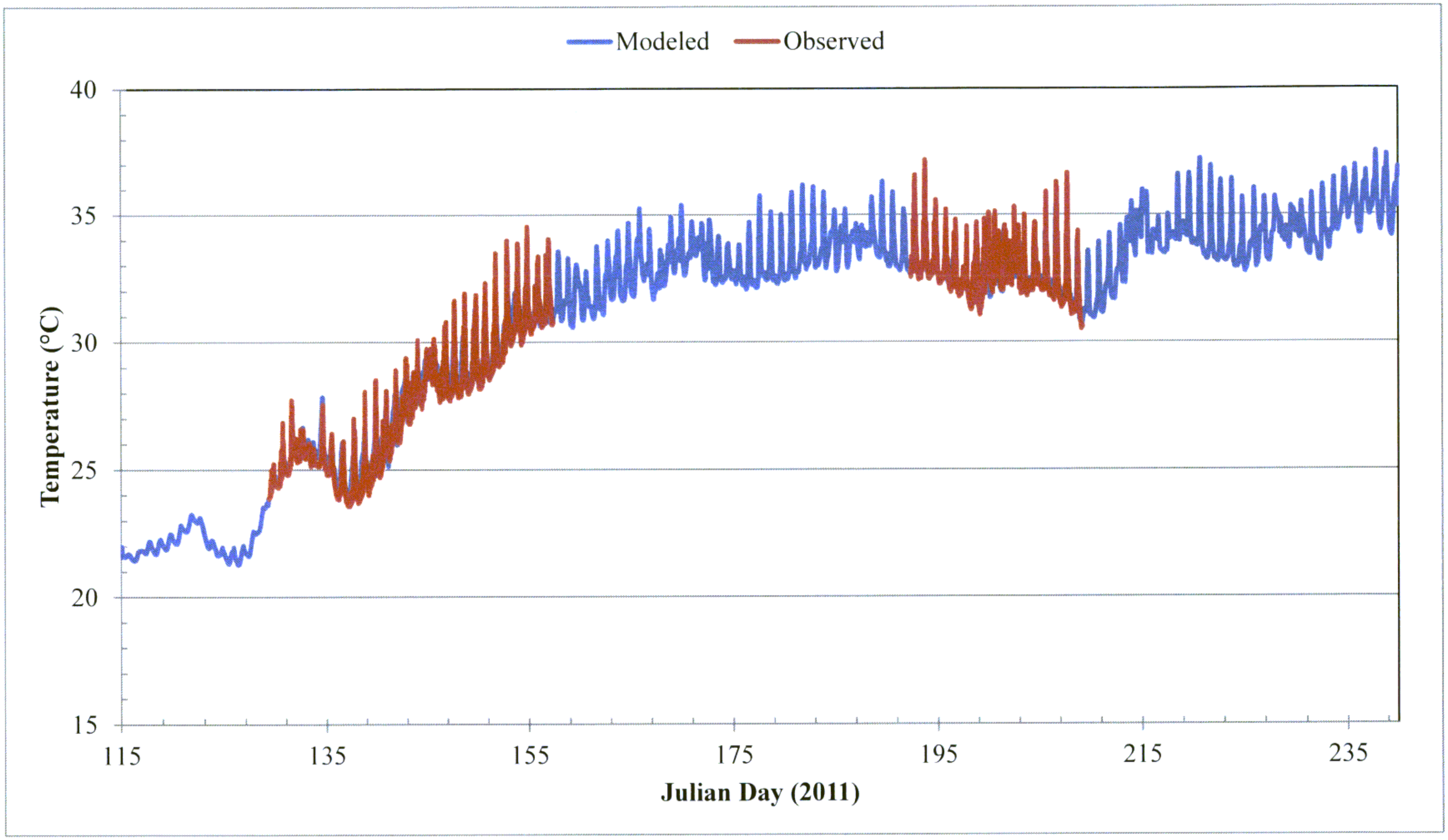


Figure 3.22 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 13** from April 26 to August 29 (Julian day 115 to 240), 2011.

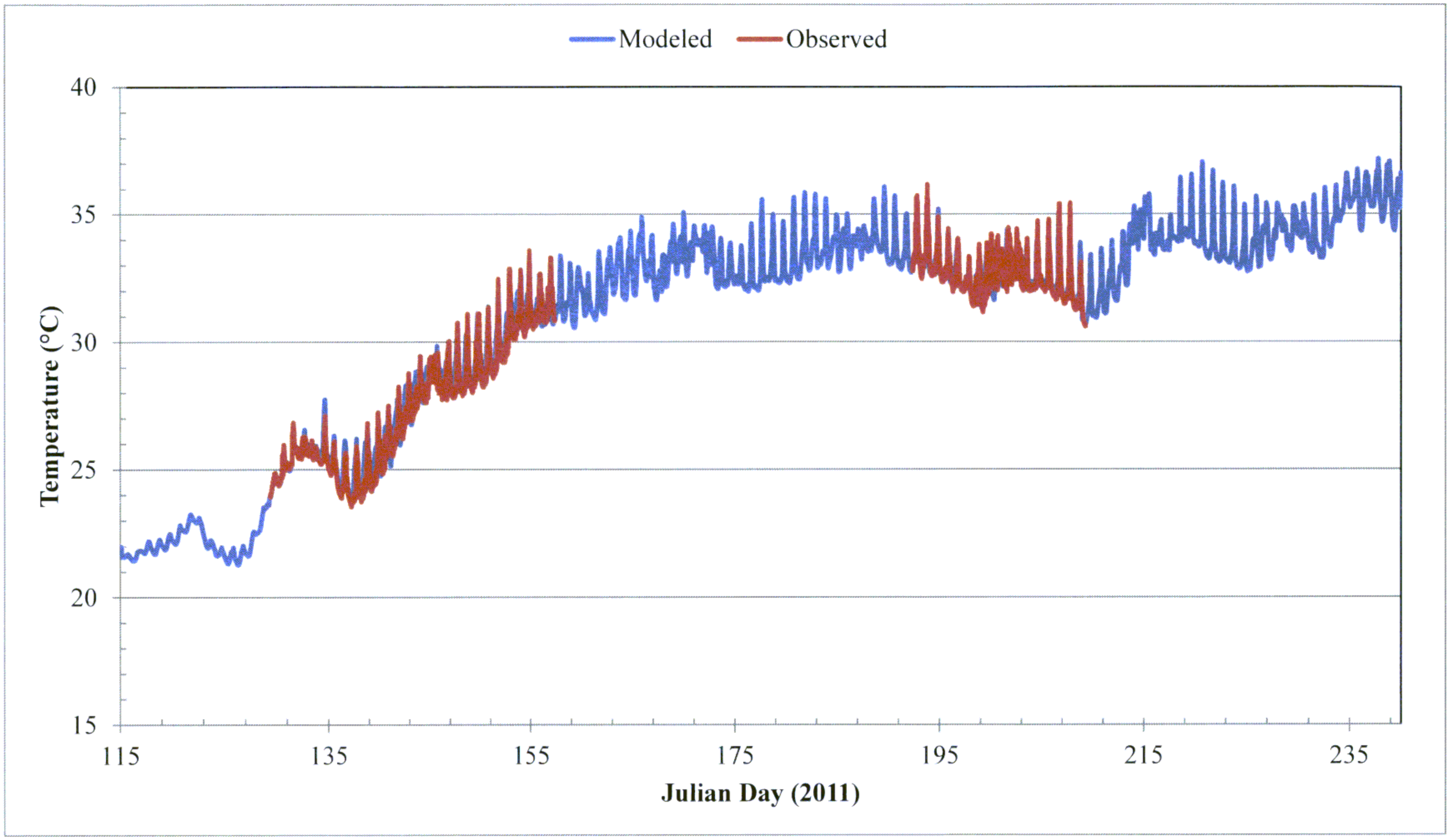


Figure 3.23 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 14** from April 26 to August 29 (Julian day 115 to 240), 2011.

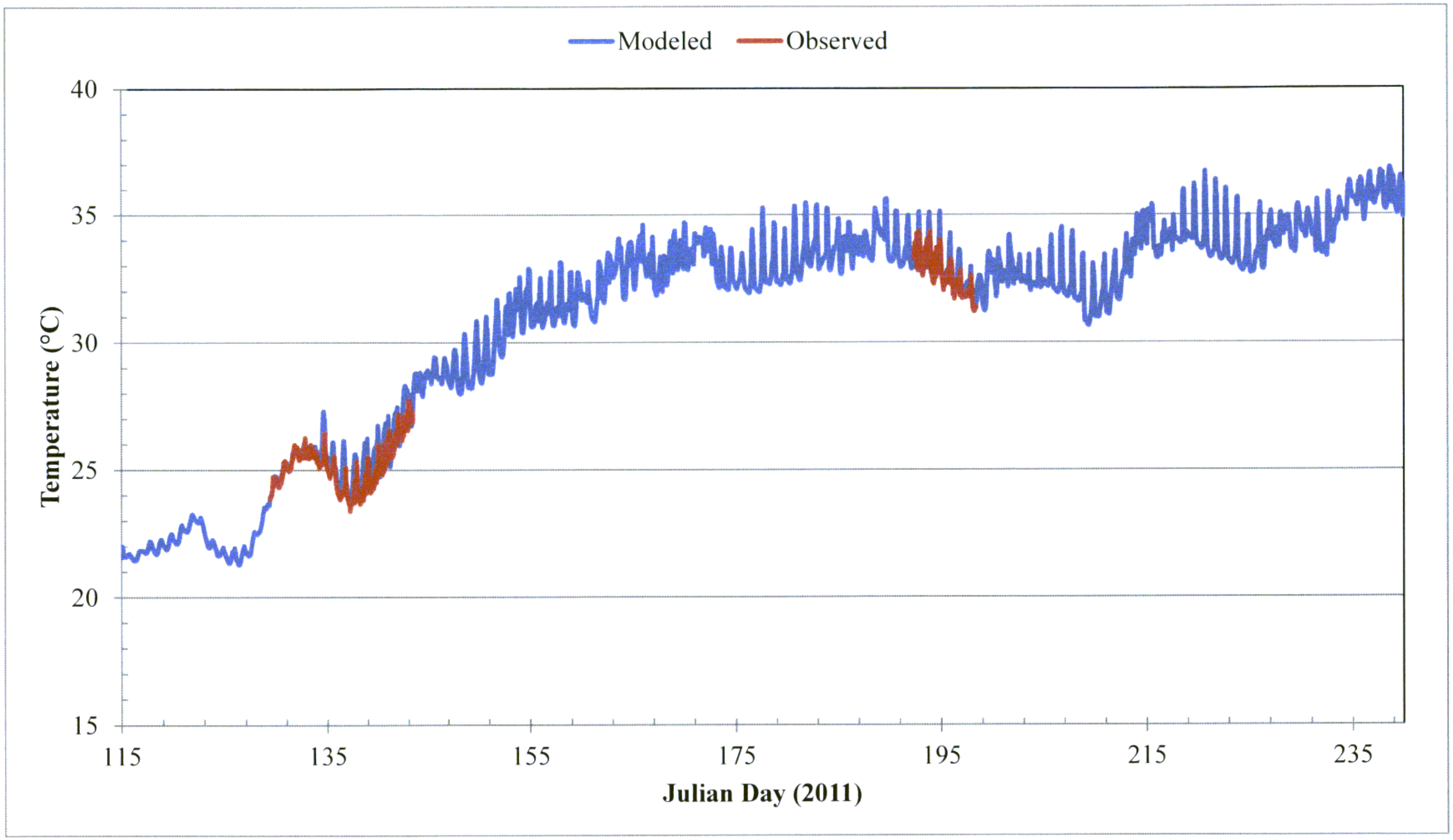


Figure 3.24 Time-series plot of observed and modeled water temperatures (°C) at the **shallow depth of the macroinvertebrate plate Station 16** from April 26 to August 29 (Julian day 115 to 240), 2011.

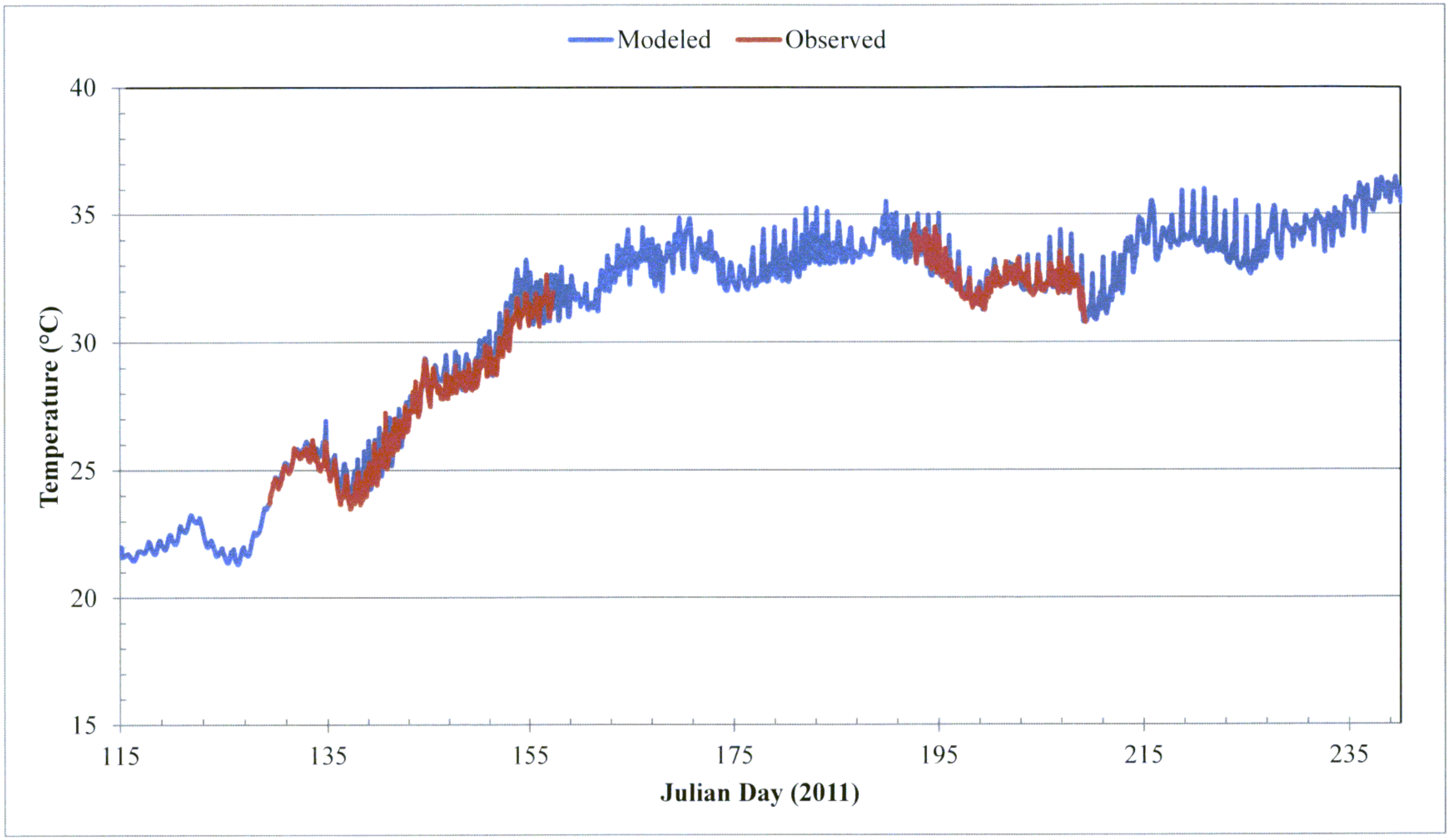


Figure 3.25 Time-series plot of observed and modeled water temperature (°C) at the **shallow depth of the macroinvertebrate plate Station 17** from April 26 to August 29 (Julian day 115 to 240), 2011.

3.5 Modeled Vertical Temperature Profiles

APC collected water temperature profiles at several monitoring stations at different hours and days in 2011 during several field trips. Observed (lines with squares) and simulated (red lines) vertical temperature profiles in the mixing zone of Plant Barry on 5/4, 5/17, 6/1, 6/14, 7/7, and 7/19, 2011 are shown on Figure 3.26. On each profile plot from Figure 3.26 to Figure 3.39, the horizontal dashed line near the top of each plot refers to the water surface elevation above mean sea level, and the light orange line near the bottom of each plot refers to the grid bottom elevation. Water surface elevations did vary with time because of the tidal effect from the downstream boundary. The bottom elevation for each grid was spatially averaged elevation based on available bathymetry. Each measured vertical profile was recorded at a specific point or location inside a horizontal grid; therefore, a few observed profiles had water depths greater than maximum water depths in corresponding horizontal grids (e.g., see Figure 3.27, on June 7, 2012; Figure 3.31, on August 10, 2012).

Observed and simulated vertical temperature profiles at the macroinvertebrate plate **stations 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, and 16** on 5/11, 6/7, 7/12, and 8/10, 2011, are shown in Figure 3.27 to Figure 3.38. Observed and simulated vertical temperature profiles at the macroinvertebrate plate **Station 17** on 5/11, 7/12, and 8/10, 2011, are shown on Figure 3.39.

There were two distinct layers during summer days (5/17, 6/1, 6/14, 7/7, and 7/19, 2011) from observed water temperature profiles at the mixing zone: warm water (about 3 to 5 ^{o}C warmer) at the top 3 m and cold water for the bottom 8 m (Figure 3.26), and the Barry EFDC model predicted temperature stratification reasonably well. Table 3.15 lists statistics for model performance evaluation on water temperature (^{o}C) vertical profiles at the macroinvertebrate plate monitoring stations (Station 3 – Station 17) and in the mixing zone (BAMZ) of Plant Barry. Modeled vertical profiles at stations 10, 11, 13, 14, 16, and 17 matched very well with observed ones. The root mean square errors or RMSEs ranged from 0.20 to 0.37 ^{o}C for stations 10 – 17 (Table 3.15). There are slightly large differences for some of the vertical temperature profiles for stations 3 – 9 (upstream or in the mixing zone). The RMSEs ranged from 0.75 to 1.25 ^{o}C for stations 3 – 9 (Table 3.15). Average differences (errors) between observed and modeled vertical temperature profiles ranged from -0.72 to 0.19 ^{o}C with an average value of -0.14 ^{o}C. The RMSE for vertical profiles in the mixing zone was 0.50 ^{o}C (Figure 3.26 and Table 3.15). Overall, simulated vertical profiles matched reasonably well with observed ones on these days at all monitoring stations.

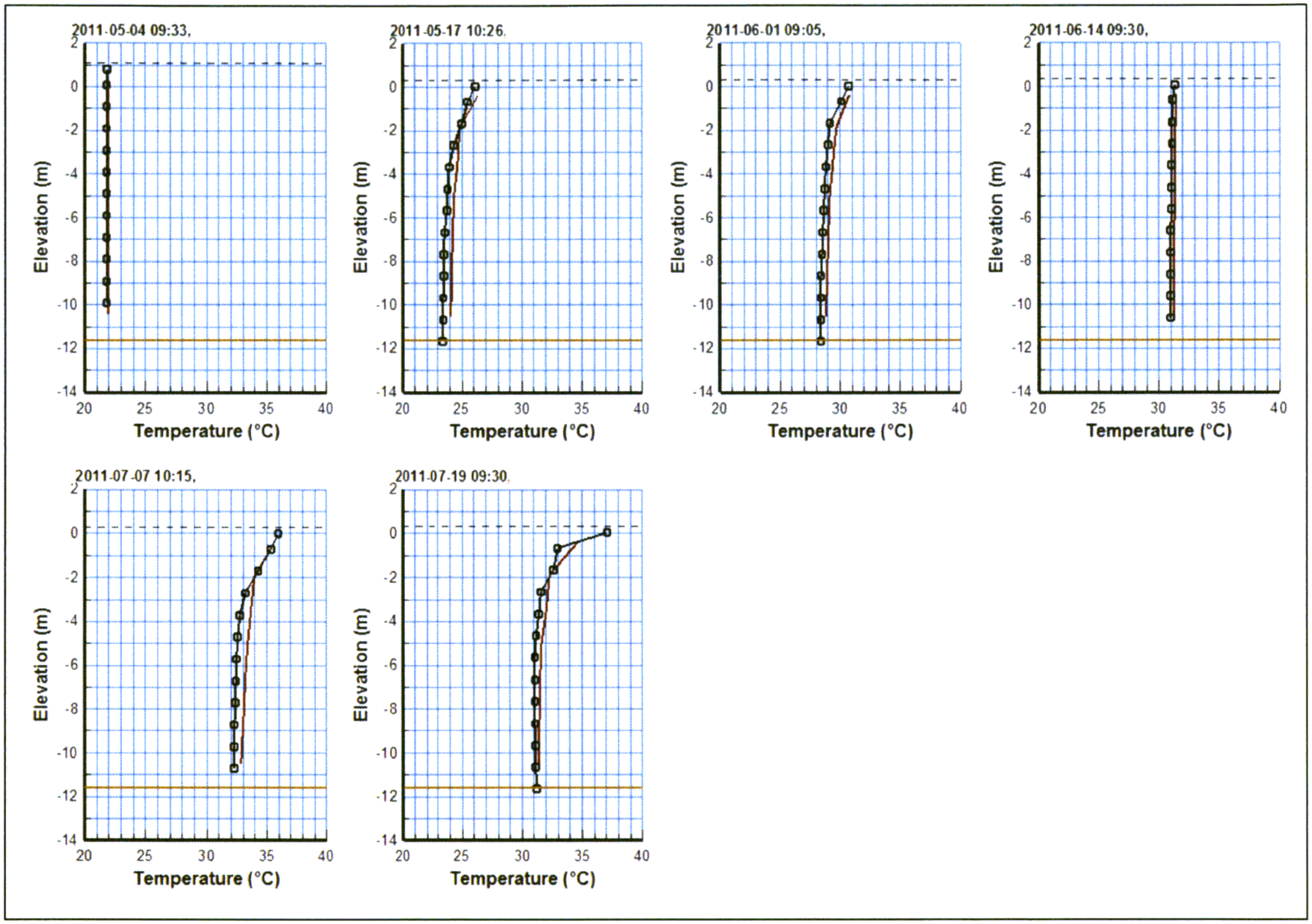


Figure 3.26 Observed (lines with squares) and simulated (red lines) vertical temperature profiles in the **mixing zone (grid 49, 138)** of Plant Barry on 5/4, 5/17, 6/1, 6/14, 7/7, and 7/19, 2011.

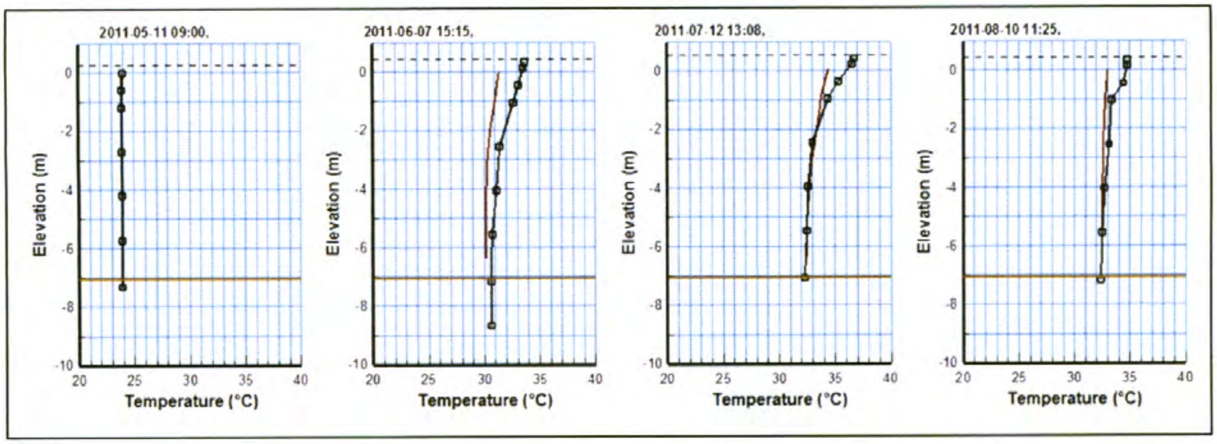


Figure 3.27 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 3** on 5/11, 6/7, 7/12, and 8/10, 2011.

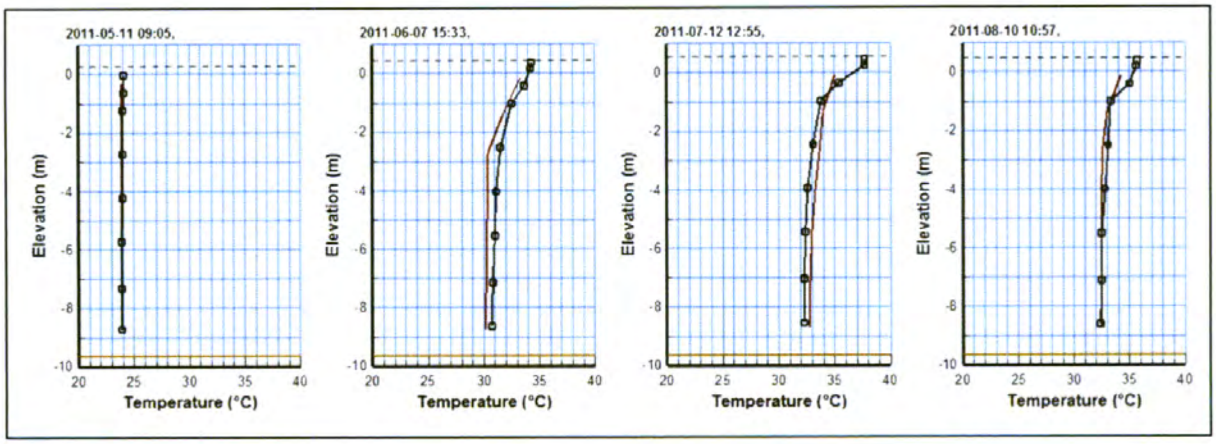


Figure 3.28 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 4** on 5/11, 6/7, 7/12, and 8/10, 2011.

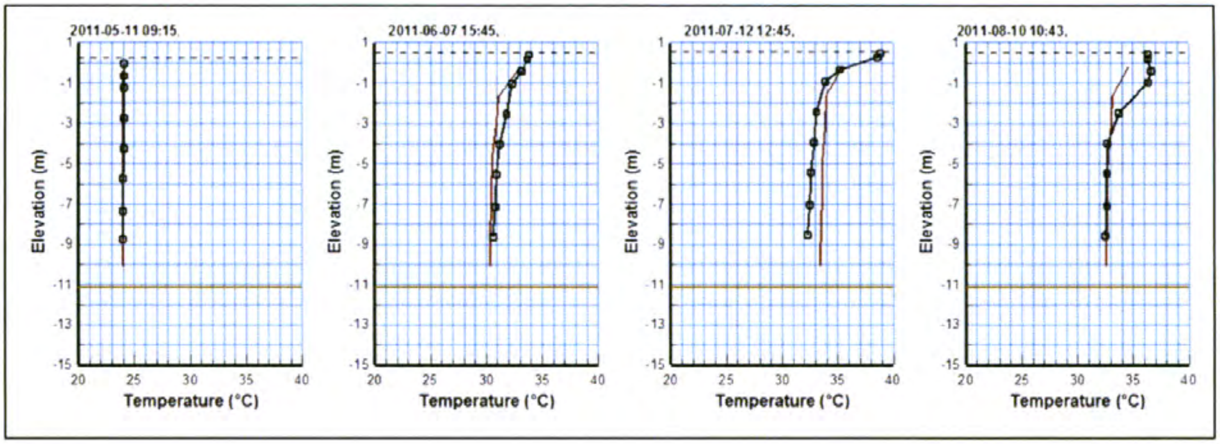


Figure 3.29 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 5** on 5/11, 6/7, 7/12, and 8/10, 2011.

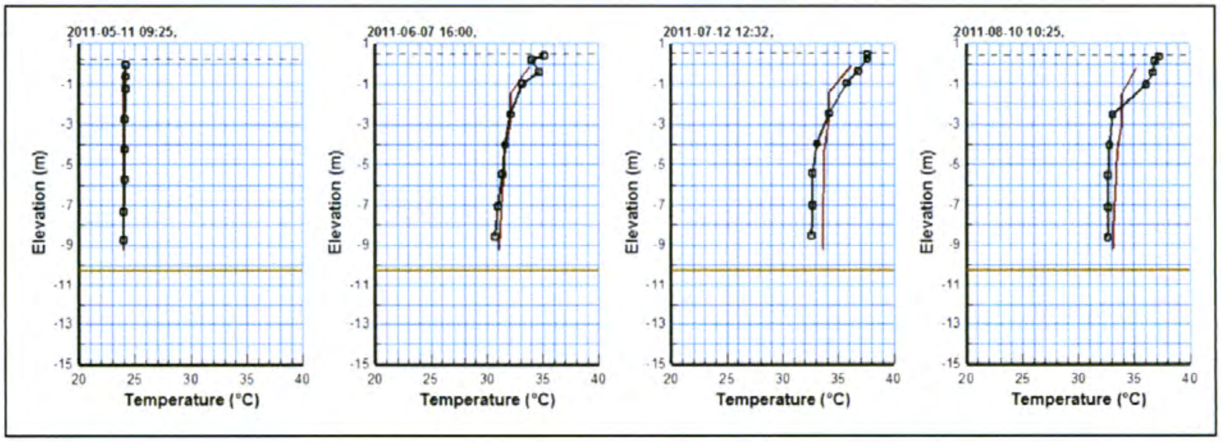


Figure 3.30 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 6** on 5/11, 6/7, 7/12, and 8/10, 2011.

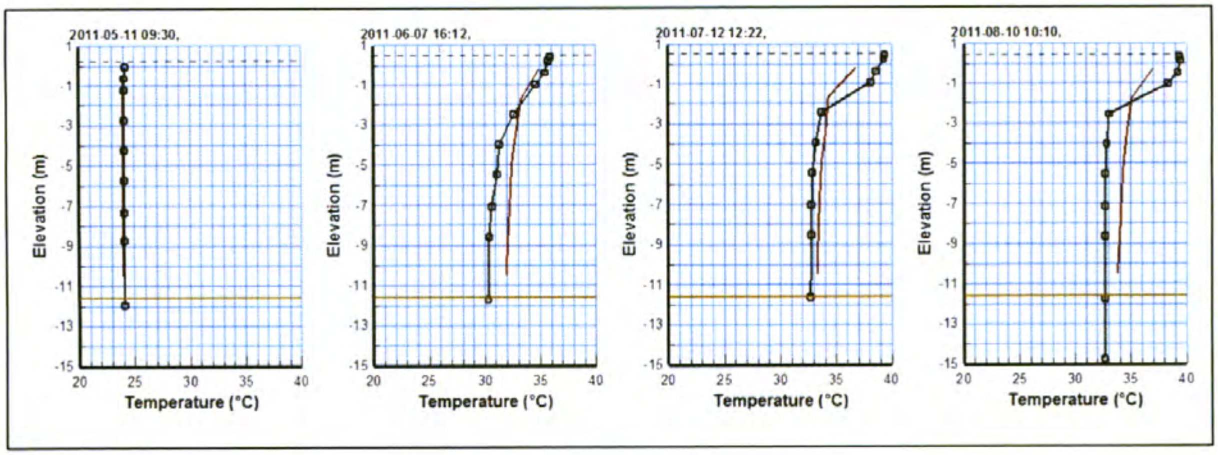


Figure 3.31 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 7** on 5/11, 6/7, 7/12, and 8/10, 2011.

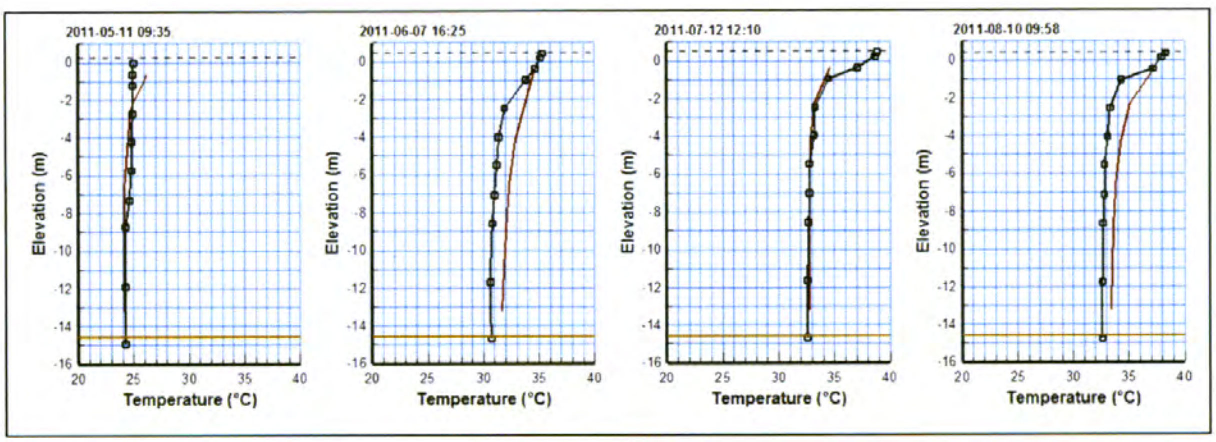


Figure 3.32 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 8** on 5/11, 6/7, 7/12, and 8/10, 2011.

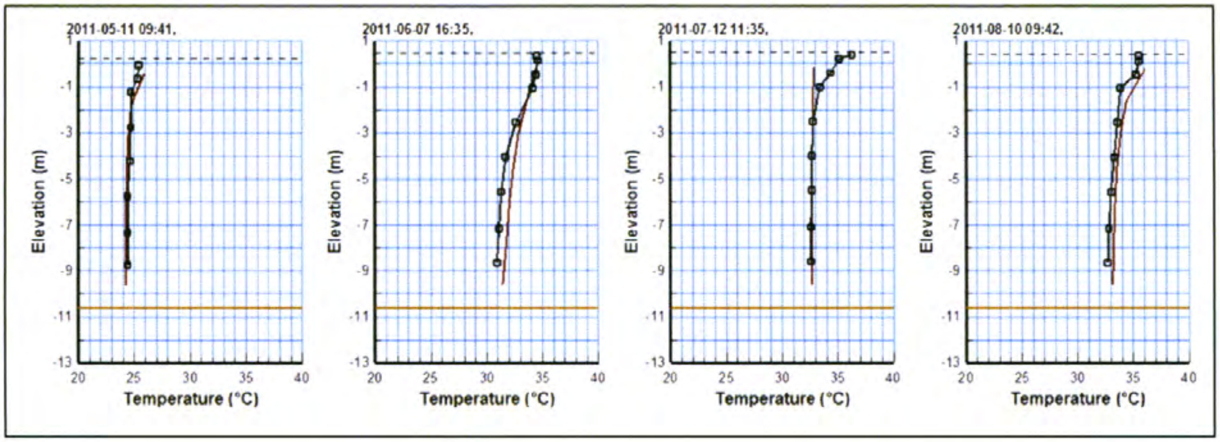


Figure 3.33 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 9** on 5/11, 6/7, 7/12, and 8/10, 2011.

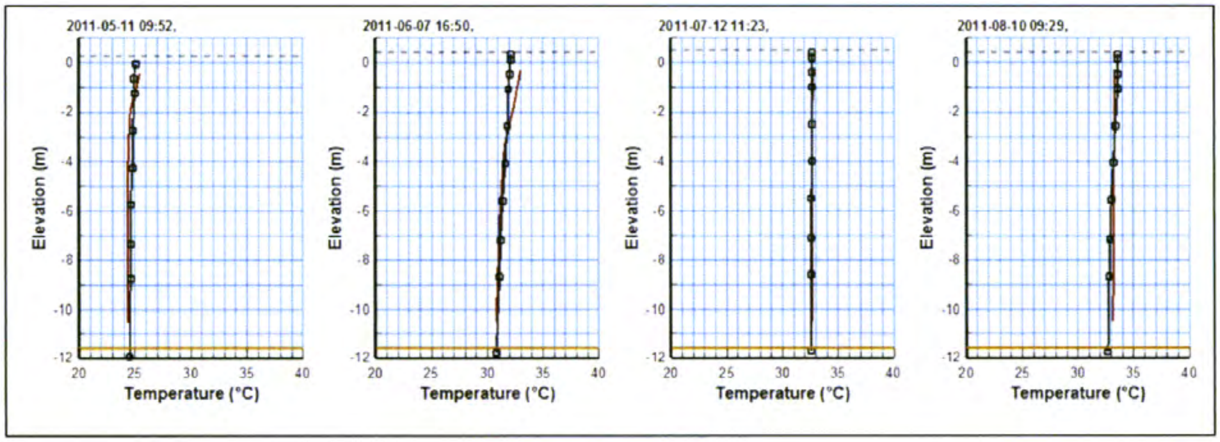


Figure 3.34 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 10** on 5/11, 6/7, 7/12, and 8/10, 2011.

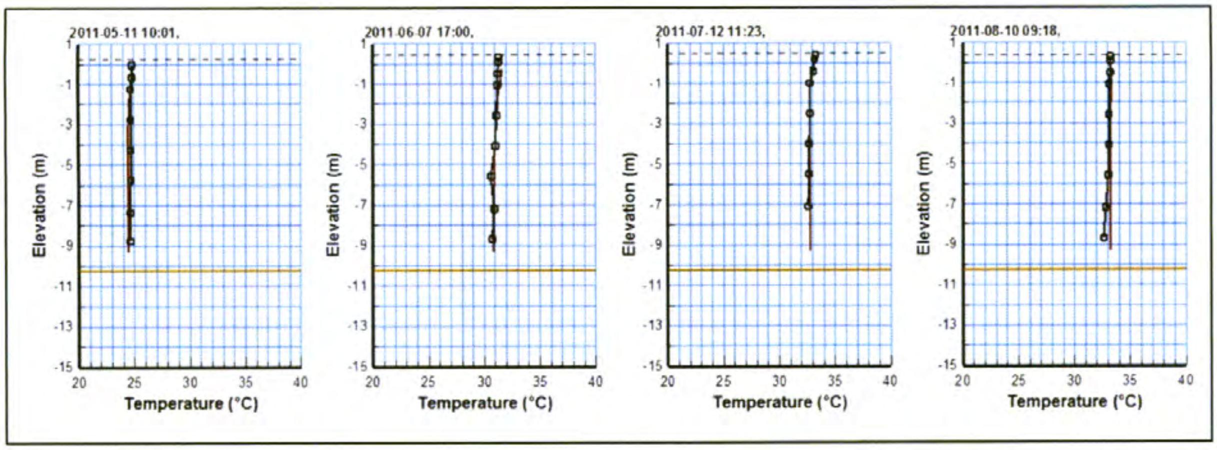


Figure 3.35 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 11** on 5/11, 6/7, 7/12, and 8/10, 2011.

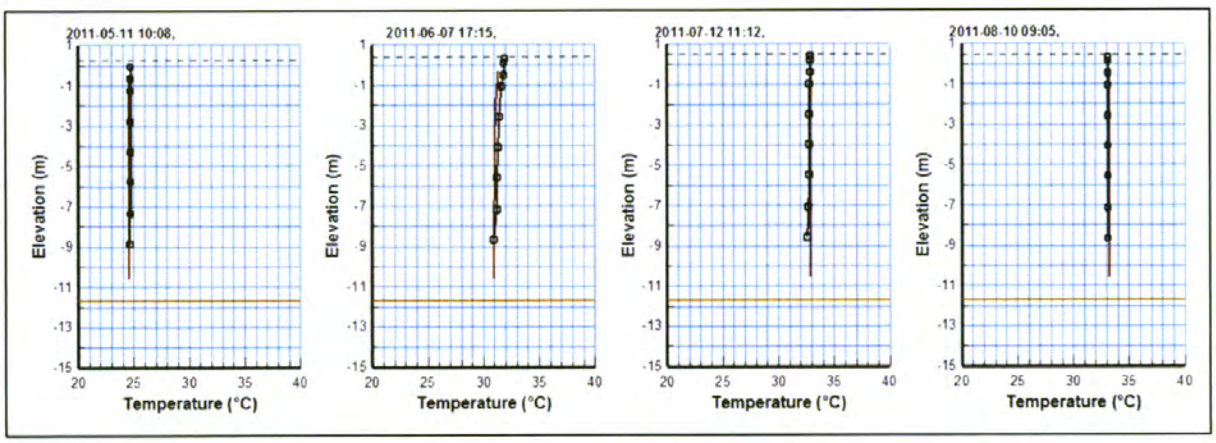


Figure 3.36 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 13** on 5/11, 6/7, 7/12, and 8/10, 2011.

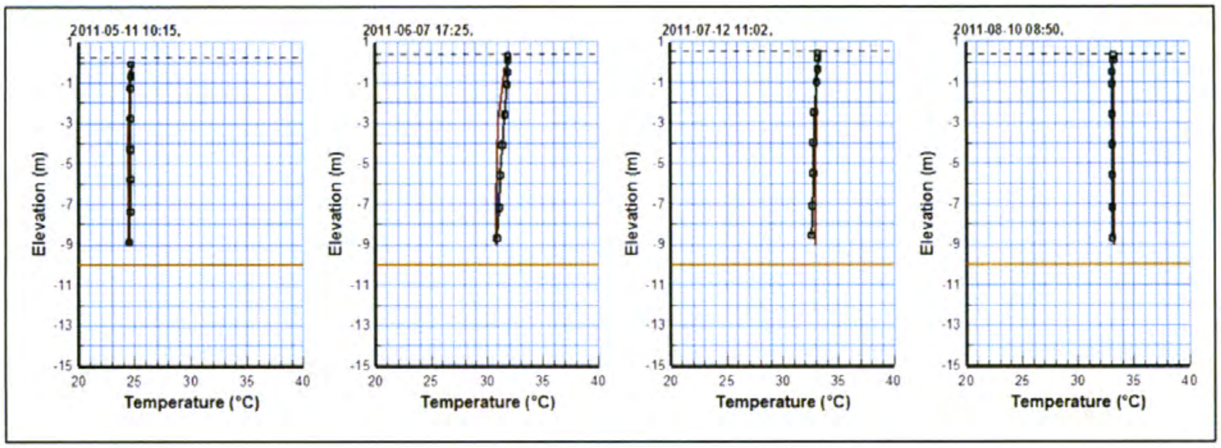


Figure 3.37 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 14** on 5/11, 6/7, 7/12, and 8/10, 2011.

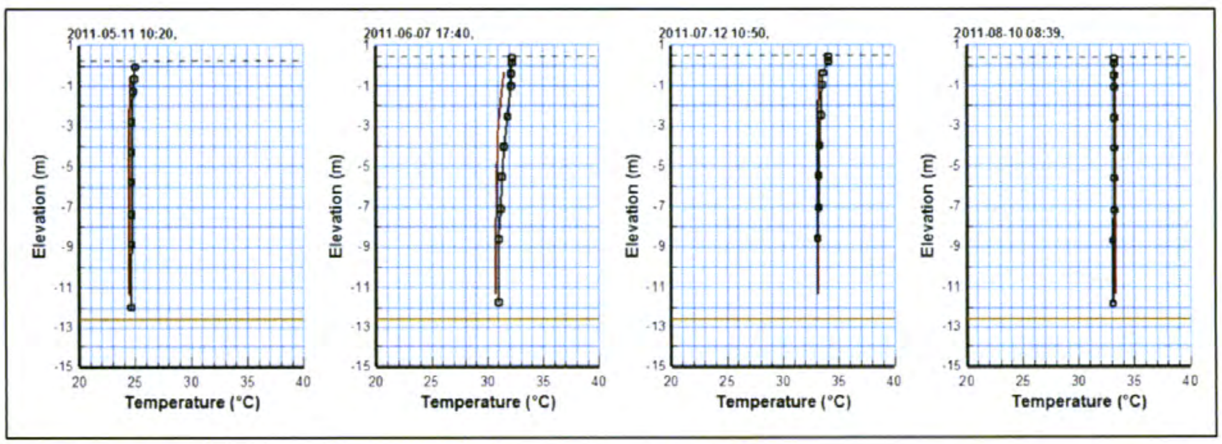


Figure 3.38 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 16** on 5/11, 6/7, 7/12, and 8/10, 2011.

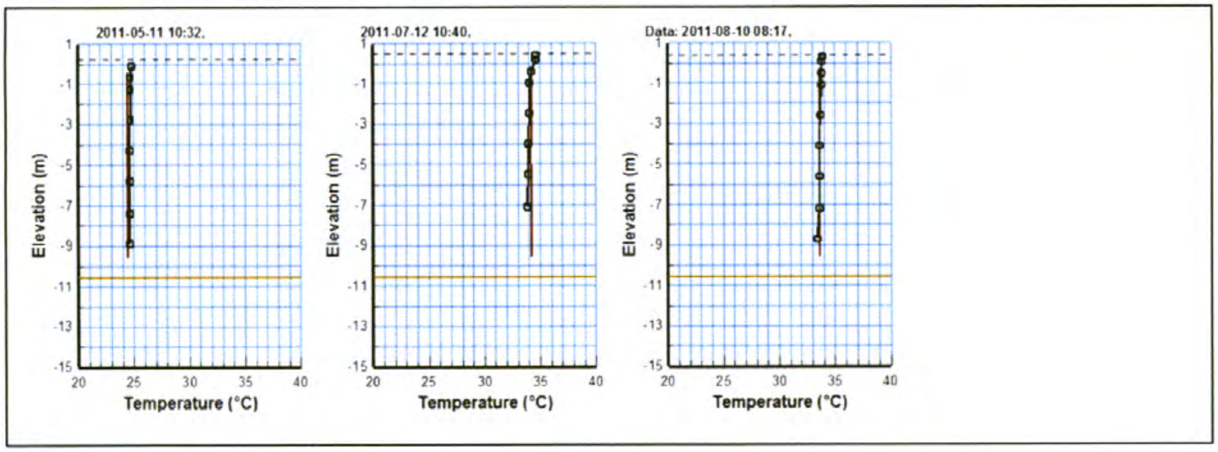


Figure 3.39 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 17** on 5/11, 7/12, and 8/10, 2011.

Table 3.15 Statistics for model performance evaluation on water temperature (^oC) vertical profile at the macroinvertebrate plate monitoring stations (Station 3 – Station 17) and in the mixing zone (BAMZ) of Plant Barry.

Station ID	Parameter	Profile Range Dates	# Pairs	RMSE	Average Error	Average Absolute Error
Station 3	Temperature (°C)	11-May-2011 to 10-Aug-2011	32	0.972	-0.72	0.765
Station 4	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.753	-0.394	0.600
Station 5	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.968	-0.409	0.773
Station 6	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.798	-0.233	0.696
Station 7	Temperature (°C)	11-May-2011 to 10-Aug-2011	40	1.247	-0.039	1.142
Station 8	Temperature (°C)	11-May-2011 to 10-Aug-2011	44	1.240	0.190	0.928
Station 9	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.748	0.034	0.557
Station 10	Temperature (°C)	11-May-2011 to 10-Aug-2011	39	0.310	0.080	0.262
Station 11	Temperature (°C)	11-May-2011 to 10-Aug-2011	34	0.234	0.067	0.191
Station 13	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.211	-0.053	0.198
Station 14	Temperature (°C)	11-May-2011 to 10-Aug-2011	35	0.202	-0.048	0.184
Station 16	Temperature (°C)	11-May-2011 to 10-Aug-2011	38	0.367	-0.227	0.325
Station 17	Temperature (°C)	11-May-2011 to 10-Aug-2011	25	0.219	-0.084	0.194
BAMZ	Temperature (°C)	04-May-2011 to 19-Jul-2011	75	0.503	0.364	0.441

3.6 Modeled Velocities and Discharges near the Downstream Boundary

APC deployed Acoustic Doppler Current Profiler (ADCP) instruments twice (June and August) in 2011 in the upstream and near the downstream boundary locations of the Barry EFDC model. The flow boundary condition (*i.e.*, time-series data of flow rates) was used in the upstream boundary of the Barry EFDC model; therefore, we couldn't use ADCP data collected in the upstream boundary for the flow calibration. However, the elevation boundary condition (*i.e.*, time-series data of water surface elevations) was used in the downstream boundary (BADS) of the Barry EFDC model, and therefore we can use the flow data and velocity data measured by ADCP to calibrate the model or compare predicted velocities and discharges with observed ones.

The ADCP data were measured in June and August in 2011. In June 2011, the data near the downstream boundary (Figure 3.40) were measured from June 29, 9:20 AM, to June 30, 9:05 AM (approximately one day or 24-hour period). The ADCP data provided by APC were processed using a VMS user interface module. Measured discharges were derived from ADCP velocity measurements. The flow rates (discharges) measured by ADCP at BADS ranged from -185.4 m^3/s to 592.2 m^3/s, with an average flow of 213.7 m^3/s (standard deviation of 259.8 m^3/s, median value of 269.2 m^3/s) from June 29 to June 30, 2011. The negative flow rate represents the flow coming from the downstream towards upstream due to the tidal effect and the positive flow rate represents the flow from the upstream towards downstream and connecting to Mobile Bay. The modeled discharges (Figure 3.41) over the cross section at different simulation times are outputs from the EFDC Explorer, which are obtained by integration of velocity distribution over a cross section using velocities computed by the EFDC model. Overall, modeled velocities (cross sectional averages) and discharges matched well with measured ones from June 29 to June 30, 2011 (Figure 3.41).

In August 2011, ADCP instruments were deployed from August 24, 8:54 AM, to August 25, 3:57 AM, in the both upstream and downstream boundary locations. The measured discharges ranged from -258.6 m^3/s to 588.2 m^3/s, with an average flow of 207.5 m^3/s (standard deviation of 266.5 m^3/s, median values of 244.6 m^3/s) in above time period. Modeled discharges from Julian day 234 to 237 (August 23 00:00 to August 26 00:00) were plotted against the observed ADCP data. Overall, the EFDC model predicted the pattern (the rise and fall) of the flow hydrograph reasonably well (Figure 3.42).

Velocity measurements in June and August were compared with modeled velocities. For the velocity comparison, modeled velocities were extracted at the center grid (where the maximum depth is) in the cross section that is just one row above the downstream boundary of the Barry EFDC model. Visually, modeled velocities matched reasonably well with observed velocities during June 29–30, and August 24–25, 2011 (Figure 3.41 and Figure 3.42).

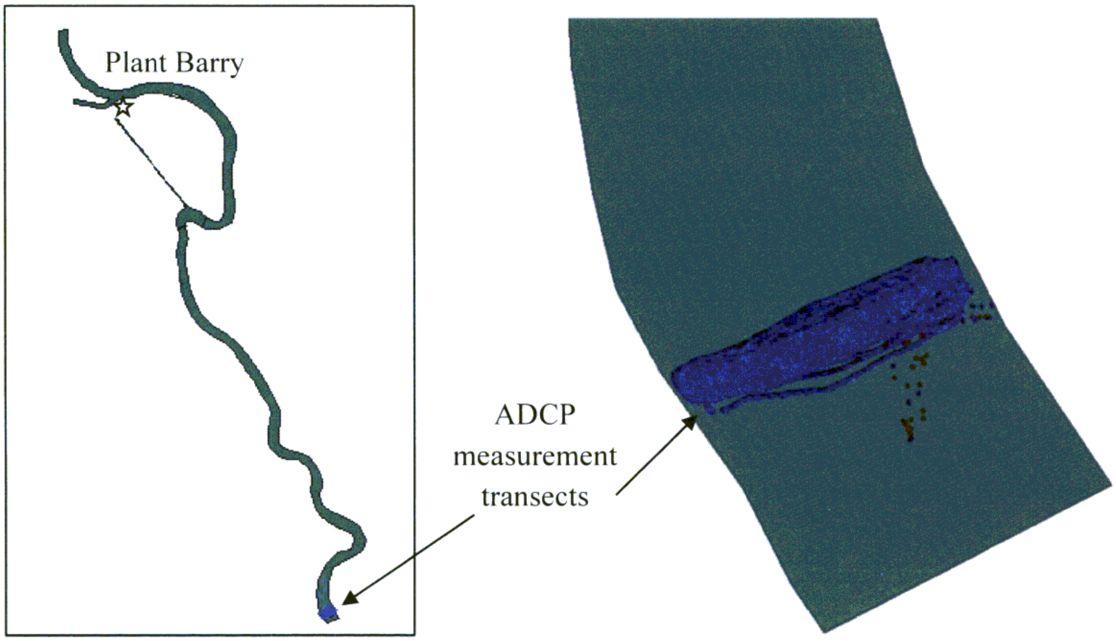


Figure 3.40 The simulation domain (Mobile River) of the Barry EFDC model showing the ADCP measurements taken across the cross sections (transects) near the downstream boundary.

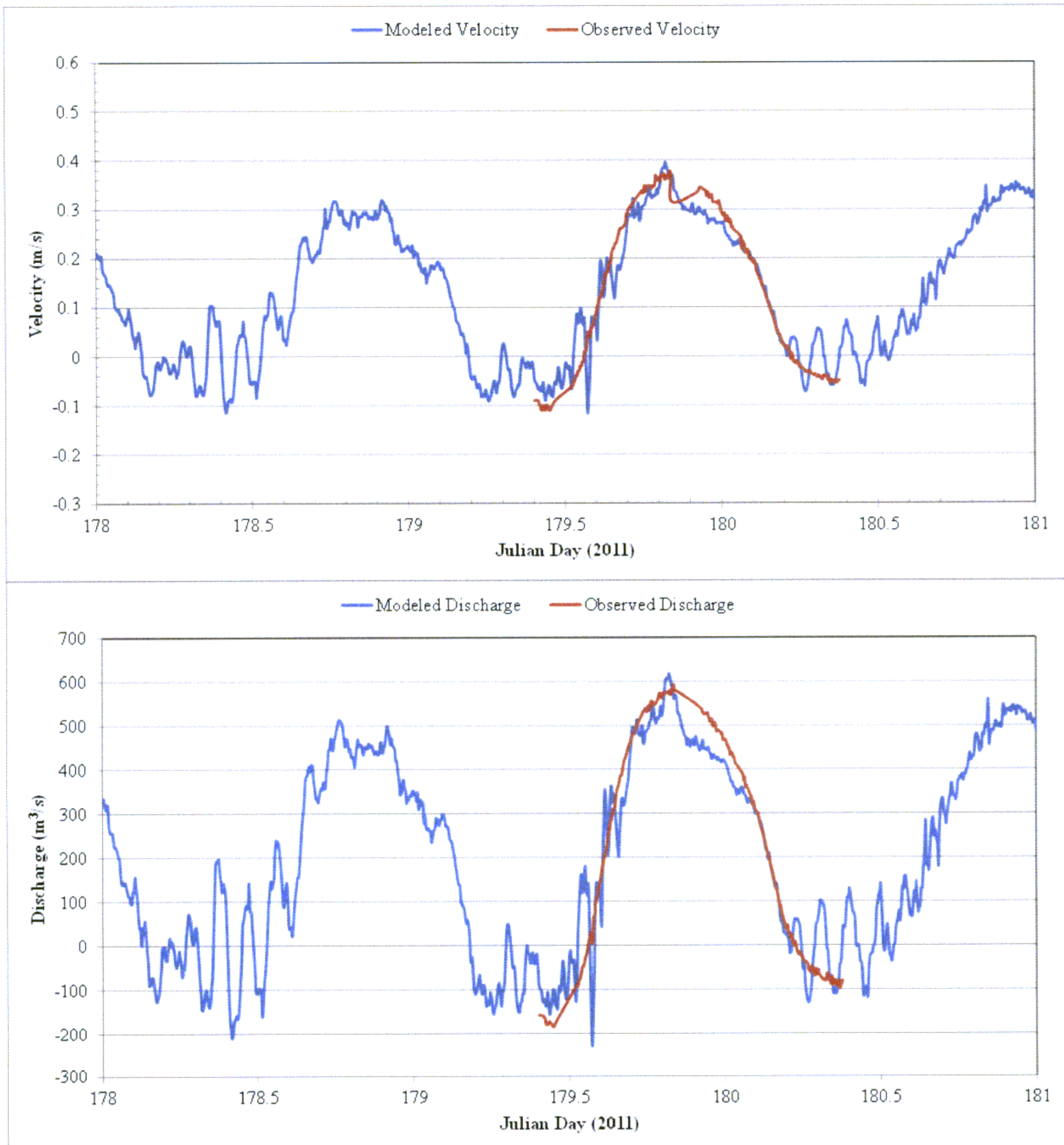


Figure 3.41 Time-series plots of ADCP-measured and EFDC-predicted velocities and discharges at the cross sections near the downstream boundary from June 29 to 30, 2011 (Julian days 179 and 180).

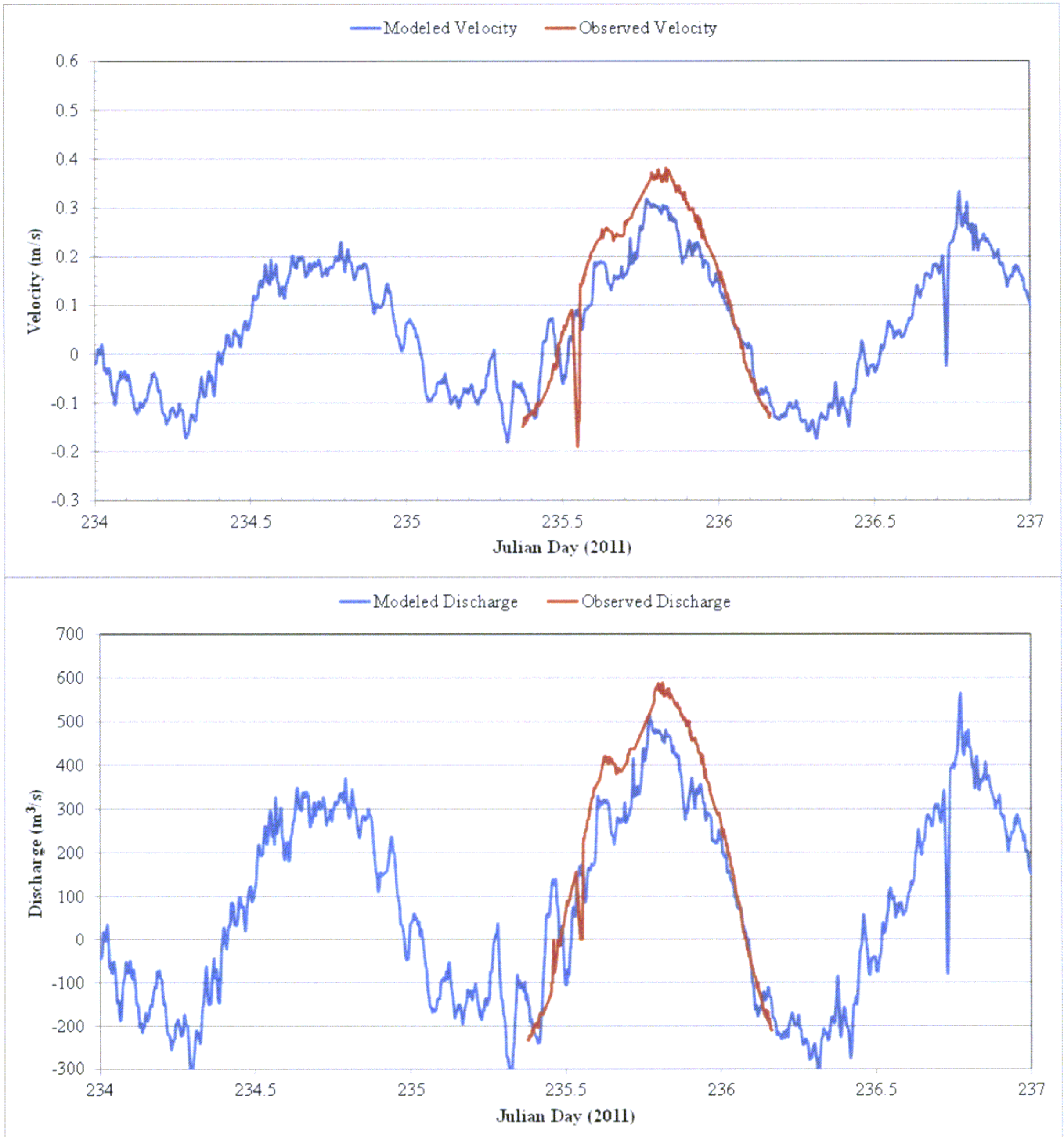


Figure 3.42 Time-series plots of ADCP-measured and EFDC-predicted velocities and discharges at the cross sections near the downstream boundary from August 24 to 25, 2011 (Julian days 235 and 236).

Chapter 4 Summary and Conclusions

Through a contract funded by the Alabama Power Company, a three-dimensional Environmental Fluid Dynamics Code (EFDC) model was developed by researchers at Auburn University to simulate unsteady flow patterns and temperature distributions. The EFDC model was developed for a segment (about 10.6 river miles) of the Mobile River including the intake canal and discharge canal of Plant Barry, and it is called "Barry EFDC model". The whole simulation domain is a portion of the Mobile River that is tidally influenced due to its connection to Mobile Bay and the Gulf of Mexico. As a three-dimensional environmental hydrodynamic model, it simulates flow velocities along all three directions: longitudinal direction along the main flow path from upstream to downstream boundaries, transverse direction along the river channel cross section, and vertical direction with depth. The model simulates heat exchange between the atmosphere and the water column, heat transport, and interaction between thermal discharge from a power plant and the ambient environment, e.g., flow from upstream of the Mobile River and the tributaries.

The Barry EFDC model has a total of 2,881 horizontal grids and six horizontal layers along the depth direction (a total of 17,286 three-dimensional computational cells). Bottom elevation of the model grids ranged from about -18.8 to -0.7 meters above mean sea level (using NAVD 1988 datum). The Mobile River in the simulation domain was divided into seven computational grids along the transverse direction, *i.e.*, along the river cross section or perpendicular to flow direction. There are a total of 2,643 horizontal grids in the Mobile River (not including the intake canal and discharge canal). The intake canal and discharge canal of Plant Barry were modeled using 110 and 128 horizontal grids or 660 and 768 three-dimensional computational cells, respectively. The once-through cooling water system for Plant Barry was modeled as two cooling-water withdrawals from the intake canal (for units 1–3 and units 4–5) and two return flows or discharge points to the discharge canal (units 1–3 and units 4–5) with temperature increases varying with time (depending on power plant operations). Withdrawals and return flows are the model boundary conditions of the Barry EFDC model to simulate or mimic Plant Barry to surrounding water environments.

All necessary input data files were developed and prepared for the Barry EFDC model, and the model was run successfully. The Barry EFDC model was run from August 1, 2010, to September 16, 2010 (46 days), and from April 26 to August 29, 2011 (125 days), to develop a calibrated EFDC model and generate accurate model results. Meteorological data used for the Barry EFDC model were from the Mobile Regional Airport for both 2010 and 2011 model runs because of availability of all the climate parameters (atmospheric pressure, air temperature, relative humidity, rainfall, cloud cover, solar radiation, wind speed, wind direction, etc.). Flow rates at the USGS Bucks gaging station were used as the upstream boundary and water surface elevations at the intersection of the Mobile River and I-65 bridge were used as the downstream boundary. Measured water temperatures at the upstream boundary (Bucks, AL) provided by APC were used as model input for the 2011 model runs. In 2010, measured water temperatures at the location 7 km upstream from Bucks were used as the model temperature boundary. Water temperatures at the downstream boundary (intersection of the Mobile River and I-65 bridge) were obtained from APC thermistor data. For 2011 model runs, flow rates at the upstream boundary and bottom temperatures at the downstream boundary during short periods of missing data were estimated after data analyses of observed data were performed.

Model results were compared with measured data such as water surface elevations, velocities, discharges, and water temperatures at the shallow, middle-depth, and deep layers at various monitoring stations of Plant Barry whenever observed data were available. Overall agreement between modeled results and measured data is good. For 2011 model simulations, the root-mean-square errors (RMSEs) for water temperatures at the intake canal (middle depth) for units 1–3 and units 4–5 were 0.32 °C and 0.29 °C. The RMSE values for water temperature at the mixing zone left bank, right bank, mid-depth, and deep depth monitoring stations were 0.83 °C, 1.07 °C, 0.76 °C, and 0.88 °C, respectively. The relative errors (the ratio of mean absolute error to the observed mean) were less than 2.5% for all the stations. Absolute differences between observed means and modeled means for all monitoring stations ranged from 0.01 °C to 0.57 °C with an average value of 0.26 °C. The Nash-Sutcliffe coefficients (a parameter to measure goodness-of-fit between modeled and observed data) for all monitoring stations ranged from 0.95 to 0.99 (the optimum value is 1.0), which indicated modeled water temperatures matched well with observed water temperature at these monitoring stations.

For the 2011 model simulations, the root-mean-square errors (RMSEs) for water temperatures at the 13 macroinvertebrate plate monitoring stations ranged from 0.44 °C to 1.41 °C (Table 3.14), with an average value of 0.75 °C. The relative errors (the ratio of mean absolute error to the observed mean) were less than 3.1% for stations 3 to 17. Absolute differences between observed means and modeled means of water temperatures for all macroinvertebrate plate monitoring stations ranged from 0.05 °C to 0.55 °C, with an average value of 0.263 °C. The Nash-Sutcliffe coefficients (Ns) for these 13 monitoring stations ranged from 0.88 to 0.98, which were much larger than 0.7 (a good agreement criterion between simulated values and measured data as suggested by Bennis and Crobeddu, 2007) and indicated that modeled water temperatures matched reasonably well with observed water temperature at these 13 monitoring stations associated with macroinvertebrate plates.

Modeled vertical profiles at the macroinvertebrate plate stations 10, 11, 13, 14, 16, and 17, matched very well with observed ones. The root mean square errors ranged from 0.20 to 0.37 °C for stations 10 – 17 (Table 3.15). Average differences (errors) between observed and modeled vertical temperature profiles ranged from -0.72 to 0.19 °C, with an average value of -0.14 °C. The RMSE for vertical profiles in the mixing zone was 0.50 °C (Figure 3.26 and Table 3.15). Overall simulated vertical profiles matched reasonably well with observed ones at all the profiling stations (13 macroinvertebrate plate stations). Modeled velocities and discharges at the cross section near the downstream boundary matched well with observed ones that were measured using ADCP during June 29–30, and August 24–25, 2011.

Appendix A. Technical Background and Previous Studies

Physical and numerical surface water hydrodynamic and transport models have been historically applied to predict power plant thermal impacts under design conditions and operational conditions (Hamrick et al. 1995; Hamrick and Mills 2000). The EFDC (Hamrick 1992a) comprises an advanced three-dimensional surface water modeling system for hydrodynamic and reactive transport simulations of rivers, lakes, reservoirs, wetland systems, estuaries, and the coastal ocean (Hamrick and Mills 2000). The EFDC (Hamrick 1992b) has evolved over the past two decades to become one of the most widely used and technically defensible hydrodynamic models in the world (more than 80 modeling studies). It solves three-dimensional, vertically hydrostatic, free surface, turbulence-averaged equations of motion for a variable-density fluid. Dynamically coupled transport equations for turbulent kinetic energy, turbulent length scale, salinity and temperature are also solved. A special version named EFDC-Hydro has been developed for U.S. EPA Region 4. EFDC-Hydro contains only the hydrodynamic, temperature, dye, and sediment transport routines and is publically available. The role of EFDC-Hydro in the TMDL Toolbox is to provide necessary hydrodynamic inputs to the Water Quality Analysis Simulation Program (WASP), the advanced receiving water quality model that is supported by U.S. EPA.

A.1 Hydrodynamic Modeling

The EFDC model solves the vertically hydrostatic momentum and continuity equations for turbulent flow in a coordinate system that is curvilinear and orthogonal in the horizontal and is a stretched or topography-free surface in the vertical direction. The momentum and continuity equations are (Hamrick 1992a):

$$\partial_t(m_x m_y Hu) + A(u) - m_x m_y f_c Hv = \\ - m_y H\partial_x(p + gH + gz_b{}^*) + m_y(\partial_x z_b{}^* + z\partial_x H)\partial_z p + m_x m_y \partial_z(H^{-1}Av\partial_z v) + Q_u \quad \text{......(A.1)}$$

$$\partial_t(m_x m_y Hv) + A(v) + m_x m_y f_c Hu = - m_x H\partial_y(p + gH + gz_b{}^*) \\ + m_x(\partial_y z_b{}^* + z\partial_y H)\partial_z p + m_x m_y \partial_z(H^{-1}k_v\partial_z v) + Q_v \quad \text{............(A.2)}$$

$$\partial_z p = -gH_b = -gH(\rho - \rho_0)\rho_0{}^{-1} \quad \text{....................(A.3)}$$

$$\partial_t(m_x m_y H) + \partial_x(m_y Hu) + \partial_y(m_x Hv) + \partial_z(m_x m_y w) = Q_H \quad \text{.................. (A.4)}$$

$$A(\psi) = (m_y Hu\psi) + \partial_y(m_x Hv\psi) + \partial_z(m_x m_y w\psi) \quad \text{.................. (A.5)}$$

$$m_x m_y f_c = m_x m_y f - u\partial_y m_x + v\partial_x m_y \quad \text{....................(A.6)}$$

where:

u and *v* are horizontal velocities in the curvilinear-orthogonal horizontal coordinates (x, y)

w is the vertical velocity in the stretched vertical coordinate z
p = kinematic excess pressure above the reference density
ρ_0 = hydrostatic pressure
$z_s{}^*$ = free surface elevation
$s_b{}^*$ = bottom bed or topography elevation
H $(= z_s{}^* - z_b{}^*)$ = total water column depth
K_v = turbulent viscosity
f_c = Coriolis parameter
Q_u and Q_v represent additional forces or momentum sources and sinks including horizontal turbulent momentum diffusion, vegetation resistance, and wave Reynolds stress due to high frequency gravity waves
Q_H represents direct rainfall, evaporation, groundwater interaction, water withdrawals, and point and nonpoint source discharges.
m_x and m_y are dimensionless scale factors

The generic transport equation in EFDC for a dissolved or suspended constituent C is:

$$\partial_t\left(m_x m_y HC\right) + A(C) = m_x m_y \partial_z (H^{-1}\partial_z K_b C + \sigma C) + m_x m_y H R_c + Q_c \quad \text{........... ... (A.7)}$$

where:
K_b = vertical turbulent or eddy diffusivity
σ = positive settling velocity
R_c = reactive sources and sinks

Q_c allows for the inclusion of horizontal turbulent diffusion and external sources and sinks associated with volumetric withdrawals and discharges.

The transport of dynamically active constituents such as salinity, temperature, and suspended sediment is coupled with the momentum equations through an equation of state and the hydrostatic condition (A.3).

The model relates vertical turbulent viscosity and diffusivity to the turbulent intensity, q, a turbulent length scale, l, and a Richardson number R_q by:

$$\begin{aligned} K_v &= \phi_v q l \\ &= 0.4\left(1 + 36R_q\right)^{-1}\left(1 + 6R_q\right)^{-1}\left(1 + 8R_q\right) q l \quad \text{..........(A.8)} \end{aligned}$$

$$K_b = \phi_b q l = 0.5(1 + 36R_q)^{-1} q l \quad \text{..........(A.9)}$$

$$R_q = -gH\partial_z b l^2 H^{-2} q^{-2} \quad \text{..........(A.10)}$$

Where ϕ_v and ϕ_b account for reduced and enhanced vertical mixing or transport in stable and unstable vertically density-stratified environments.

A.2 Thermal Budget Modeling

The EFDC model for Plant Barry was designed to model or simulate temperature distributions along the Mobile River and with depth. Therefore, the temperature model component in EFDC was activated to simulate thermal or heat budget for each computational cell.

While using EFDC Explorer we have four options for doing the thermal heat exchange calculations. Among the four computation options, the CE-QUAL-W2 equilibrium method is the most robust method; therefore, for the Barry EFDC model, we used the CE-QUAL-W2 method for water temperature modeling. The following paragraphs provide some basic information on the governing equations and heat exchange processes in a water body. The information provided here was based on the CE-QUAL-W2 manual.

Surface heat exchange: Surface heat exchange can be formulated as a term-by-term process using the explicit adjacent cell transport computation as long as the integration time step is shorter than or equal to the frequency of the meteorological data. Surface heat exchange processes depending on water surface temperatures are computed using previous time step data and are therefore lagged from transport processes by the integration time step. Surface heat exchange is computed as:

$$H_n = H_s + H_a + H_e + H_c - (H_{sr} + H_{ar} + H_{br}) \quad \text{(A.11)}$$

where:

H_n = the net rate of heat exchange across the water surface, $W\,m^{-2}$
H_s = incident shortwave solar radiation, $W\,m^{-2}$
H_a = incident longwave radiation, $W\,m^{-2}$
H_{sr} = reflected shortwave solar radiation, $W\,m^{-2}$
H_{ar} = reflected longwave radiation, $W\,m^{-2}$
H_{br} = back radiation from the water surface, $W\,m^{-2}$
H_e = evaporative heat loss, $W\,m^{-2}$
H_c = heat conduction, $W\,m^{-2}$

The shortwave solar radiation is either measured directly (read from input file aser.inp) or computed from sun angle relationships and cloud cover within the CE-QUAL-W2 or EFDC program. The longwave atmospheric radiation is computed from air temperature and cloud cover or air vapor pressure using the Brunts formula. Several terms in equation (A.11) are water-surface-temperature dependent.

The water surface back radiation (H_{br}) is computed as:

$$H_{br} = \varepsilon\sigma\,(T_s + 273.15)^4 \quad \text{(A.12)}$$

where:

ε = emissivity of water, 0.97
σ = Stephan-Boltzmann constant, $5.67 \times 10^{-8}\ W\,m^{-2}\ {}^{\circ}K^{-4}$

T_s = water surface temperature, $°C$

Like the remaining terms, the back radiation is computed for each surface layer cell on each iteration time step.

Evaporative heat loss is computed as:

$$H_e = f(W)\ (e_s - e_a) \quad \text{(A.13)}$$

where:

$f(W)$ = evaporative wind speed function, $W\ m^{-2}\ mm\ Hg^{-1}$
e_s = saturation vapor pressure at the water surface, $mm\ Hg$
e_a = atmospheric vapor pressure, $mm\ Hg$

Evaporative heat loss depends on air temperature, dew point temperature or relative humidity, and wind speed. Saturation vapor pressure (e_s) is computed from the surface temperature for each surface cell on each iteration.

Surface heat conduction is computed as:

$$H_c = C_c f(W)\ (T_s - T_a) \quad \text{(A.14)}$$

where:

C_c = Bowen's coefficient, $0.47\ mm\ Hg\ °C^{-1}$
T_a = air temperature, $°C$

Shortwave solar radiation penetrates the surface and decays exponentially with depth according to Bears law:

$$H_s(z) = (1 - \beta) H_s\, e^{-\eta z} \quad \text{(A.15)}$$

where:

$H_s(z)$ = shortwave radiation at depth z, $W\ m^{-2}$
β = fraction absorbed at the water surface
η = extinction coefficient, m^{-1}
H_s = shortwave radiation reaching the water surface, $W\ m^{-2}$

Evaporation and convective heat losses have a user-defined wind-speed formula of the form

$$f(W) = a + b\, W^c \quad \text{(A.16)}$$

where:

$f(W)$ = wind speed function, $W\ m^{-2}\ mm\ Hg^{-1}$
a = empirical coefficient, 9.2 default
b = empirical coefficient, 0.46 default
c = empirical coefficient of exponent, 2 default
W = wind speed measure at 2 m above the ground, $m\ s^{-1}$

Equilibrium temperature is used for heat exchange computation in the CE-QUAL-W2. Because some of the terms in the term-by-term heat balance equation are surface temperature dependent and others are measurable or computable input variables, the most direct route to simplify computation is to define an equilibrium temperature, T_e, as the temperature at which the net rate of surface heat exchange is zero.

Linearization of the term-by-term heat balance along with the definition of equilibrium temperature allows for expression of the net rate of surface heat exchange, H_n, as:

$$H_{aw} = -K_{aw}(T_w - T_e) \quad \text{(A.17)}$$

where:

H_{aw} = rate of surface heat exchange, $W\,m^{-2}$
K_{aw} = coefficient of surface heat exchange, $W\,m^{-2}\,°C^{-1}$
T_w = water surface temperature, °C
T_e = equilibrium temperature, °C

Sediment Heat Exchange: Sediment heat exchange with overlying water is generally small compared to surface heat exchange and many previous modelers have neglected it. Investigations on several reservoirs have shown that the process must be included to accurately reproduce hypolimnetic temperatures primarily because of the reduction in numerical diffusion that previously swamped the numerical solution. The formulation is similar to surface heat exchange:

$$H_{sw} = -K_{sw}(T_w - T_s) \quad \text{(A.18)}$$

where:

H_{sw} = rate of sediment/water heat exchange, $W\,m^{-2}$
K_{sw} = coefficient of sediment/water heat exchange, $W\,m^{-2}\,°C^{-1}$
T_w = water temperature, $°C$
T_s = sediment temperature, $°C$

A.3 EFDC Model Applications

EFDC is capable of simulating a variety of thermal discharges from power plants and was applied to simulate water temperature conditions in Conowingo Pond on the Susquehanna River in Pennsylvania and Maryland as influenced by the Peach Bottom Atomic Power Plant thermal discharge (Hamrick and Mills 2000). Figure A.1 shows the computational grid system of Conowingo pond (approximately 23 km long) and shows the location of the intake and the discharge from the plant. The horizontal grid contains 954 cells, with grid resolution ranging from about 100 m in the vicinity of the plant, to 2 km near the upstream and downstream dams. There are water temperature and water quality observations at 16 stations. The model simulations were conducted using both four and eight layers in the vertical direction, and the average water depth is about 7 m with a maximum depth of 15 m (Hamrick and Mills 2000). Figure A.2 shows that model-predicted temperatures reasonably agree with observed temperatures at the plant's cooling water intake and the difference is 1–2 ^{o}C. Figure A.3 shows model-predicted and observed surface and bottom temperatures at station 102, in the 100 transect, which is approximately 3 km northwest of the cooling water intake.

The Cornell Mixing Zone Expert System (CORMIX) is used as a hydrodynamic mixing zone computer simulation model and was developed for the U.S. Environmental Protection Agency (Jirka et al. 1996). CORMIX emphasizes predicting the geometry and dilution characteristics of pollutant plumes to assess regulatory compliance. CORMIX is limited to the mixing processes under steady ambient conditions. The analysis of thermal discharge as buoyant jets can be simplified by recognizing two separate regions: the "near-field" and the "far-field". The near-field designates the extent of the flow near the discharge in which the mixing is highly dependent on the discharge conditions (initial volume, momentum, and buoyancy flux) whereas the mixing in the far-field is dependent solely on the ambient conditions (Jirka et al. 1996). In the far-field, ambient turbulence, stratification, wind shear, and many other factors dependent on the ambient conditions play a role in determining the rate of mixing (Jirka et al. 1996). CORMIX only can be applied to simplified receiving water body and discharge configurations, and is not applicable for thermal discharge modeling in the proposed study.

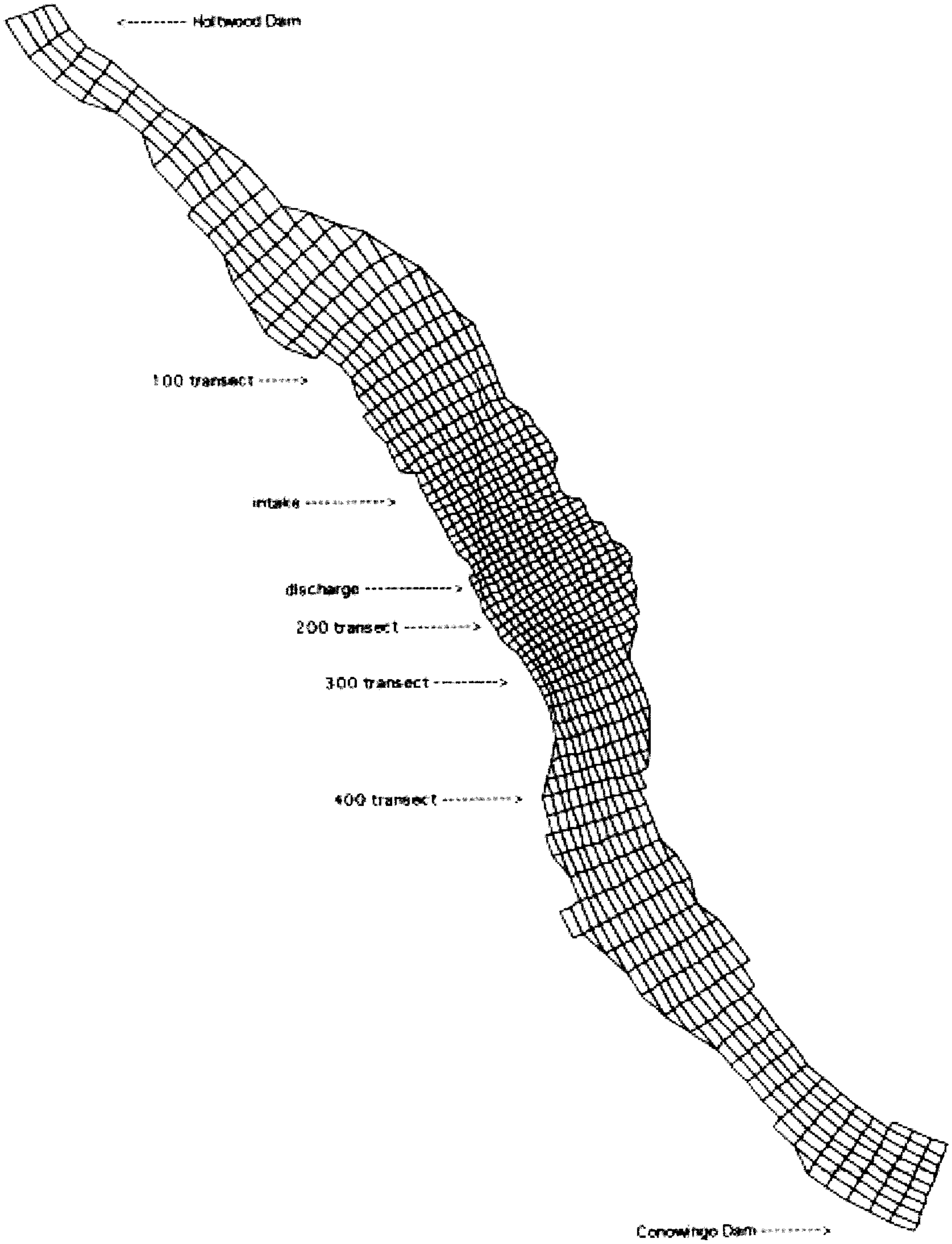


Figure A.1 Horizontal computational grid of the EFDC model for Conowingo Pond (from Hamrick and Mills 2000).

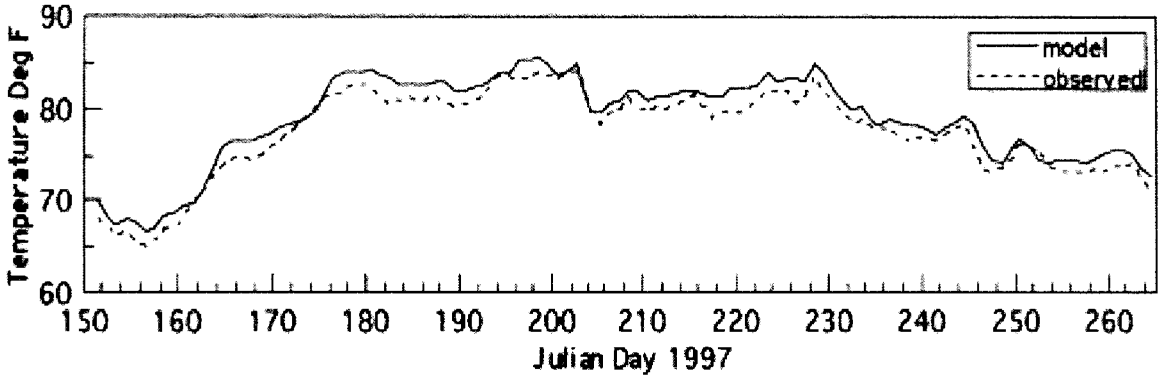


Figure A.2 Model-predicted and observed temperatures at the plant's cooling water intake (from Hamrick and Mills 2000).

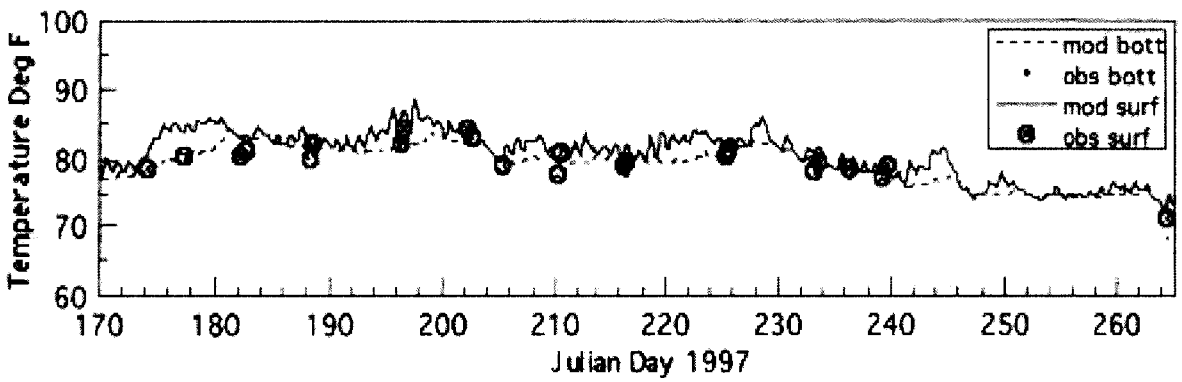


Figure A.3 Model-predicted and observed surface and bottom temperatures at Station 102 (from Hamrick and Mills 2000).

Appendix B. Data Files for the Barry EFDC Model

Data files for the working model for Plant Barry have been uploaded into APC ftp site: https://xtr.southernco.com/ under the /APC_AU_2011/ folder. Inside "APC_AU_2011" folder, there is a new folder: BarryModel2011. "BarryModel" folder contains all input files and output files for the EFDC model developed for Plant Barry. These input and output files are for the most recent calibration run for the model. The "EFDCEXplorer_APC" folder contains installation files for EFDC Explorer that are used to view or modify input data files and display model results, and contains the EFDC executive file.

EFDC uses/reads/outputs data files with the same file names for different EFDC models developed by a model developer, therefore, the model developer has to store/save input and output files for different EFDC models in separate folders, such as BarryModel and GorgasModel folders. Even input file names are the exact same, but the information stored inside input files could be total different. Therefore, simply copying the same file for one model folder to another model folder can potentially destroy one of the EFDC models developed for a specific study area. The following paragraphs provide some basic information on EFDC input files.

1) **Cell.inp:**
Cell.inp is a horizontal cell identifier file. It also stores the information about the number of cells in I and J direction. The columns across the row in cell.inp specify the cell identification number entered in the array, IJCT(I, j) for I increasing from 1 to 9. Seven default identification numbers are used to define the cell type. They are as follows:
0 Dry land cell not bordering a water cell on a side or corner
1 Triangular water cell with land to the northeast
2 Triangular water cell with land to the southeast
3 Triangular water cell with land to the southwest
4 Triangular water cell with land to the northwest
5 Quadrilateral water cell
9 Dry cell bordering a water cell on a side or corner

2) **Celllt.inp**:
The file Celllt.inp may be identical to the file cell.inp or specify a subset of the water cells in the cell.inp file. In specifying the subset, the following rules apply. Type 0 cells remain unchanged; type 9 cells may be changed only to type 0, and type 1-5 cells may be changed only to types 0 or 9.

3) **Dxdy.inp**:

The file Dxdy.inp provides the physical x and y dimensions of a cell, dx and dy, the initial water depth, the bottom elevation, and the roughness height. These quantities should generally be specified in meters, although unit conversion options can be specified in the master input file, efdc.inp.

4) **Lxly.inp**:
The file Lxly.inp provides cell center coordinates and the components of a rotation matrix.

5) **Efdc.inp**:
The EFDC model has a master input file named efdc.inp. In this file, there is almost all the information required for the simulation except bathymetry, boundary condition (flow, salinity, temperature), and atmospheric conditions (air temperature, solar radiation, cloud cover, atmospheric pressure, and relative humidity).

The duration of the run (date from start to finish), time step for the simulation, locations of the boundaries such as volumetric source/sink, open boundaries, withdrawal and return flow conditions are given as input in the file. The number of layers in the water body is also specified. The parameters of interest for the simulations, such as salinity, temperature, and dye must be input in efdc.inp. The file also gives information about the number of cells in X and Y directions, drying and wetting of the area (drying height, wetting height, and the minimum height should be specified).

6) **Pser.inp**:
The input file pser.inp is used to specify the time series of surface elevation primarily used at the open boundary. The file may contain multiple time series; each having a single control and conversion data line followed by a sequence of MPSER time data lines. The parameter MPSER specifies the number of time data lines.

7) **Qser.inp**:
The input file qser.inp is a volumetric source-sink time series file. The file is used to specify the flow (discharge) boundaries primarily for use in inflows and outflows.

8) **Temp.inp**:
The input file temp.inp provides the initial condition for the temperature in the model. The columns in the temp.inp file give the initial temperature for the number of layers used in the model.

9) **Aser.inp**:

The input file aser.inp specifies atmospheric, wind, and thermal forcing as well as precipitation and evapotranspiration. The aser.inp file contains atmospheric pressure (millibars), dry temperature (°C), wet bulb temperature (°C) or relative humidity (decimal between 0.0 and 1.0), rainfall rate (m/day), evaporation, solar radiation, and cloud cover (between 0.0 and 1.0).

10) **Wser.inp**:
The input file wser.inp specifies the wind speed (m/s) and the wind direction for the model.

11) **Show.inp**:
The input file show.inp is used to control screen writing of information at the horizontal location specified by the horizontal cell indices ISHOW and JSHOW.

12) **Qwrs.inp**:
The input file qwrs.inp provides the information about the withdrawal and return boundary conditions. The file may contain multiple numbers of time series. The file contains the Julian day, flow rate of withdrawal and return flow (m^3/s), increase in salinity, increase in temperature (°C), and increase in dye.

13) **Pshade.inp**:
The input file pshade.inp is used to specify the atmospheric shading factor in the model to reduce or increase solar radiation for the study area.

Appendix C. Analysis of 2011 Monitoring Data

APC collected water temperature data at several monitoring stations (Figure C.1) near Plant Barry and throughout the Mobile River between the USGS Bucks gaging station and the downstream boundary from April 18, 2011, to October 22, 2011. Geographic locations of APC's major long-term monitoring stations are shown on Figure C.1, and related information is listed in Table 2.1. An analysis of observed temperature data was conducted and shows that there were temperature variations along river cross sections (from left to right river bank), between river cross sections (from the upstream boundary to the mixing zone and then to the downstream boundary), and along the vertical or depth direction (from the water surface to river bottom).

Table C.1 gives statistics of observed water temperatures (°C) at the BAIC (intake canal, near the intakes for units 1–3 and units 4–5), BADC (discharge canal, near the discharge points for units 1–3 and units 4–5), and BAUS (upstream) monitoring stations of Plant Barry. The statistical parameters include minimum, maximum, 25% quartile, median (50% quartile), 75% quartile, average, and standard deviation. Observed 5-minute water temperatures at the BAIC monitoring station (near the intake for units 1–3) ranged from 20.6 to 35.8 °C, with an average value of 28.5 °C. Observed 5-minute water temperatures at the BADC (discharge canal) monitoring station (near the discharge point for units 1–3) ranged from 22.3 to 43.1 °C, with an average value of 32.8 °C. Observed shallow-depth water temperatures at the BAUS (upstream) monitoring station ranged from 20.5 to 35 °C, with an average value of 28.3 °C. Observed deep-depth (near the channel bottom) water temperatures at the BAUS monitoring station ranged from 20.5 to 32.6 °C, with an average value of 28.4 °C.

Figure C.2 shows a time-series plot of water temperatures observed near the intake and the discharge points for units 1–3 and units 4–5. Water temperatures observed near the intake structure for units 1–3 were almost the same as water temperatures observed near the intake structure for units 4–5 (average difference is less than 0.1 °C). However, water temperatures observed near the discharge point for units 4–5 (two generating units) were higher than water temperatures observed near the discharge point for units 1–3 (three generating units), and the differences ranged from -3.9 °C (for some short periods) to 11.6 °C, with an average value of 2.2 °C (Figure C.2). For the 2010 modeling study to develop a working model, there were no separate measurements of water temperatures for intake and discharge points of power generating units 1–3 and units 4–5.

Figure C.3 shows time-series plots of observed water temperatures (left y-axis) and computed temperature differences (right y-axis) at the shallow depths and deep depths at the Plant Barry upstream (BAUS), mixing zone (BAMZ), and downstream (BAUS) monitoring stations from June 15 to July 5, 2011. Differences of observed temperatures between shallow and deep depths in the upstream boundary ranged from -0.06 °C to 2.84 °C, with an average value of 0.36 °C. After Julian day 175 (June 25), temperature differences in the upstream boundary (top frame of Figure C.3) during the nighttime period were not zero instead of small positive values; and it means that there were small temperature stratification during the night also (it was possible that heated water from the discharge canal drifted backward to the upstream). Differences of observed temperatures between shallow and deep depths in the mixing zone ranged from -0.08

°C to 6.04 °C, with an average value of 1.54 °C (Figure C.3). The larger average difference between shallow and deep temperatures in the mixing zone was due to thermal discharge from the discharge canal in addition to solar heating during the daytime period. Differences of observed temperatures between shallow and deep depths near the downstream boundary ranged from -0.30 °C to 1.55 °C, with an average value of 0.09 °C. Water temperatures at the shallow depth and deep depth near the downstream boundary were measured at two different locations but they are very close to each other (shown as one point in Figure C.1, labeled as "downstream right bank"). Temperature differences at all three monitoring stations show clear diurnal cycle patterns: temperature differences were zero or small during the night and increased during the day. If one assumes that water temperature variations in the downstream boundary had natural diurnal cycles, then temperature stratifications due to solar heating were less than 2 °C.

Table C.2 gives the statistics of observed water temperatures (°C) at the BAMZ (mixing zone) and BADS (downstream) monitoring stations of Plant Barry. Observed shallow-depth water temperature at the BAMZ left bank monitoring station ranged from 20.5 to 41.7 °C, with an average value of 29.8 °C. Observed shallow-depth water temperatures at the BAMZ right bank monitoring station ranged from 20.4 to 39.7 °C, with an average value of 29.6 °C, which are slightly lower than ones at the right bank station. Observed mid-depth water temperature at the BAMZ monitoring station ranged from 20.6 to 35.6 °C, with an average value of 28.9 °C. Observed water temperature at the deep depth of the BAMZ monitoring station ranged from 20.5 to 35.2 °C, with an average 28.7 °C. Observed shallow-depth water temperature at the BADS (downstream) monitoring station ranged from 20.6 to 35.6 °C, with an average temperature of 29.4 °C. Observed water temperatures at deep depth of the BADS monitoring station ranged from 16 to 34.4 °C, with an average temperature of 29.0 °C. For 2010 and 2011 simulations, the Barry EFDC model had seven or more computational grids in the transverse direction and 358 rows of horizontal grids along the flow direction in the Mobile River, which will allow the EFDC model to accurately model temperature variations in both directions.

Figure C.4 shows observed **shallow-depth** water temperatures and computed temperature differences in the Plant Barry upstream (BAUS), mixing zone (BAMZ), and downstream (BAUS) monitoring stations. Observed water temperatures at the shallow depth in the mixing zone were typically higher than ones at the upstream and downstream monitoring stations, which indicated temperature variations along the flow direction in the simulation domain. Observed water temperatures at the shallow depth at the left bank station in the mixing zone were slightly higher than one at the right bank station, which indicated temperature variations along the cross section. Observed temperature variations through Figure C.2 to Figure C.4 indicate that it is necessary to use a three-dimensional flow and thermal discharge model such as EFDC for the study of Plant Barry.

Table C.3 gives statistics of computed water temperature differences (°C) between the shallow depth and deep depth at the BAUS (upstream), BAMZ (mixing zone) and BADS (downstream) monitoring stations of Plant Barry. These temperature differences help us to understand the degree of thermal stratifications along depth at the different monitoring stations. Computed temperature differences between the shallow depth and the deep depth temperature at the BAUS monitoring station from April 18, 2011, to October 22, 2011, ranged from -1.0 to 3.8 °C, with an average value of 0.5 °C. Computed temperature differences between the shallow depth at the left bank and the deep depth in the mixing zone ranged from -1.1 to 8.1 °C, with an average value of 1.1 °C. Computed temperature differences between the shallow depth at the right bank and the deep depth in the mixing zone ranged from -3.5 to 7.6 °C, with an average value of 1.0 °C. Computed temperature differences between the middle depth and the deep depth in the mixing zone from April 18, 2011, to October 22, 2011, ranged from -1.6 to 2.7 °C, with an average value of 0.2 °C. Temperature differences between the middle depth and the deep depth in the mixing zone are smaller than ones between the shallow depth and the deep depth. Computed temperature differences between the shallow depth and deep depth at the downstream monitoring station (BADS) of Plant Barry ranged from -0.5 to 2.4 °C, with an average value of 0.1 °C. The Barry EFDC model had six horizontal layers along depth that allow the EFDC model to model temperature stratifications with reasonably accuracy, as shown and demonstrated by vertical profile comparisons in Section 3.5 and in Appendix D.

Table C.4 gives statistics of computed water temperature differences (°C) at the shallow depth between different monitoring stations of Plant Barry. Computed differences of shallow-depth temperatures from the upstream (BAUS) boundary to the downstream (BADS) boundary of the Barry EFDC model ranged from -2.1 to 3.9 °C, with an average value of 0.8 °C. Computed differences of shallow-depth temperatures from the mixing zone (left bank) to the downstream boundary ranged from -6.7 to 2.4 °C, with an average value of -0.4 °C. The 75% quartile (increase from the mixing zone left bank station to the downstream boundary) is less than 0.1 °C. This means that a large part of heat added from the discharge canal was lost to the atmosphere when water flows from the mixing zone to the downstream boundary. Computed differences of shallow-depth temperatures from the upstream boundary and the mixing zone (left bank) ranged from -2.7 to 7.5 °C, with an average increase of 1.2 °C. These increases are most likely due to heat added from the discharge canal.

Tables C.5 to C.16 give monthly statistics of observed water temperatures (°C) at different depths and different monitoring stations of Plant Barry. Water temperatures at the BAUS (upstream), BAIC (intake), BAMZ (mixing zone), and BADS (downstream) monitoring stations were measured from April 18, 2011, to October 22, 2011. The highest water temperatures at all monitoring stations occurred in August, 2011.

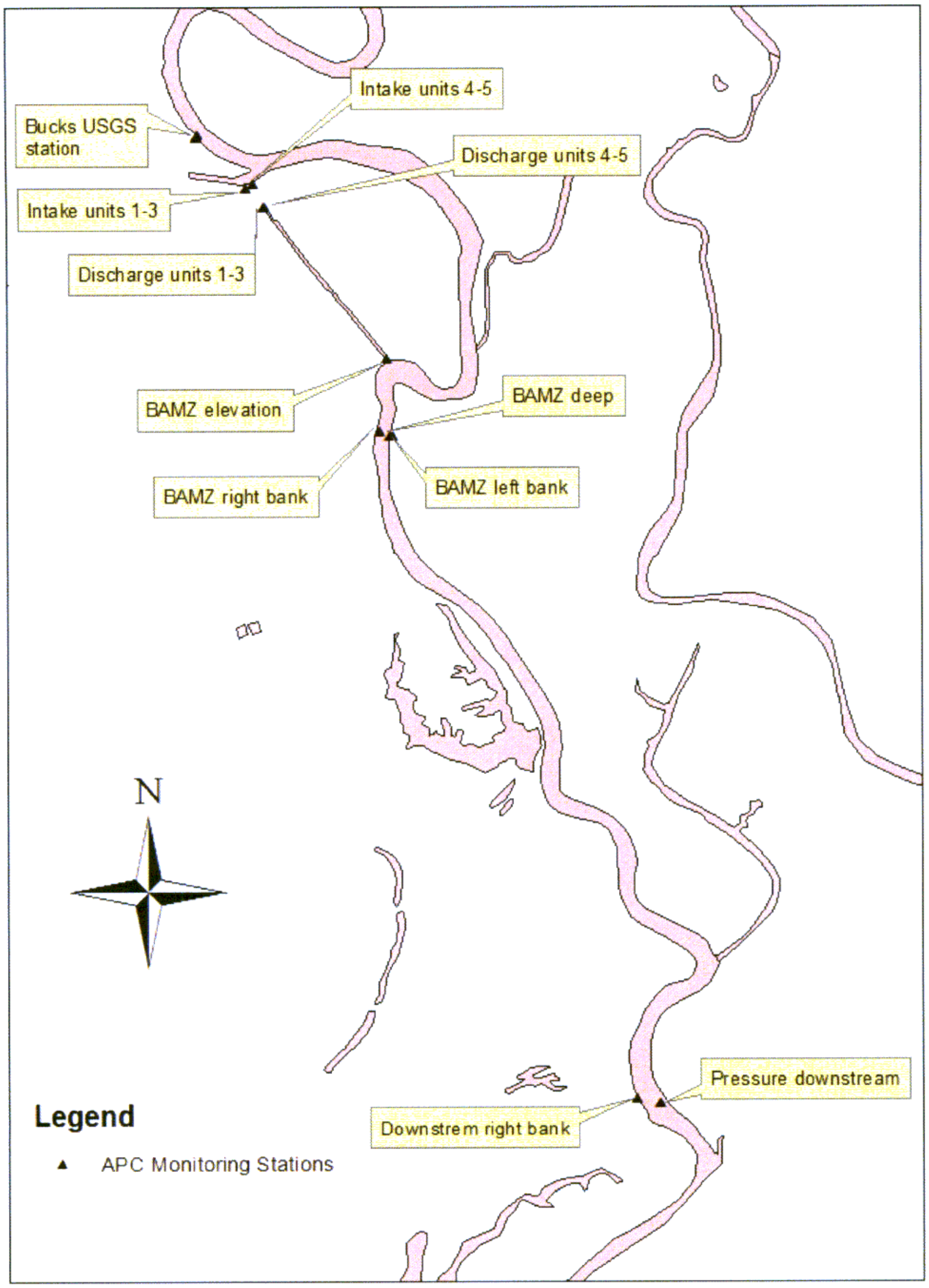
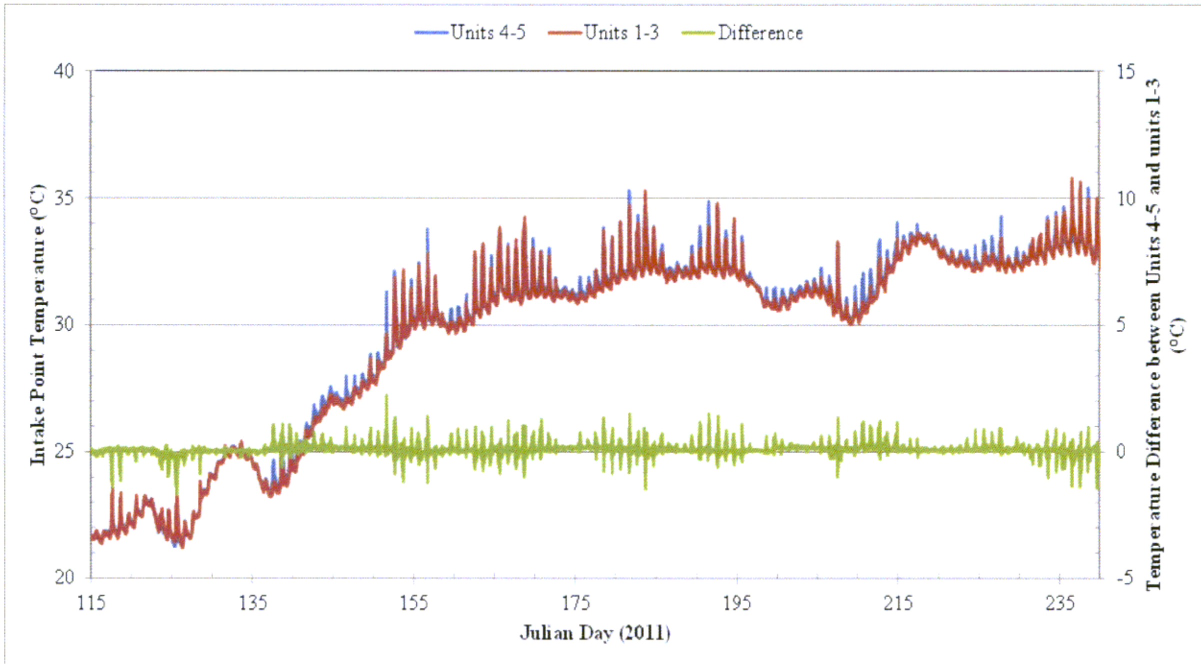


Figure C.1 Locations of APC's long-term monitoring stations along the Mobile River.



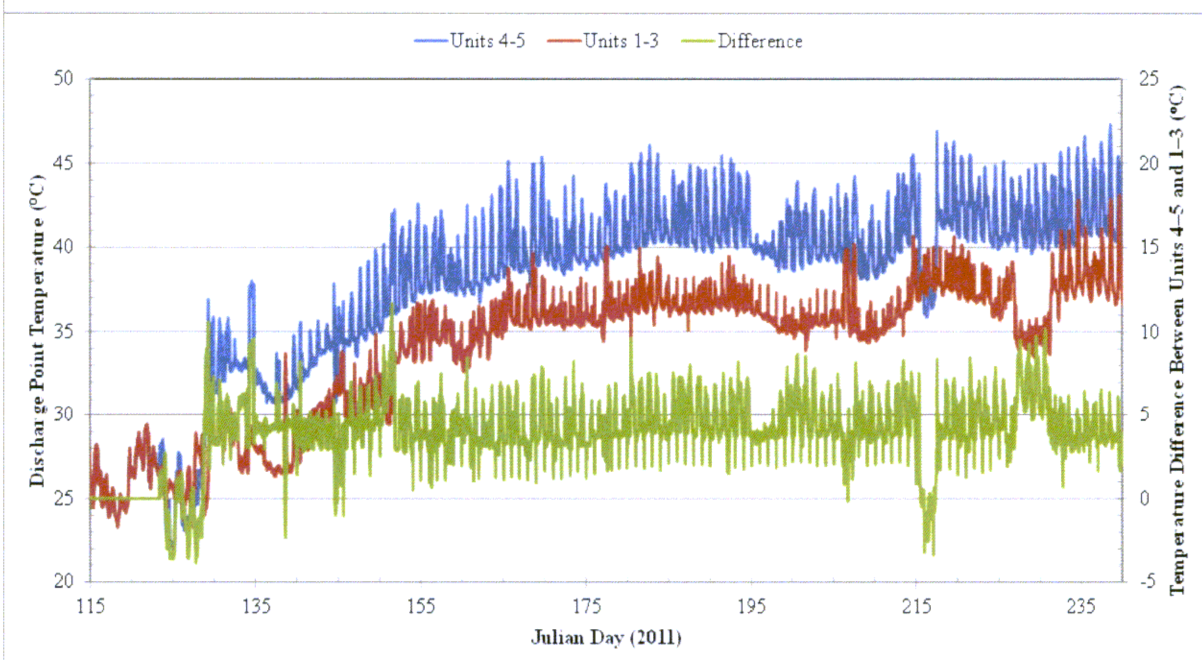


Figure C.2 Time-series plots of observed water temperatures and computed temperature differences at the middle depths near the intake structures and the shallow depths of discharge points for units 1–3 and units 4–5 for Plant Barry.

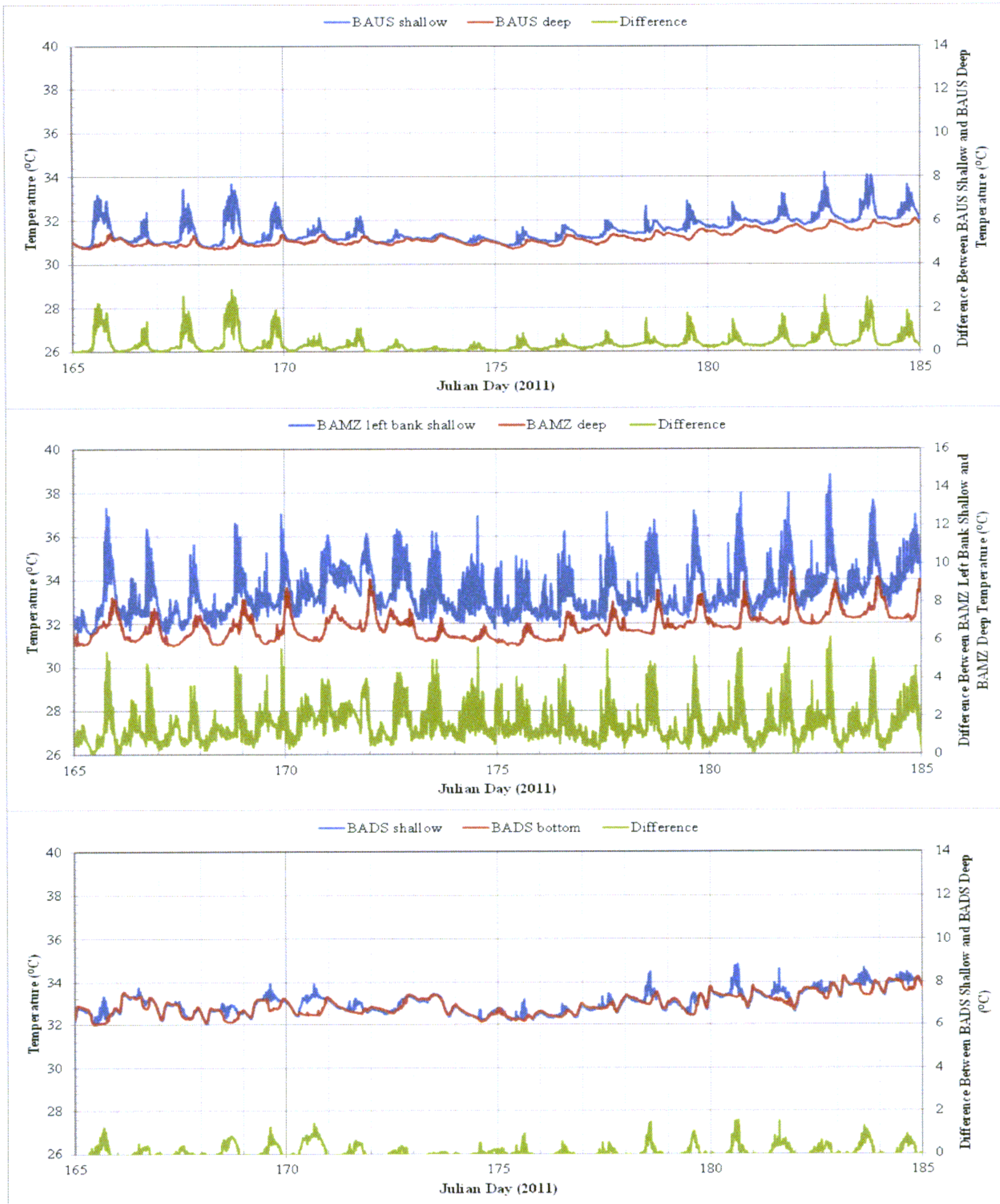


Figure C.3 Time-series plots of observed water temperatures and computed temperature differences at the shallow depths and deep depths in the Plant Barry upstream (BAUS), mixing zone (BAMZ), and downstream (BADS) monitoring stations from June 15 to July 5, 2011.

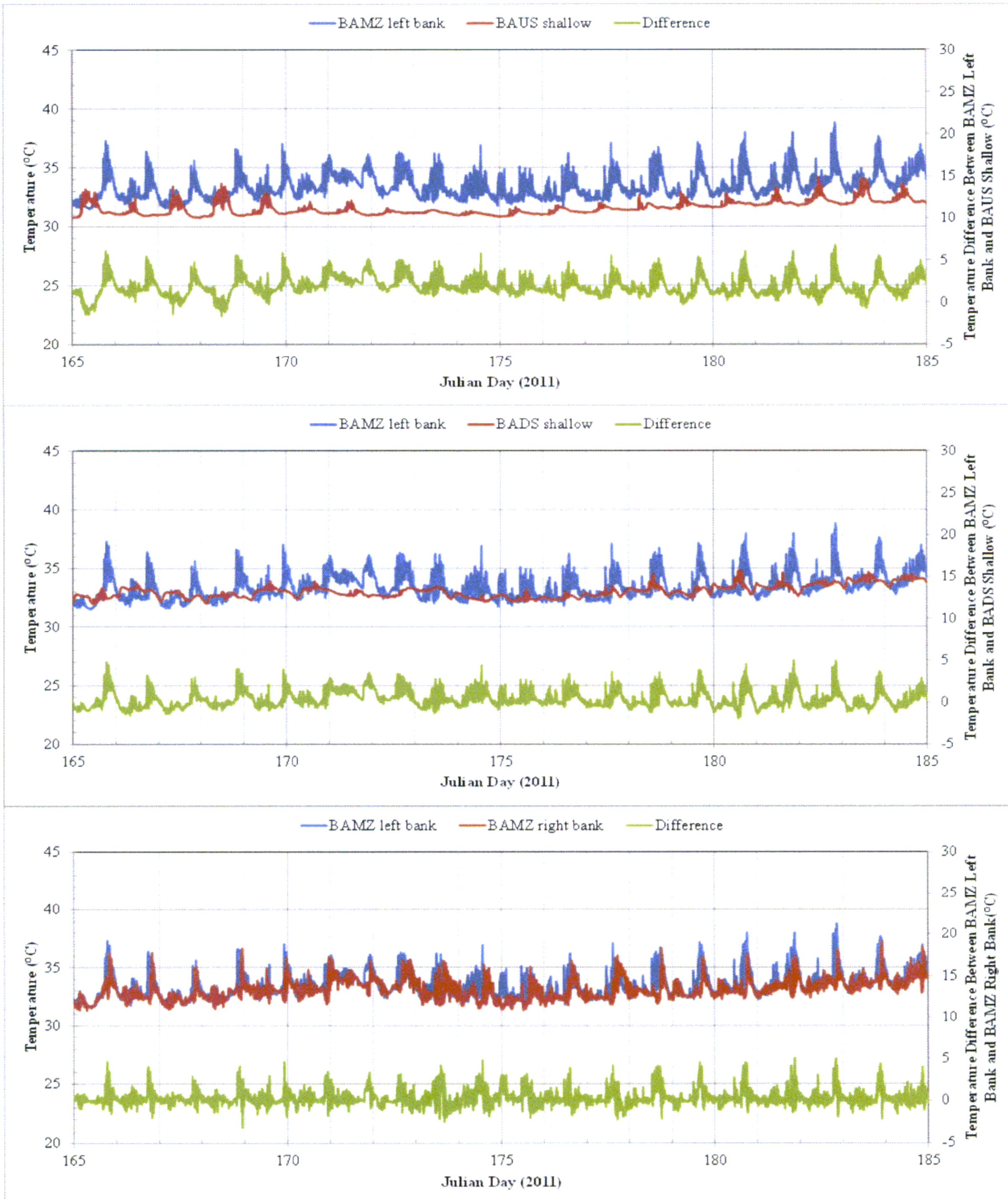


Figure C.4 Time-series plots of observed shallow-depth water temperatures and computed temperature differences in the Plant Barry upstream (BAUS), mixing zone (BAMZ), and downstream (BADS) monitoring stations from June 15 to July 5, 2011.

Table C.1 Statistics of observed water temperatures (°C) at the BAIC (intake canal), BADC (discharge canal), BAUS (upstream) and BADS (downstream) monitoring stations of Plant Barry.

Location / Statistical parameters	BAIC 4-5 [1] mid-depth	BAIC 1-3 [2] mid-depth	BADC 4-5 [1] mid-depth	BADC 1-3 [2] mid-depth	BAUS surface	BAUS bottom
Minimum	20.5	20.6	21.4	22.3	20.5	20.5
Maximum	35.3	35.8	47.3	43.1	35.0	32.6
25% Quartile	24.9	24.9	31.5	29.1	24.9	24.8
Median	29.8	29.9	37.5	33.6	29.8	30.4
75% Quartile	32.0	32.0	40.5	36.1	31.9	31.7
Average	28.5	28.5	35.9	32.8	28.3	28.4
Standard deviation	3.9	3.9	5.8	4.2	3.7	3.7

Note:

[1] near the cooling water intake structure for units 1–3.

[2] near the cooling water intake structure for units 4–5.

Table C.2 Statistics of observed water temperatures (°C) at the BAMZ (mixing zone), and BADS (downstream) monitoring stations of Plant Barry.

Location / Statistical parameters	BAMZ left-bank	BAMZ right-bank	BAMZ mid-depth	BAMZ Deep	BADS shallow	BADS bottom
Minimum	20.5	20.4	20.6	20.5	20.6	16.0
Maximum	41.7	39.7	35.6	35.2	35.6	34.4
25% Quartile	26.3	26.3	25.5	25.5	25.9	24.9
Median	31.2	30.8	30.5	30.1	31.1	31.5
75% Quartile	33.7	33.4	32.6	32.2	33.3	32.7
Average	29.8	29.6	28.9	28.7	29.4	29.0
Standard deviation	4.5	4.3	4.1	3.9	4.3	4.6

Table C.3 Statistics of computed water temperature differences (^{o}C) between the shallow depth and deep depth at the BAUS (upstream), BAMZ (mixing zone) and BADS (downstream) monitoring stations of Plant Barry.

Location / Statistical parameters	BAUS Difference [1]	BAMZ Difference [2]	BAMZ Difference [3]	BAMZ Difference [4]	BADS Difference [5]
Minimum	-1.0	-1.1	-3.5	-1.6	-0.5
Maximum	3.8	8.1	7.6	2.7	2.4
25% Quartile	-0.1	0.2	0.2	0.0	-0.1
Median	0.2	0.9	0.7	0.2	0.0
75% Quartile	0.5	1.7	1.4	0.5	0.1
Average	0.5	1.1	1.0	0.2	0.1
Standard deviation	0.9	1.2	1.0	0.4	0.3

Note:

[1] Temperature difference computed between shallow and deep depths in the upstream monitoring station.

[2] Temperature difference computed between shallow depth at the left bank and deep depth in the mixing zone monitoring stations.

[3] Temperature difference computed between shallow depth at the right bank and deep depth in the mixing zone monitoring stations.

[4] Temperature difference computed between mid-depth and deep depth in the mixing zone monitoring station.

[5] Temperature difference computed between shallow and deep depths in the downstream monitoring station.

Table C.4 Statistics of computed water temperature differences (°C) at the **shallow depth** between different monitoring stations of Plant Barry.

Statistical parameters	BADS - BAUS	BADS - BAMZ (left bank)	BADS - BAMZ (right bank)	BAMZ (right bank) - BAUS	BAMZ (left bank) - BAUS
Minimum	-2.1	-6.7	-6.1	-2.9	-2.7
Maximum	3.9	2.4	3.3	8.2	7.5
25% Quartile	0.1	-0.9	-0.6	0.3	0.3
Median	0.7	-0.1	-0.1	0.8	1.0
75% Quartile	1.4	0.1	0.3	1.6	1.9
Average	0.8	-0.4	-0.2	1.0	1.2
Standard deviation	0.8	1.0	1.0	1.2	1.2

Table C.5 Monthly statistics of observed water temperatures (°C) at the middle depth of the **BAIC** (intake canal) monitoring station near the intake structure for units 4–5 of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.5	21.1	28.4	30.1	31.1	25.7	22.9
Maximum	22.5	28.9	34.0	35.3	35.2	34.9	26.5
25% Quartile	21.1	22.9	30.1	31.1	32.3	26.5	24.2
Median	21.4	24.4	31.1	31.7	32.6	27.1	24.5
75% Quartile	21.7	26.5	31.5	32.1	33.0	28.0	24.8
Average	21.4	24.5	30.9	31.7	32.7	27.8	24.6
Standard deviation	0.4	2.0	1.0	0.8	0.5	2.0	0.6

Table C.6 Monthly statistics of observed water temperatures (°C) at the middle depth of the **BAIC** (intake canal) monitoring station near the intake structure for units 1–3 of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.6	21.2	28.3	30.0	31.0	25.8	22.8
Maximum	23.5	28.7	34.3	35.3	35.8	35.1	26.4
25% Quartile	21.2	22.9	30.2	31.0	32.4	26.6	24.1
Median	21.5	24.5	31.1	31.7	32.7	27.2	24.4
75% Quartile	21.7	26.3	31.4	32.1	33.2	28.1	24.8
Average	21.5	24.6	30.9	31.6	32.8	27.9	24.5
Standard deviation	0.4	1.9	1.0	0.8	0.6	1.9	0.6

Table C.7 Monthly statistics of observed water temperatures (°C) at the middle depth of the **BADC** (discharge canal) monitoring station near the intake structure for units 4–5 of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	21.4	21.8	36.0	38.1	36.0	26.8	25.5
Maximum	29.9	40.2	45.4	46.1	47.3	45.6	41.9
25% Quartile	24.4	28.2	38.2	39.7	40.5	32.9	28.9
Median	25.0	32.3	39.3	40.4	41.4	33.8	29.4
75% Quartile	25.8	34.3	40.5	42.0	43.1	34.9	29.9
Average	25.2	31.4	39.5	40.9	41.7	34.3	29.8
Standard deviation	1.2	4.0	1.8	1.7	2.0	3.1	2.8

Table C.8 Monthly statistics of observed water temperatures (°C) at the middle depth of the **BADC** (discharge canal) monitoring station near the intake structure for units 1–3 of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	22.3	23.4	29.4	33.9	33.2	27.9	24.2
Maximum	29.9	34.8	40.0	40.2	43.1	37.2	32.0
25% Quartile	24.4	26.8	34.5	35.4	36.4	31.9	28.4
Median	25.0	28.3	35.4	36.1	37.3	32.5	28.8
75% Quartile	25.8	29.9	36.0	36.6	38.1	33.1	29.1
Average	25.2	28.4	35.2	36.1	37.2	32.6	28.6
Standard deviation	1.2	2.1	1.4	1.0	1.7	1.1	0.9

Table C.9 Monthly statistics of observed water temperatures (°C) at the **shallow depth** of the **BAUS** (upstream) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.54	21.1	28.2	30.2	30.9	25.9	23.1
Maximum	22.36	29.7	34.3	34.6	35.0	32.8	26.6
25% Quartile	21.04	23.0	30.0	31.1	31.9	26.6	24.3
Median	21.41	24.4	31.2	31.7	31.9	27.1	24.6
75% Quartile	21.74	26.5	31.5	32.1	31.9	27.7	25.0
Average	21.40	24.5	30.8	31.6	31.9	27.4	24.7
Standard deviation	0.45	2.1	1.0	0.7	0.2	1.2	0.6

Table C.10 Monthly statistics of observed water temperatures (°C) at the **deep depth** of the **BAUS** (upstream) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.46	21.21	28.2	30.0	31.1	25.9	23.0
Maximum	22.27	28.46	31.8	32.6	31.9	31.7	26.4
25% Quartile	20.97	22.87	29.9	30.9	31.7	26.8	24.1
Median	21.33	24.38	30.8	31.5	31.7	27.3	24.4
75% Quartile	21.67	26.33	31.1	31.9	31.7	31.7	24.6
Average	21.33	24.49	30.5	31.4	31.7	28.9	24.4
Standard deviation	0.45	1.97	0.8	0.6	0.1	2.4	0.6

Table C.11 Monthly statistics of observed water temperatures (°C) at the **shallow depth** of the **BAMZ** (mixing zone) left bank monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.53	21.2	28.5	21.2	31.5	25.8	23.4
Maximum	22.30	34.0	38.0	38.7	41.7	32.9	30.9
25% Quartile	20.98	22.9	31.9	26.5	33.9	26.8	25.4
Median	21.34	25.6	32.7	32.1	34.4	27.5	26.0
75% Quartile	21.65	28.1	33.5	33.3	35.2	28.0	26.6
Average	21.34	25.6	32.7	30.2	34.6	27.6	26.1
Standard deviation	0.43	2.9	1.4	4.4	1.1	1.3	1.1

Table C.12 Monthly statistics of observed water temperatures (^oC) at the **shallow depth** of the **BAMZ** (mixing zone) right bank monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.6	20.4	28.5	30.6	31.0	26.0	23.4
Maximum	23.7	33.0	36.6	38.5	39.7	32.8	30.8
25% Quartile	21.1	23.1	31.3	32.6	33.7	26.8	25.4
Median	21.6	25.4	32.2	33.2	34.1	27.4	26.0
75% Quartile	22.0	28.1	32.9	34.0	34.7	28.0	26.7
Average	21.6	25.5	32.1	33.4	34.3	27.6	26.1
Standard deviation	0.5	2.7	1.3	1.2	1.0	1.2	1.1

Table C.13 Monthly statistics of observed water temperatures (^oC) at the **deep depth** of the **BAMZ** (mixing zone) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.5	21.2	28.3	29.9	31.0	25.9	23.1
Maximum	22.3	29.3	34.0	34.4	35.2	32.0	26.8
25% Quartile	21.0	22.9	30.3	31.1	32.6	26.6	24.9
Median	21.3	24.6	31.2	32.0	32.9	27.2	25.3
75% Quartile	21.6	26.5	31.8	32.3	33.4	27.7	25.7
Average	21.3	24.7	31.1	31.8	33.0	27.4	25.3
Standard deviation	0.4	2.1	1.0	0.8	0.6	1.3	0.6

Table C.14 Monthly statistics of observed water temperatures (°C) at the **middle depth** of the **BAMZ** (mixing zone) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.6	21.1	28.5	30.3	31.1	25.9	20.6
Maximum	22.3	29.8	34.9	35.3	35.6	32.4	35.6
25% Quartile	21.0	22.9	30.9	31.6	32.9	26.5	24.8
Median	21.4	24.7	31.8	32.3	33.3	27.2	25.2
75% Quartile	21.7	26.6	32.3	32.8	33.8	27.7	25.6
Average	21.4	24.7	31.6	32.2	33.3	27.4	25.2
Standard deviation	0.4	2.1	1.1	0.9	0.6	1.3	0.7

Table C.15 Monthly statistics of observed water temperatures (°C) at the **shallow** depth of the **BADS** (downstream) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July	August	September	October
Minimum	20.6	21.2	29.0	30.9	31.1	25.9	23.3
Maximum	22.2	30.9	34.8	35.5	35.6	31.8	27.2
25% Quartile	21.1	22.9	31.6	32.3	33.7	26.6	25.2
Median	21.4	25.1	32.4	33.0	34.1	27.4	25.7
75% Quartile	21.7	27.2	32.9	33.8	34.4	27.8	26.0
Average	21.4	25.1	32.2	33.0	34.0	27.5	25.6
Standard deviation	0.4	2.4	0.9	0.9	0.7	1.2	0.7

Table C.16 Monthly statistics of observed water temperatures (^{o}C) at the **deep** depth of the **BADS** (downstream) monitoring station of Plant Barry.

Month / Parameters	April	May	June	July
Minimum	20.6	21.2	29.1	30.9
Maximum	22.3	29.8	33.8	34.4
25% Quartile	21.1	23.0	31.5	32.3
Median	21.5	25.1	32.4	33.0
75% Quartile	21.7	27.2	32.8	33.6
Average	21.4	25.1	32.1	32.9
Standard deviation	0.4	2.4	0.9	0.8

Appendix D. Brief Summary of Results for Updated 2010 Model Runs

A preliminary working model of the Barry EFDC model was developed in 2010 (Fang and Devkota 2011). During the study period in 2010, an EFDC model was developed and tested using input data in 2010. In the preliminary working model, the upstream boundary was located 7 km upstream of the USGS Bucks gaging station. The discharge data were not available at the upstream boundary; therefore, the flow data measured at the USGS Bucks gaging station were used. The model developed during the preliminary study had 1,305 horizontal grids and 4 horizontal layers along the depth direction, and a total of 5,220 computational cells were used (Fang and Devkota 2011). The preliminary working model was run from Julian day 210 to 257 in 2010 (July 29 to September 14, 2010), but graphic results and statistical error parameters were reported from Julian 242 to 257 (August 30 to September 14, 2010), only because water surface elevations before August 30, as the downstream boundary, were roughly estimated.

The Barry EFDC model was first revisited in March 2011, when additional bathymetry data in the intake canal and temperature data associated with the macroinvertebrate plates measured in 2010 were available and provided by APC. The revised Barry EFDC model had 1,926 horizontal grids and six horizontal layers along the depth direction, and a total of 11,556 three-dimensional computational cells were used. Updated results were presented at the 25th annual (2011) Alabama Water Resources Conference in Orange Beach, AL, and at the Third Thermal Ecology and Regulation Workshop in Maple Grove, MN.

From March to June 2012, the Barry EFDC model was further revisited in order to utilize all temperature and ADCP data that APC collected in 2011 to develop a calibrated EFDC model. The updated Barry EFDC model was then applied using the 2010 input data. The updated simulation domain is a river segment of the Mobile River from the USGS Bucks gaging station to the intersection of the Mobile River and I-65 bridge. The model grids developed had 2,881 horizontal grids and 6 horizontal layers in the depth direction. Observed flow rates from the USGS gaging station at Bucks in 2010 were used as the upstream flow boundary. However, there were no long-term water temperature data available at the Bucks station. Water temperatures observed at 7 km upstream of the Bucks station (2010 model upstream boundary) were used as the upstream temperature boundary for updated 2010 model runs. The model simulation was performed from Julian days 212 to 258 (August 1 to September 16, 2010).

Water surface elevations at the downstream boundary were measured only from August 31 to September 16, 2010 by APC. Measured elevation data were available for only 17 days; however, the model simulation period was 46 days. Water surface elevations for the missing data period (29 days, August 1 to August 30, 2010) were estimated using the harmonic constituents that were derived from a harmonic analysis of the 2011 water surface elevation time-series data measured at the downstream boundary. Initially, there was datum shift between estimated water surface elevations and observed water surface elevations in 2010. The datum shift was obvious because we tried to predict water surface elevations in 2010 based on harmonic constituents in 2011. The datum shift was corrected, and the time series of predicted water surface elevation was compared with and matched reasonably well with the time series of observed water surface elevation (Figure D.1) except in two days, Julian day 254–255 (September 2–3, 2010). Predicted water surface elevations were combined with observed water surface elevations in 2010 to form the downstream boundary for the Barry EFDC model (Figure D.2).

Water temperatures at the downstream boundary (BADS) were specified using observed data from APC at the intersection of the Mobile River and I-65 bridge. The shallow-depth temperature data at BADS were available from April 28 to September 16, 2010. The deep-depth temperature data at BADS were available from August 17 to September 16, 2010.

Meteorological data used for updated 2010 model simulations were obtained from the Mobile Regional Airport. Simulation results are compared against observed data at several APC monitoring stations (BAUS, BAIC, BADC, BAMZ, and BADS) and at the 14 macroinvertebrate plate monitoring stations shown in Figures D.3 to D.21. Simulation vertical temperature profiles are compared against observed profiles at the intake canal, discharge canal, and mixing zone monitoring station (BAIC, BADC, and BAMZ) and at some of the macroinvertebrate plate monitoring stations shown in Figures D.22 to D.31. Overall, modeled temperatures matched well with observed data.

Statistical summary (minimum, 25% quartile, median or 50% quartile, 75% quartile, maximum, average, and standard deviation) of differences and absolute differences between observed and modeled are summarized in the Tables D.1 to D.7.

Table D.4 lists a statistical summary of the absolute differences (|Observed - Modeled|) between observed and **2010 and 2012 modeled** water temperatures (^{0}C) in the shallow-depth and deep layers at the Barry mixing zone monitoring station (from Julian day 231.5 to 258.0, August 18 to September 16, 2011). There were no observed data available at the deep-depth monitoring station before August 18, 2011. Figures D.6 and D.7 give graphic comparisons between 2010 and 2012 modeled temperatures at the shallow-depth and deep layers, respectively. Overall, model results generated from the 2012 updated EFDC model have better model accuracy in comparison to results from the preliminary working model developed in 2010.

Table D.8 lists statistical error parameters (such as ME, MAE, RMSE, and RRE) for model predictions on water temperatures at the intake canal (units 1-3, units 4-5), discharge canal, BAMZ surface, and BAMZ deep monitoring stations. Table D.9 lists the statistical error parameters (ME, MAE, RMSE, and RRE) for model predictions on water temperatures at the macroinvertebrates monitoring stations from Station 3 to Station 18.

Table D.1 Statistical summary of the differences (Observed-Modeled) and absolute difference (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow and deep layers at the Barry intake monitoring station (for units 1–3).

	Intake Canal (shallow depth)		Intake Canal (deep depth or bottom)	
Statistical Parameters	Observed - Modeled	|Observed - Modeled|	Observed - Modeled	|Observed - Modeled|
Minimum	-1.29	0.00	-0.36	0.00
25% Quartile	-0.02	0.10	-0.05	0.06
50% Quartile	0.13	0.22	0.07	0.13
75% Quartile	0.30	0.38	0.23	0.23
Maximum	2.52	2.52	1.77	1.77
Average	0.15	0.31	0.15	0.22
Standard deviation	0.43	0.33	0.32	0.28

Table D.2 Statistical summary of the differences (Observed-Modeled) and absolute difference (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow layer at the Barry discharge canal monitoring station (for units 1–3).

	Discharge Canal (shallow depth)	
Statistical Parameters	Observed - Modeled	|Observed - Modeled|
Minimum	-0.63	0.00
25% Quartile	-0.11	0.07
50% Quartile	0.03	0.15
75% Quartile	0.21	0.27
Maximum	1.98	1.98
Average	0.12	0.24
Standard deviation	0.37	0.30

Table D.3 Statistical summary of the differences (Observed - Modeled) and absolute differences (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow-depth and deep layers at the Barry mixing zone monitoring station.

Statistical Parameters	Mixing Zone (shallow depth) Observed - Modeled	Mixing Zone (shallow depth) |Observed - Modeled|	Mixing Zone (deep depth or bottom) Observed - Modeled	Mixing Zone (deep depth or bottom) |Observed - Modeled|
Minimum	-4.41	0.00	-3.24	0.00
25% Quartile	-0.98	0.32	-1.13	0.22
50% Quartile	-0.33	0.68	-0.53	0.57
75% Quartile	0.32	1.27	-0.11	1.13
Maximum	3.67	4.41	1.56	3.24
Average	-0.35	0.92	-0.70	0.80
Standard deviation	1.16	0.80	0.84	0.74

Table D.4 Statistical summary of the absolute differences (|Observed - Modeled|) between observed and **2010 and 2012 modeled** water temperatures (^{0}C) in the shallow-depth and deep layers at the Barry mixing zone monitoring station (from Julian day 231.5 to 258.0, August 18 to September 16, 2011).

Statistical Parameter	Surface (Shallow-depth) |Observed – Modeled 2010|	Surface (Shallow-depth) |Observed – Modeled 2012|	Bottom (Deep –depth) |Observed – Modeled 2010|	Bottom (Deep –depth) |Observed – Modeled 2012|
Minimum	0.006	**0.001**	0.003	**0.000**
Maximum	5.484	**4.081**	5.525	**3.240**
25% Quartile	0.632	**0.422**	0.319	**0.225**
Median	1.259	**0.839**	0.569	**0.577**
75% Quartile	2.046	**1.400**	1.128	**1.187**
Average	1.694	**1.051**	1.282	**0.807**
Standard deviation	1.029	**0.874**	0.941	**0.761**

Table D.5 Statistical summary of the **absolute differences** (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow-depth layers at the macroinvertebrate plate monitoring stations 3, 4, 5, and 6.

	Station 3	Station 4	Station 5	Station 6
Statistical Parameters	|Observed - Modeled|	|Observed - Modeled|	Observed - Modeled	|Observed - Modeled|
Minimum	0.00	0.00	0.00	0.00
25% Quartile	0.09	0.10	0.14	0.25
50% Quartile	0.23	0.25	0.35	0.63
75% Quartile	0.59	0.66	0.88	1.27
Maximum	4.70	3.87	3.91	4.11
Average	0.48	0.48	0.59	0.85
Standard deviation	0.65	0.57	0.61	0.72

Table D.6 Statistical summary of the **absolute differences** (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow-depth layers at the macroinvertebrate plate monitoring stations 7, 8, 9, and 10.

Statistical Parameters	Station 7	Station 8	Station 9	Station 10
Minimum	0.00	0.00	0.00	0.00
25% Quartile	0.26	0.30	0.19	0.19
50% Quartile	0.76	0.74	0.52	0.40
75% Quartile	1.45	1.34	1.02	0.73
Maximum	5.47	5.12	3.81	4.12
Average	1.00	0.96	0.77	0.56
Standard deviation	0.94	0.85	0.78	0.56

Table D.7 Statistical summary of the **absolute differences** (|Observed - Modeled|) between observed and modeled water temperatures (^{0}C) in the shallow-depth layers at the macroinvertebrate plate monitoring stations 11, 13, 14, 16, and 17.

Statistical Parameters	Station 11	Station 13	Station 14	Station 16	Station 17
Minimum	0.00	0.00	0.00	0.00	0.00
25% Quartile	0.15	0.13	0.15	0.15	0.21
50% Quartile	0.34	0.41	0.44	0.45	0.54
75% Quartile	0.65	0.74	0.83	1.11	0.98
Maximum	3.40	3.97	2.15	2.70	1.97
Average	0.51	0.55	0.54	0.66	0.64
Standard deviation	0.55	0.57	0.45	0.59	0.50

Table D.8 Statistics for model performance evaluation on water temperature (°C) at the intake canal (near intake structures for units 1–3 and units 4–5), discharge canal, mixing zone (BAMZ) surface, and BAMZ deep monitoring stations.

Station ID	Layer	Starting Date/Time	Ending Date/Time	# Pairs	RMSE	Avg. Error	Avg. Abs Error	Rel. RMSE	Data Mean	Model Mean
Units 1–3 Intake [1]	Layer 6	8/1/2010 1:00	9/15/2010 22:59	1,103	0.46	-0.15	0.31	8.84	32.05	31.90
Units 1–3 Intake	Layer 1	8/17/2010 19:59	9/15/2010 22:59	700	0.36	-0.15	0.22	9.63	31.30	31.15
Units 4–5 Intake [1]	Layer 6	8/1/2010 1:00	9/15/2010 22:59	1,103	0.47	-0.25	0.31	9.04	32.05	31.80
Units 1–3 discharge	Layer 6	8/1/2010 1:00	9/15/2010 22:59	1,103	0.39	-0.12	0.24	3.91	39.93	39.81
Mixing zone surface	Layer 5	8/1/2010 1:00	9/15/2010 23:45	2,709	1.22	0.35	0.93	20.16	32.83	33.18
Mixing zone deep	Layer 1	8/17/2010 15:00	9/15/2010 22:59	705	1.09	0.70	0.80	39.71	31.62	32.32

Note: [1] There was one shallow-depth monitoring station in the intake canal in 2010. Obseved data were used to compare with modeled surfeace-layer temperatures near the intake structures for units 1–3 and 4–5.

Table D.9 Statistics for model performance evaluation on water temperature (^{o}C) at the macroinvertebrate stations 3–18 from August 1 to September 16, 2010.

Station ID	Layer /Type	# Pairs	RMSE	Avg. Error	Avg. Abs. Error	Rel. RMSE (%)	Data Mean	Model Mean
Station 3	Layer 5	430	0.79	-0.30	0.46	11.08	32.42	32.11
Station 4	Layer 5	433	0.72	-0.11	0.46	11.04	32.50	32.39
Station 5	Layer 5	431	0.79	-0.10	0.55	10.76	32.85	32.75
Station 6	Layer 5	453	1.06	0.09	0.81	13.56	33.23	33.32
Station 7	Layer 4	451	1.36	-0.17	0.98	15.11	33.47	33.30
Station 8	Layer 4	451	1.29	0.01	0.97	14.06	34.11	34.12
Station 9	Layer 4	450	1.11	0.35	0.79	17.66	33.37	33.72
Station 10	Layer 5	434	0.80	0.08	0.57	10.15	33.71	33.78
Station 11	Layer 5	432	0.76	0.09	0.52	10.13	33.72	33.80
Station 13	Layer 5	432	0.79	-0.03	0.54	9.90	33.90	33.88
Station 14	Layer 5	432	0.71	0.03	0.54	10.40	33.79	33.82
Station 16	Layer 5	430	0.88	0.45	0.66	14.71	33.52	33.97
Station 17	Layer 5	430	0.80	0.43	0.63	15.26	33.70	34.12
Station 18	Layer 5	429	0.66	0.35	0.49	14.32	33.50	33.84

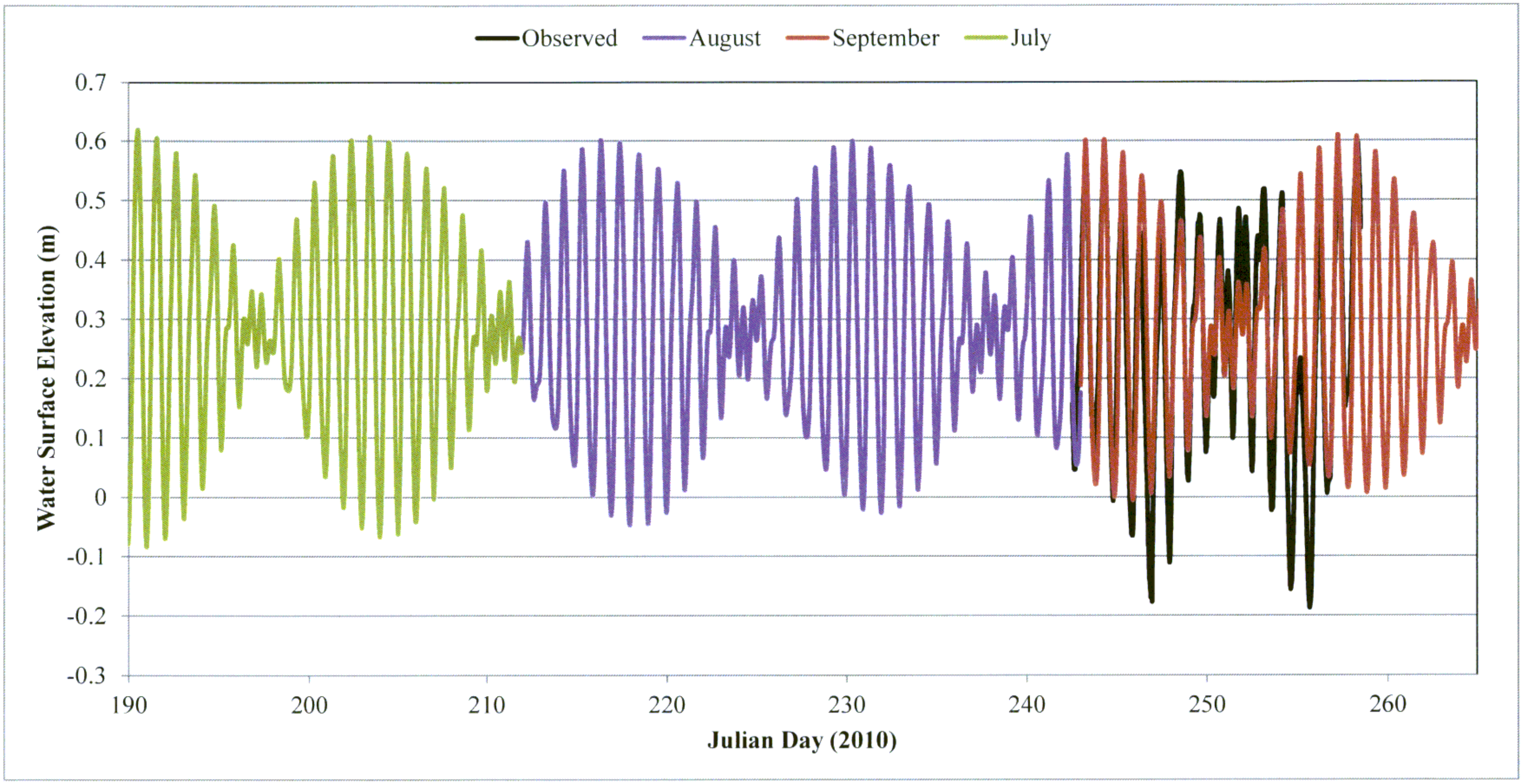


Figure D.1 Time-series plot of predicted water surface elevations (July, August, September 2010) from the harmonic analysis with datum correction and observed (black) water surface elevation in 2010 at the downstream boundary.

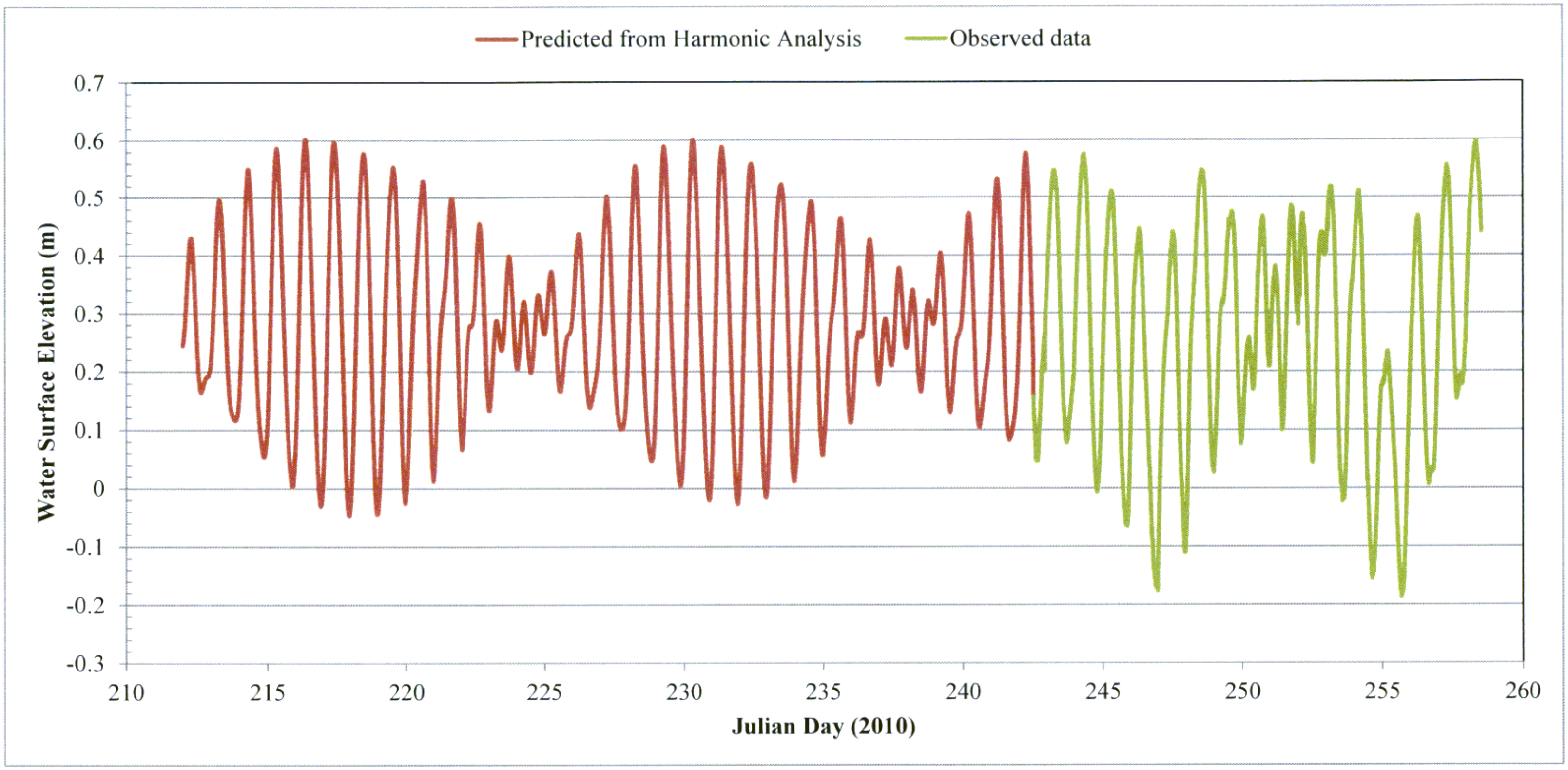


Figure D.2 Time-series of predicted (red) and observed (green) water surface elevations in 2010 that were used as the downstream boundary for the Barry EFDC model.

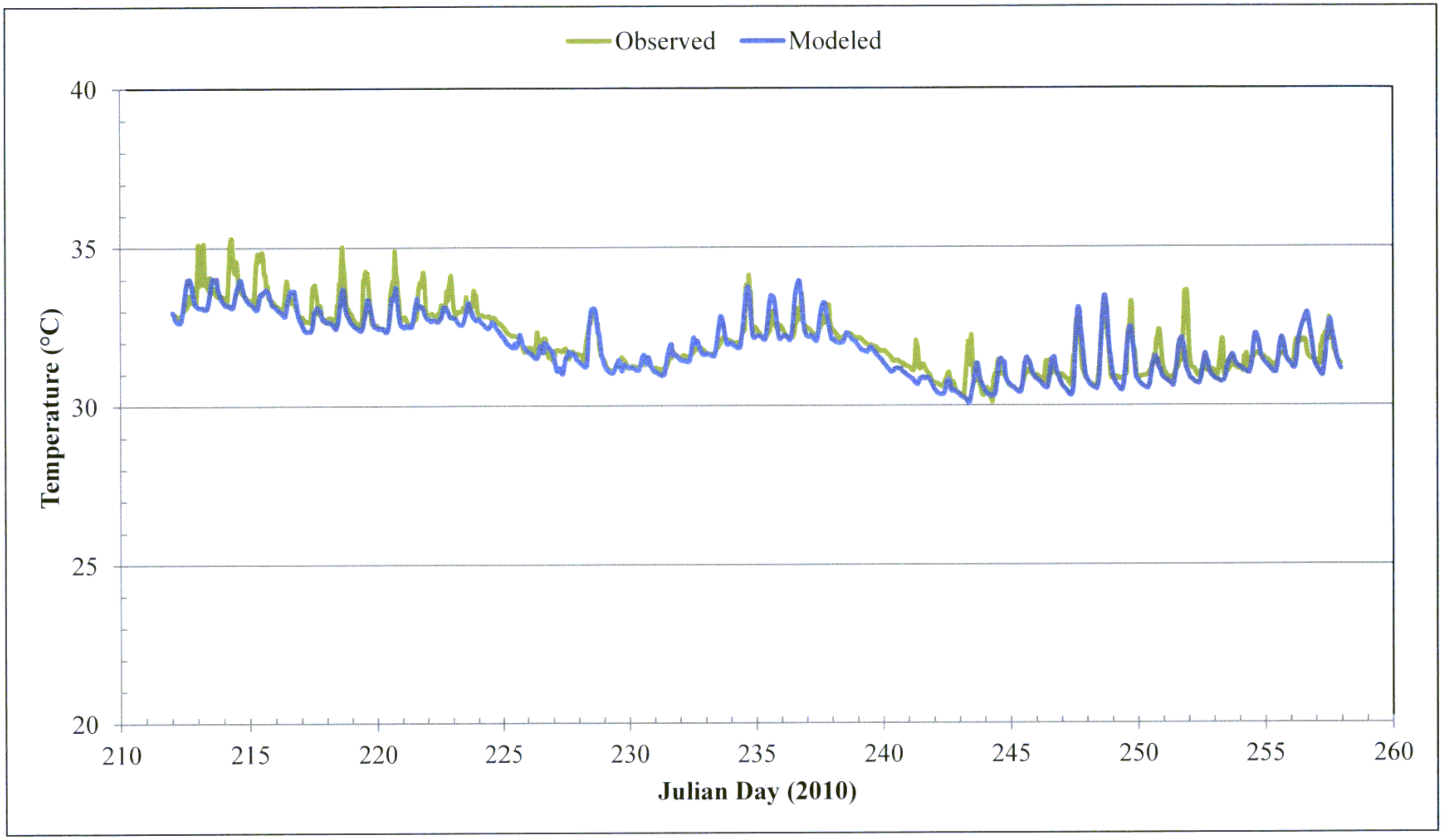


Figure D.3 Time-series plot of observed and simulated top-layer (shallow-depth) temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 **in the intake canal for units 1–3**.

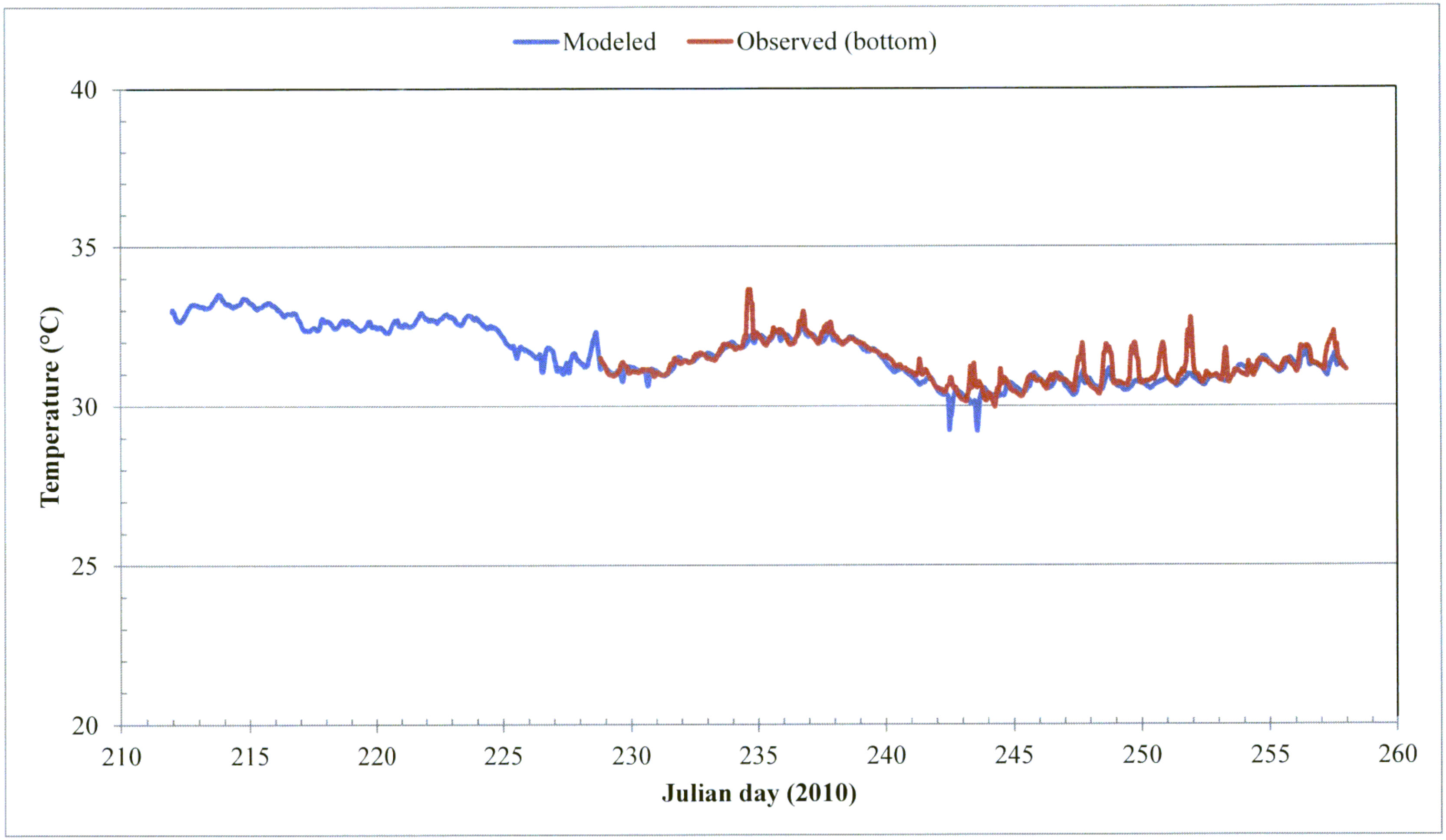


Figure D.4 Time-series plot of observed and simulated bottom-layer (**deep**) temperatures from August 1 to September 16 (Julian day 115 to 284) in 2010 **in the intake canal for units 1–3**.

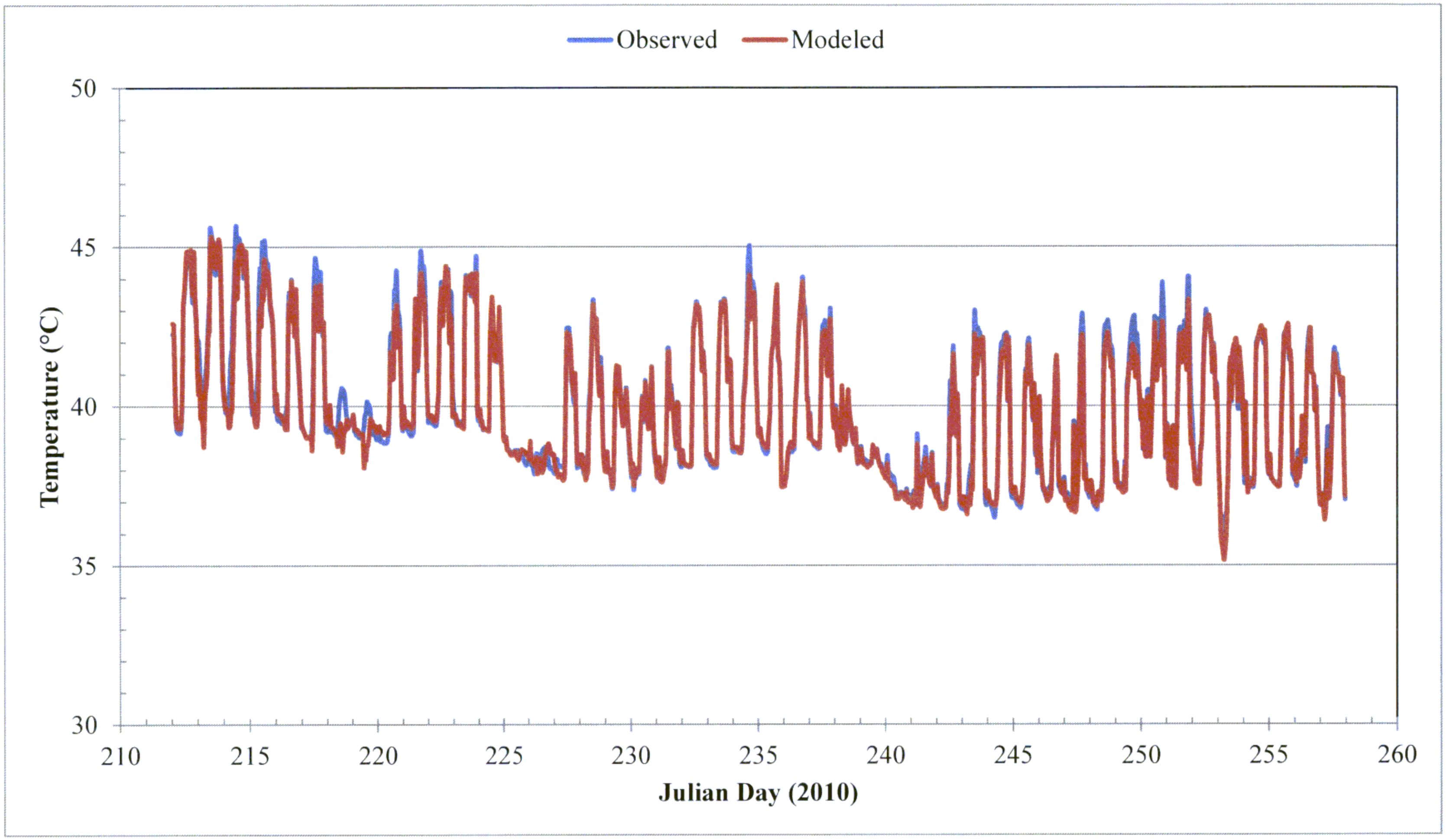


Figure D.5 Time-series plot of observed and simulated **bottom-layer** (deep) temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 **in the discharge canal**.

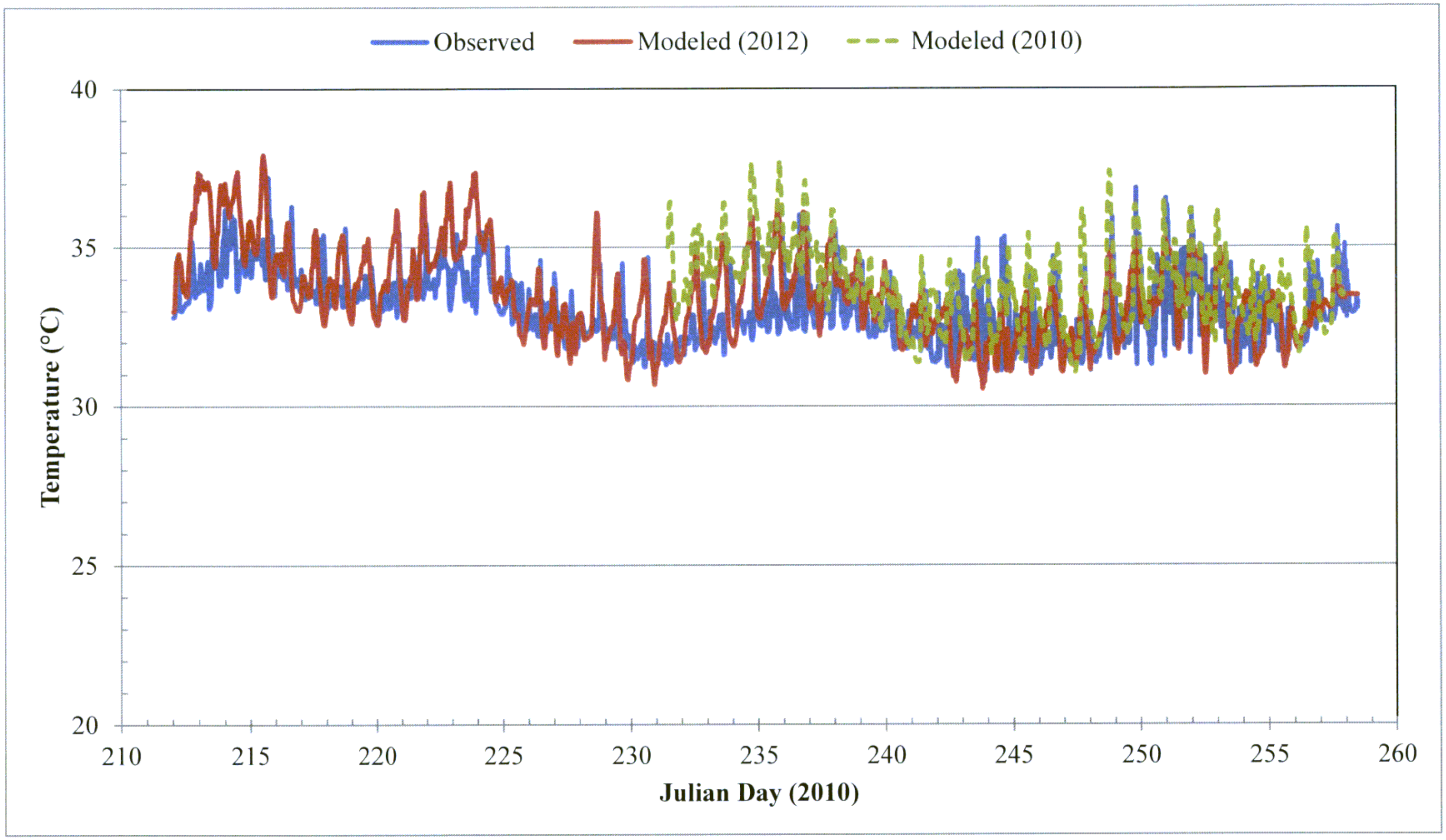


Figure D.6 Time-series plot of observed and simulated **top-layer** (deep) temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 **in the mixing zone.** Modeled top-layer temperatures from the 2010 model were plotted for comparison also.

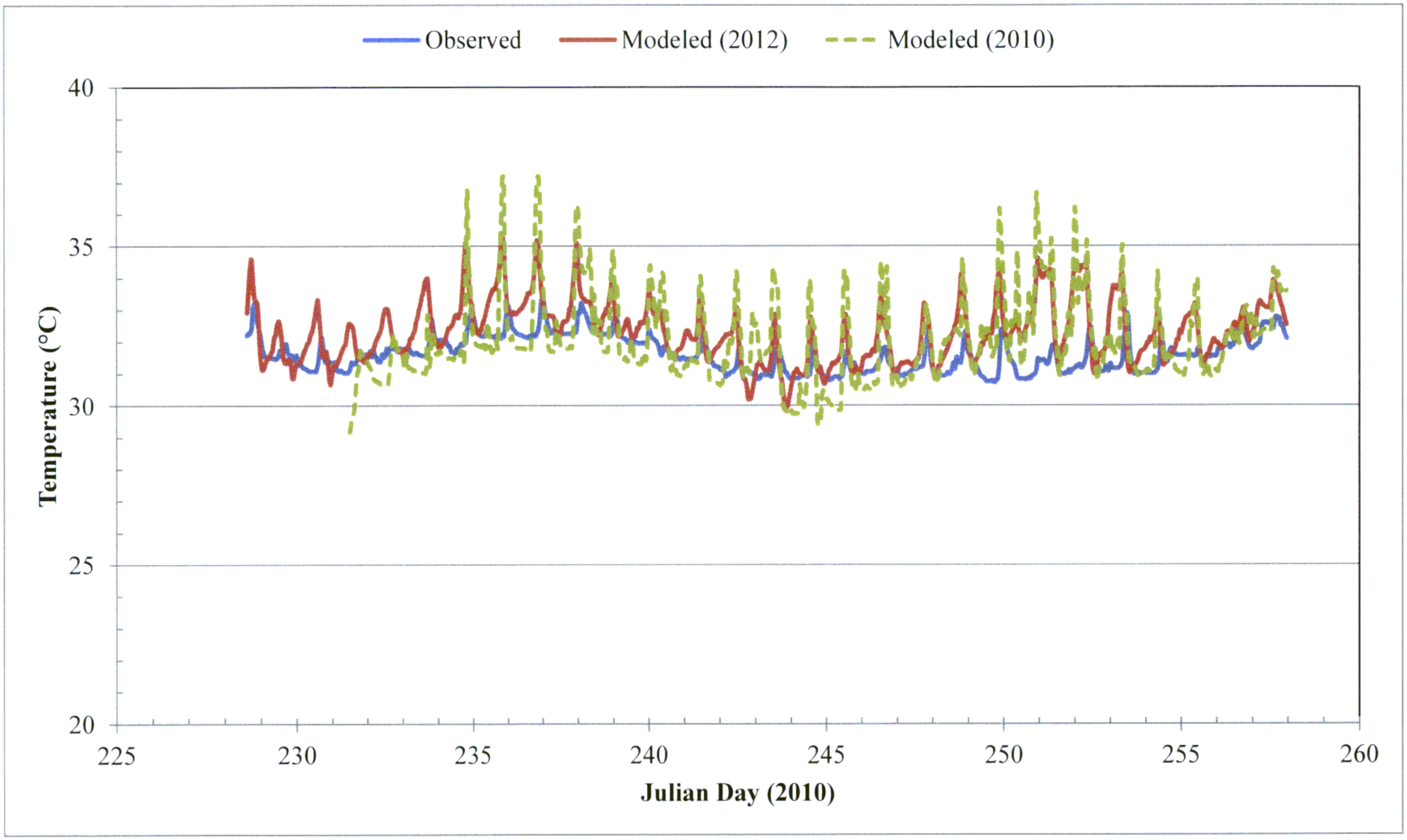


Figure D.7 Time-series plot of observed and simulated **bottom-layer** (shallow-depth) temperatures from August 17 to September 16 (Julian day 228 to 258) in 2010 **in the mixing zone.** Modeled bottom-layer temperatures from the 2010 model were plotted for comparison also.

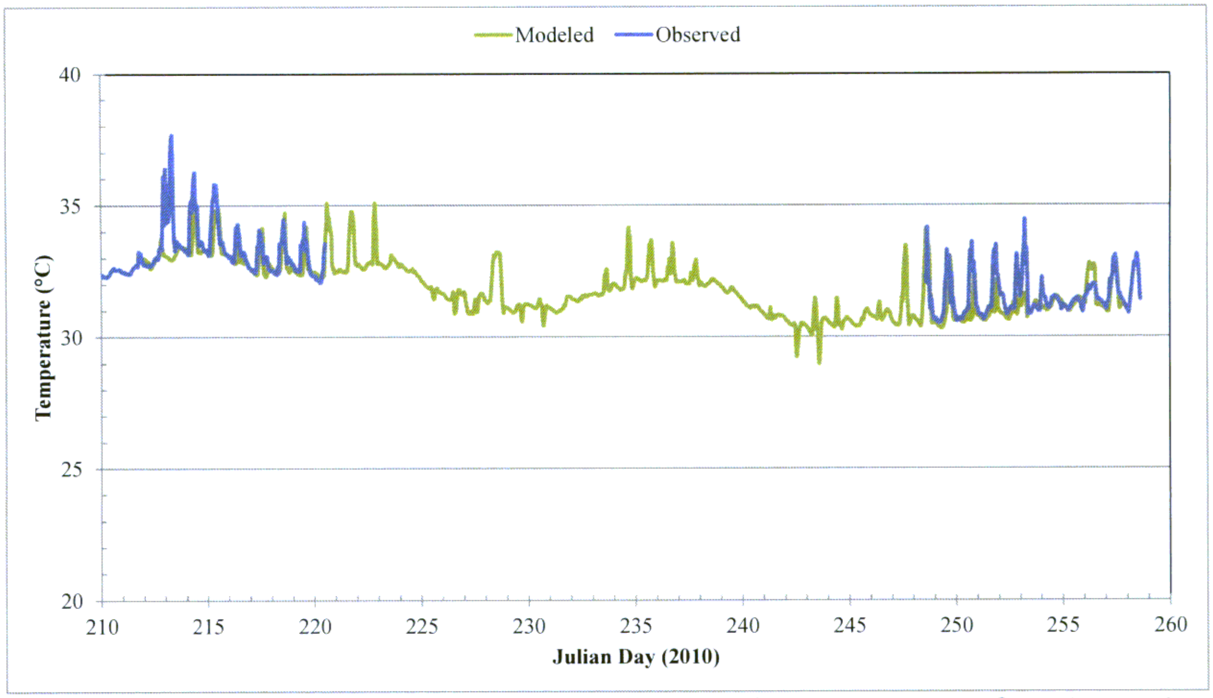


Figure D.8 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 3**.

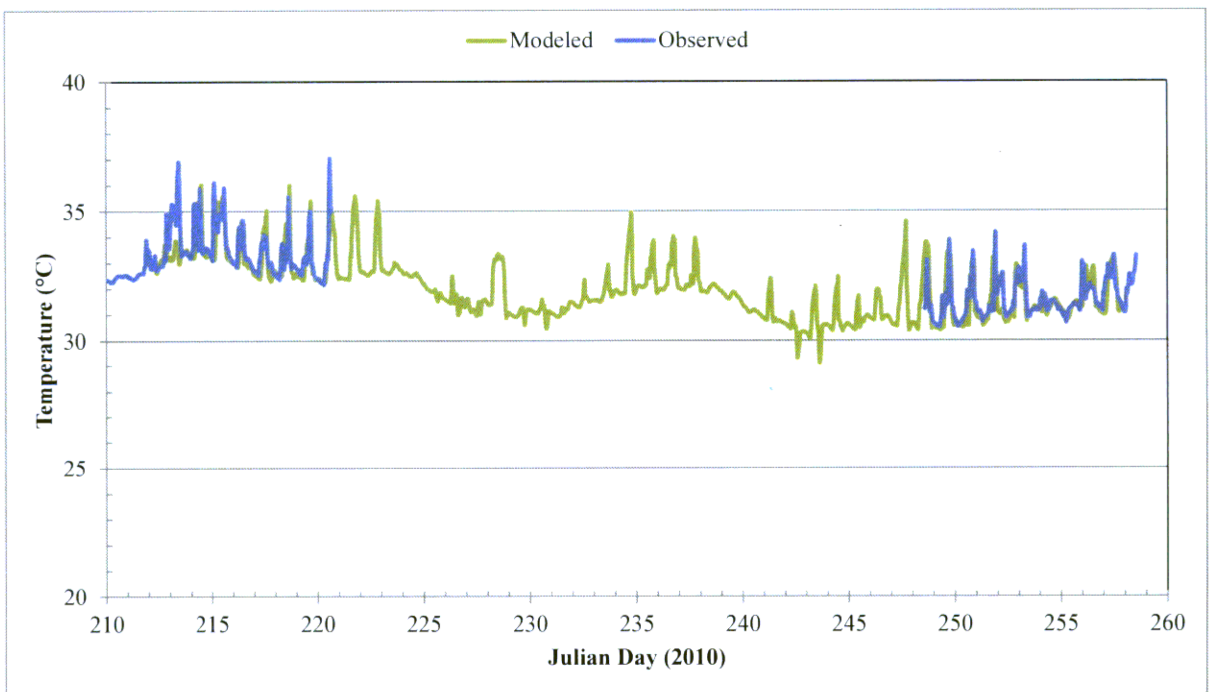


Figure D.9 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 4**.

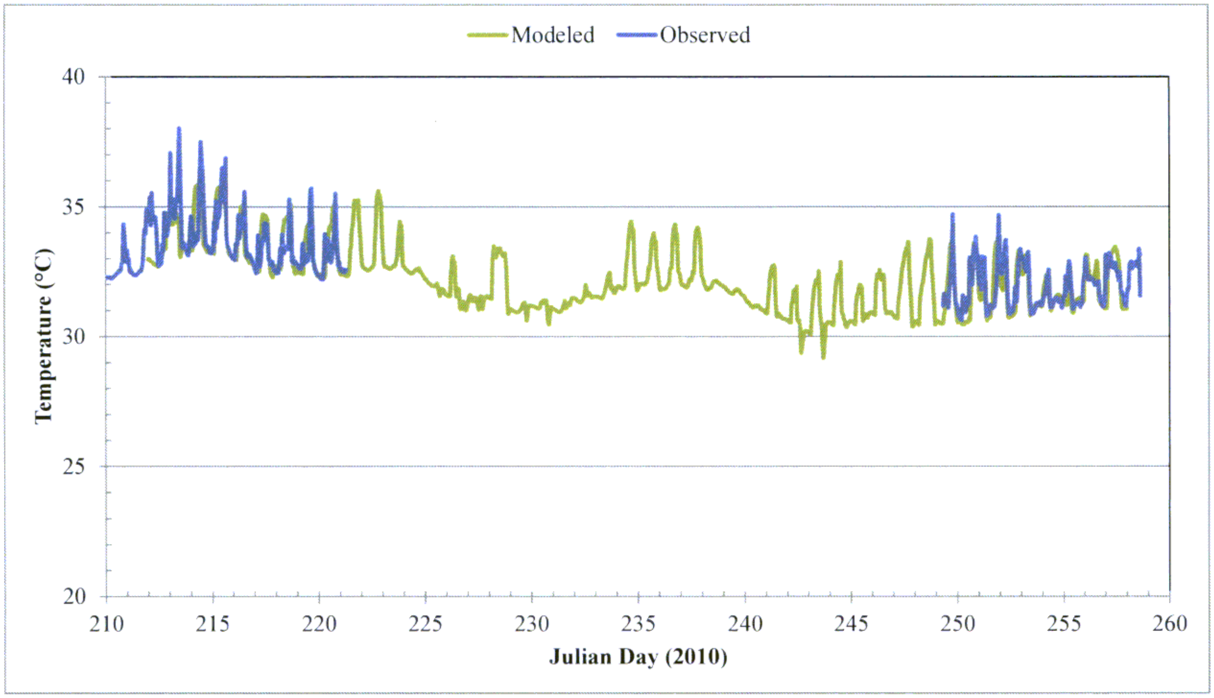


Figure D.10 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 5**.

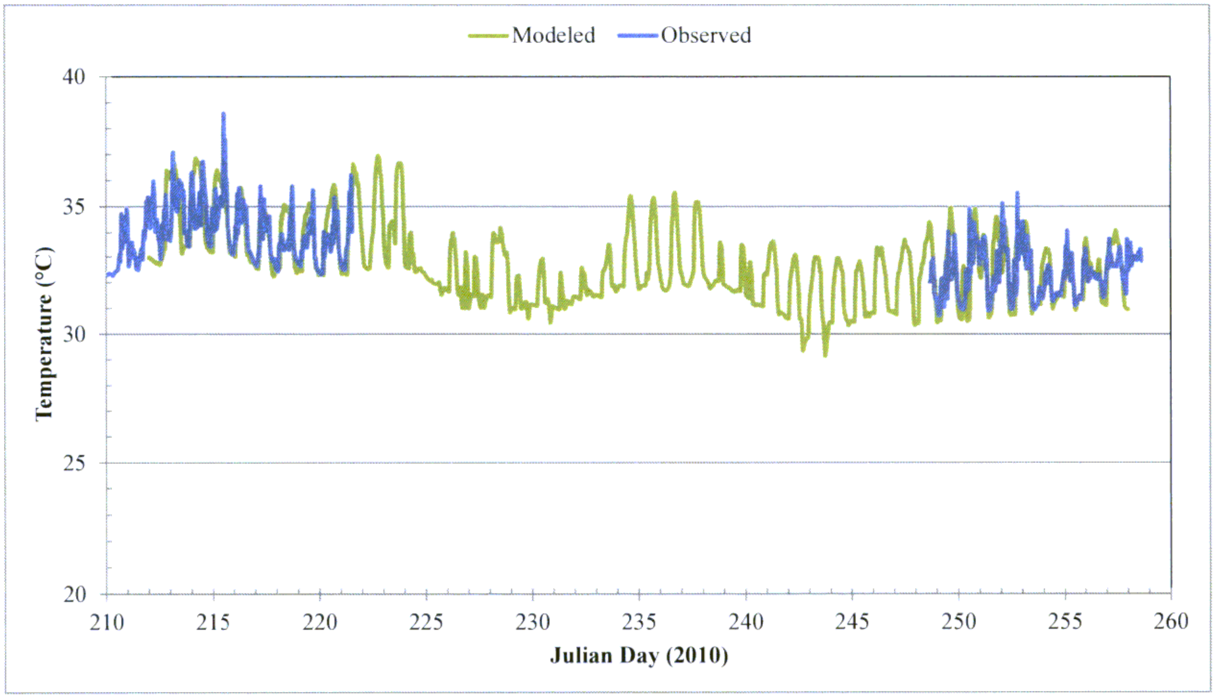


Figure D.11 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 6**.

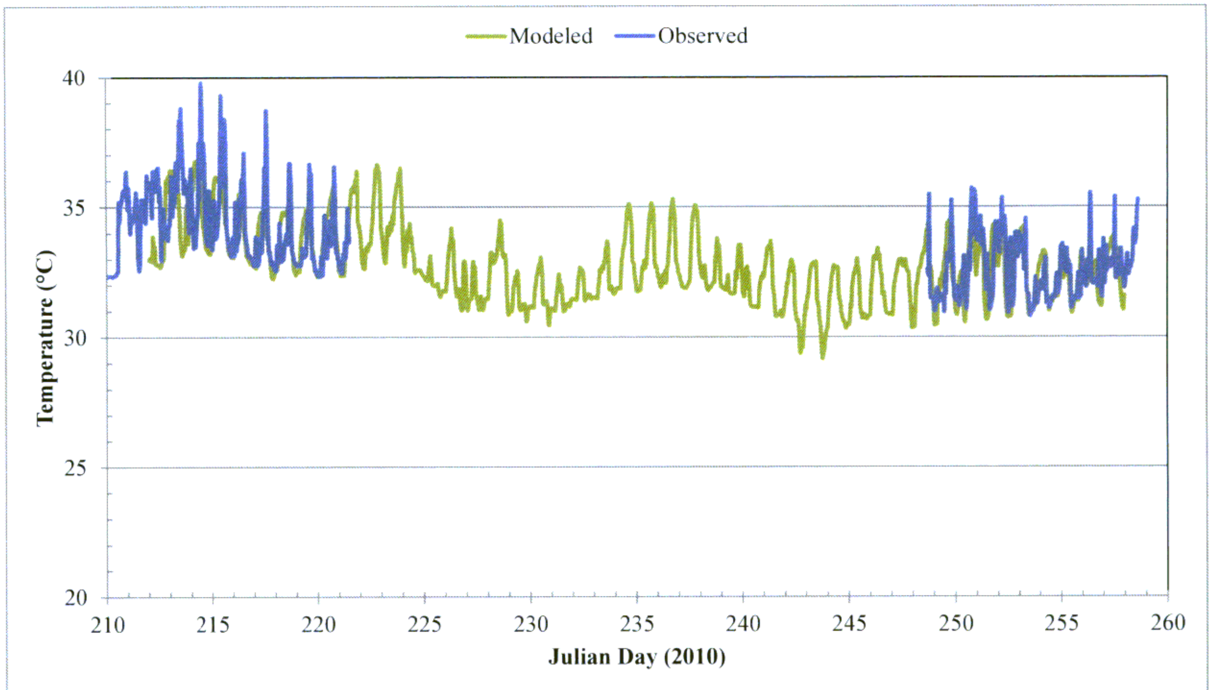


Figure D.12 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 7**.

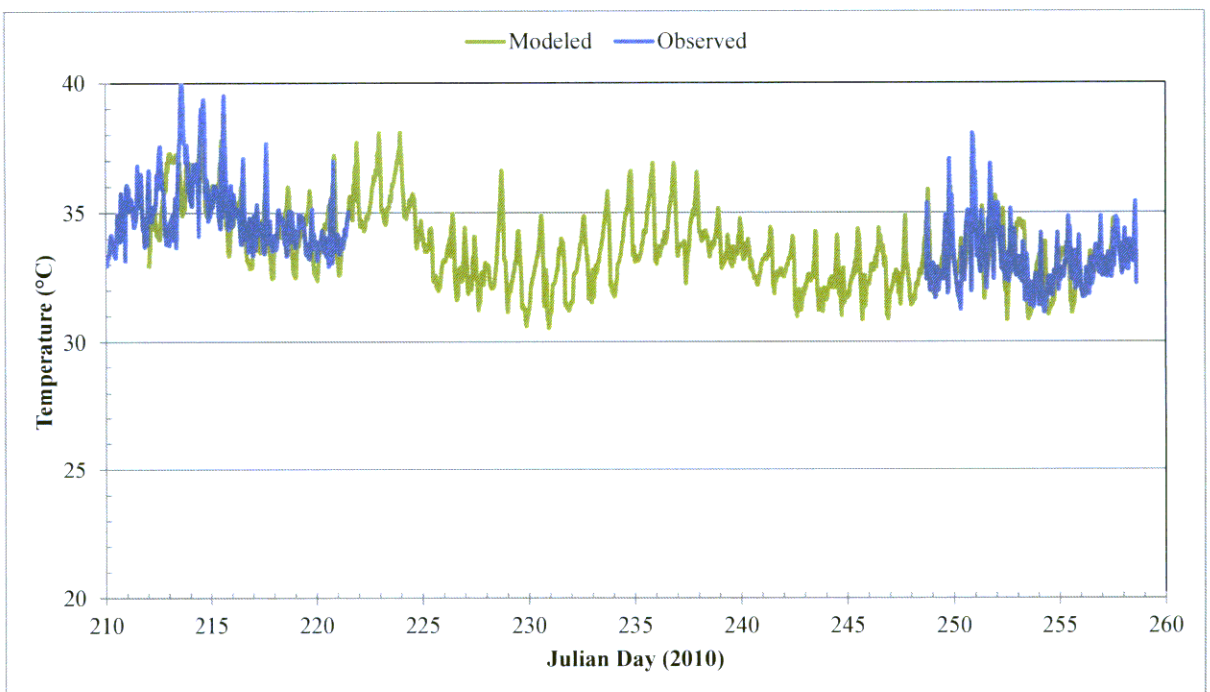


Figure D.13 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 8**.

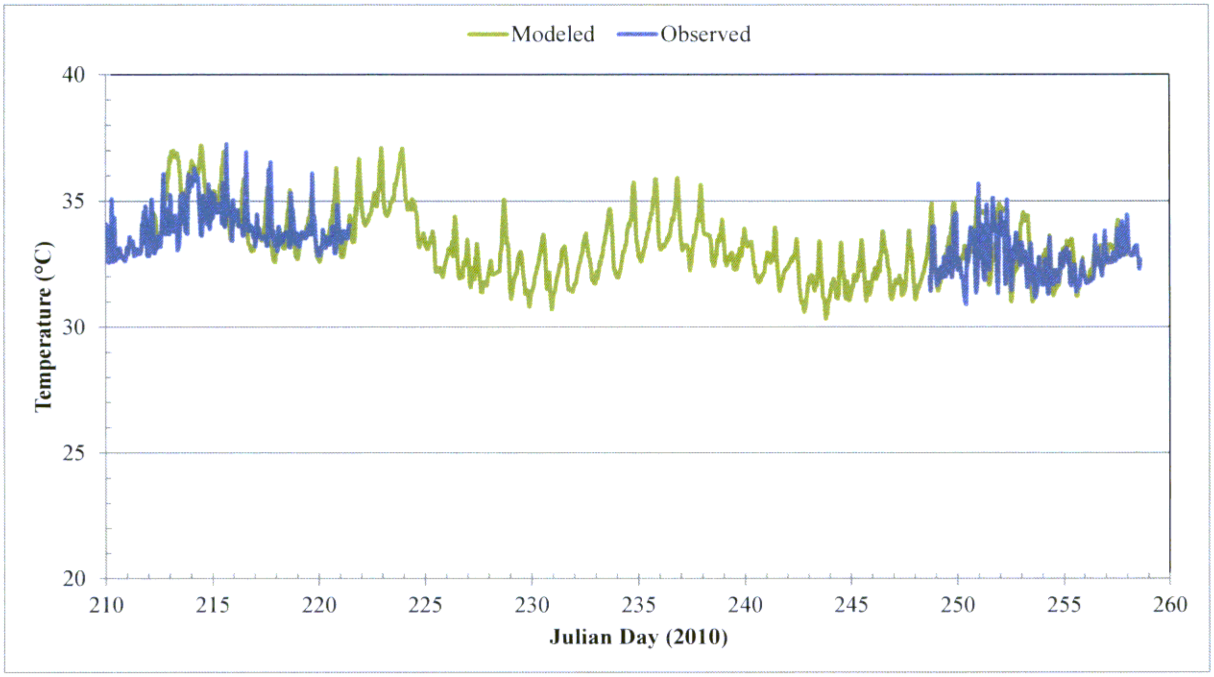


Figure D.14 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 9**.

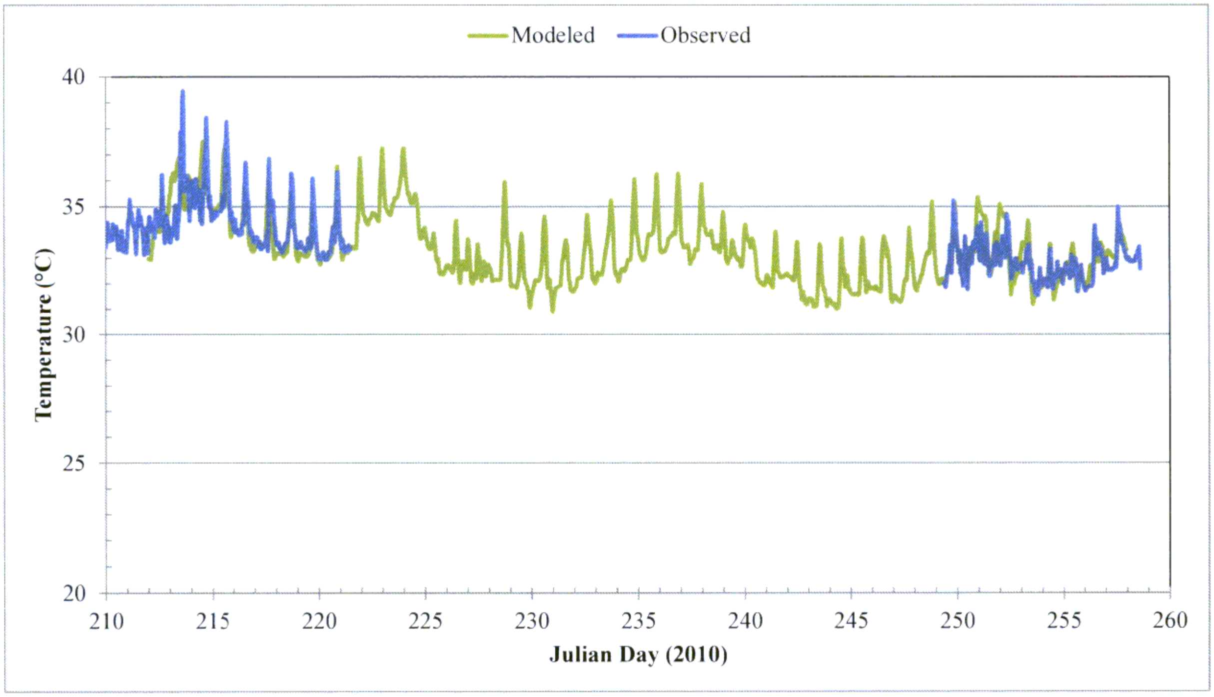


Figure D.15 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 10**.

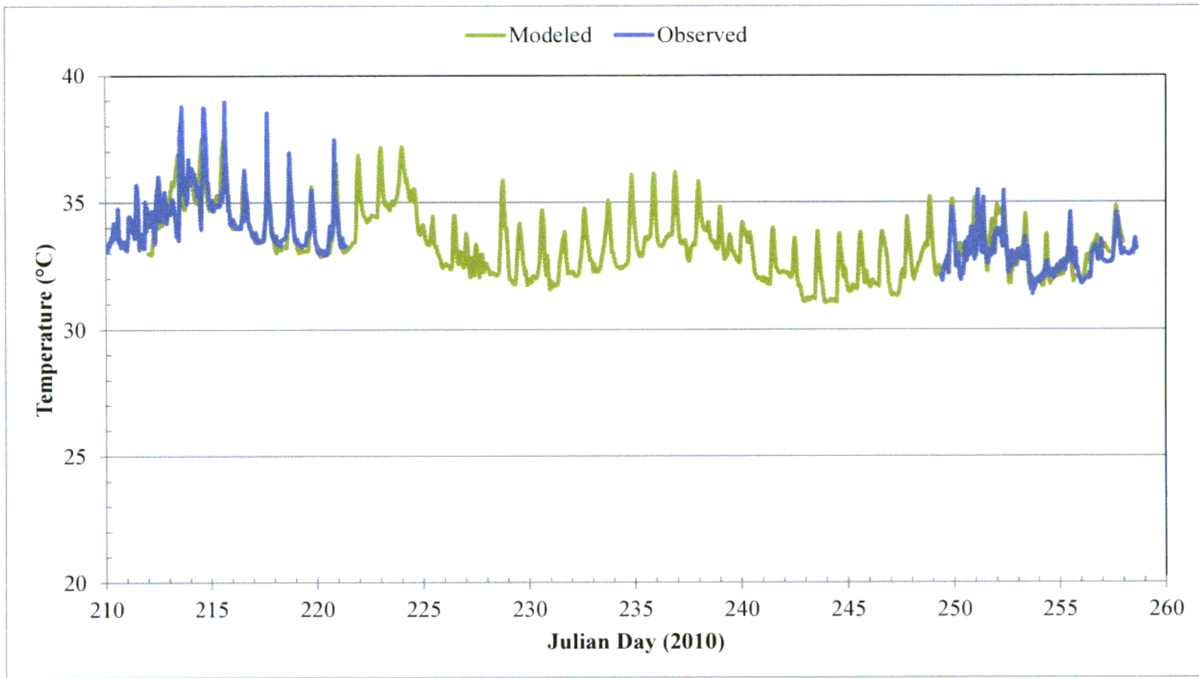


Figure D.16 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 11**.

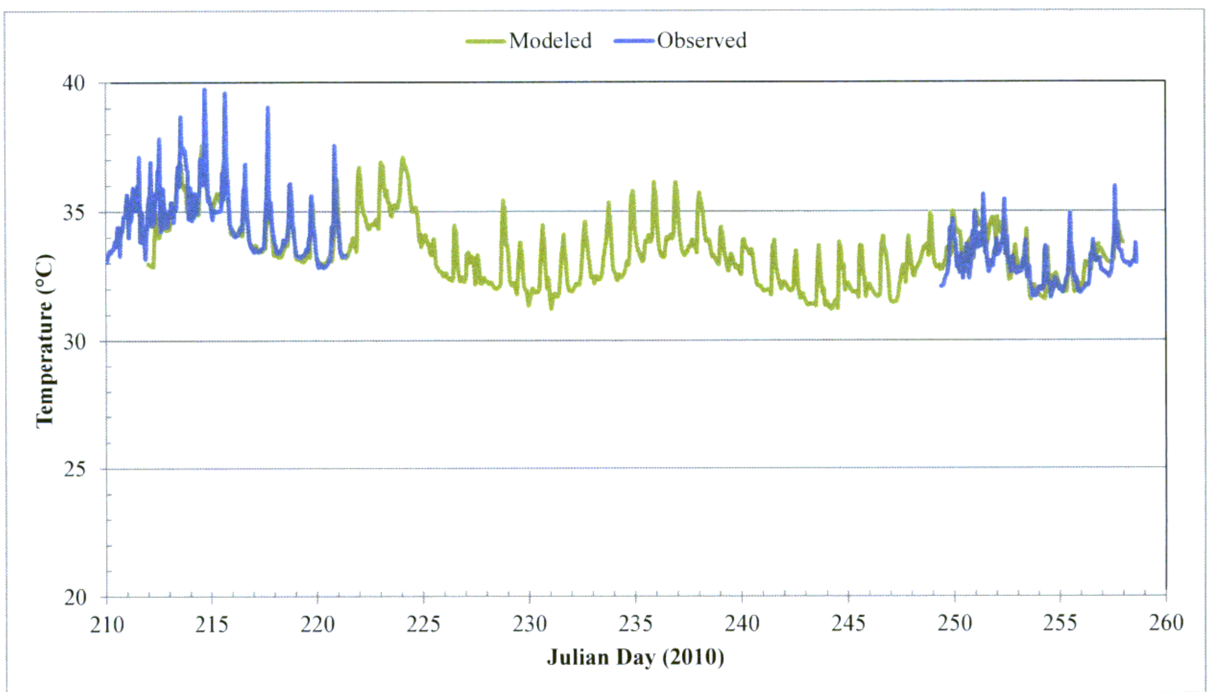


Figure D.17 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 13**.

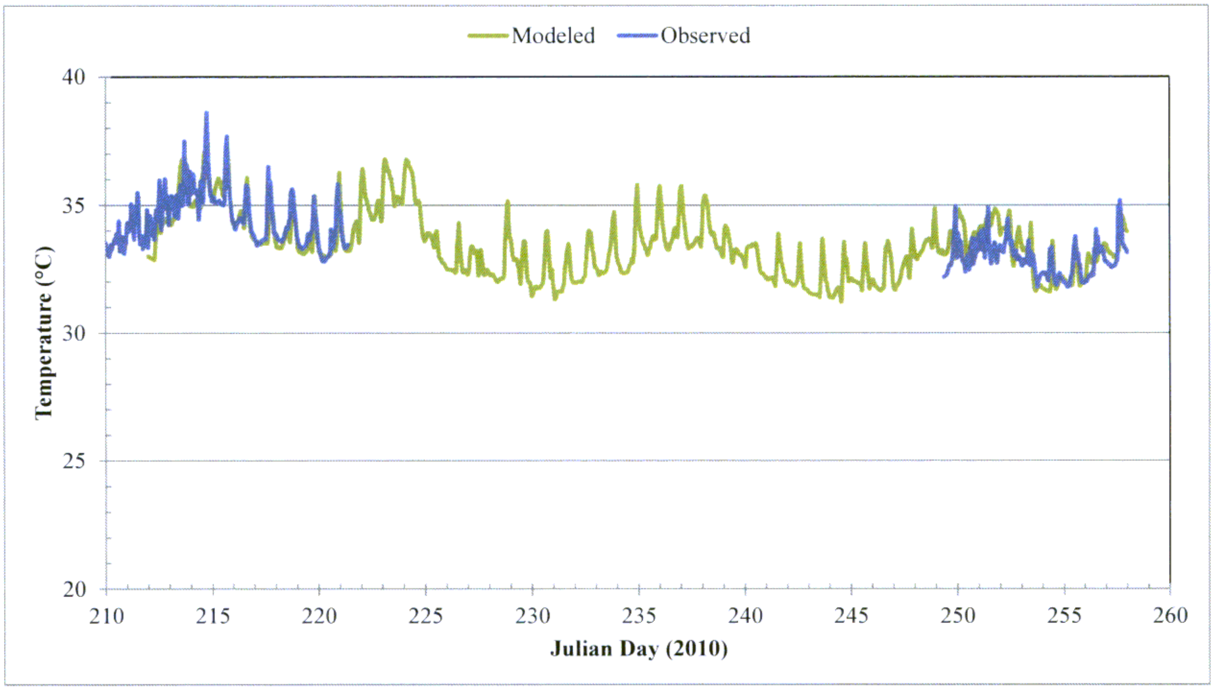


Figure D.18 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 14**.

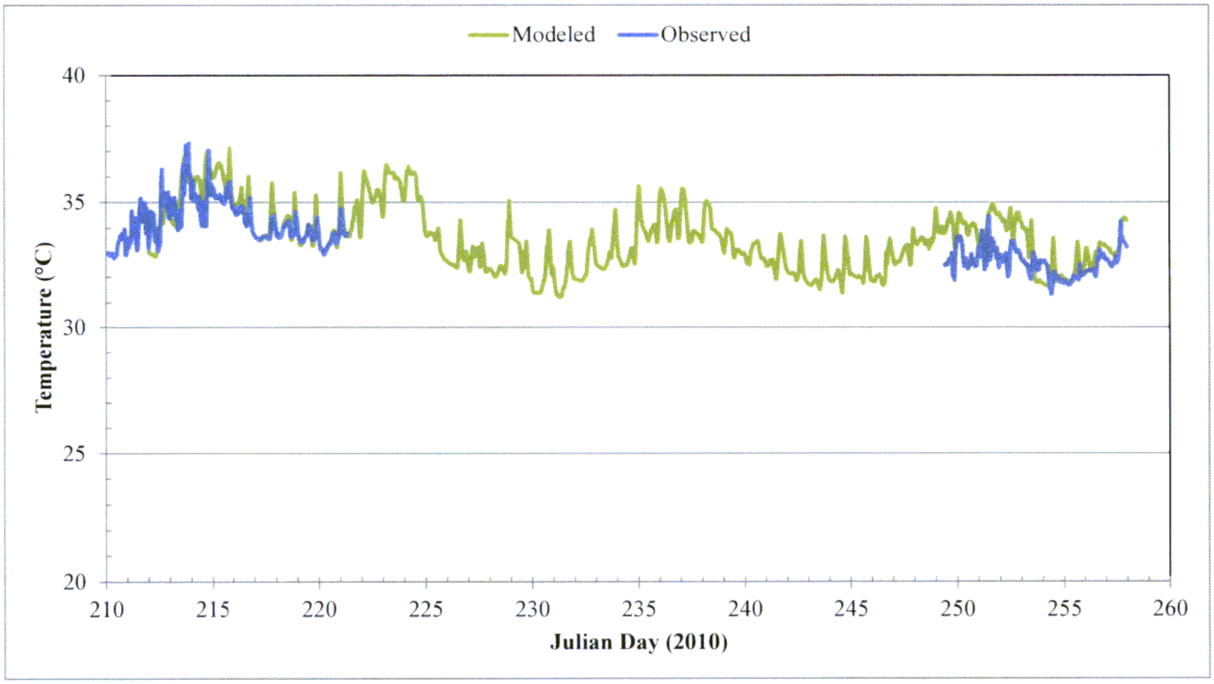


Figure D.19 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 16**.

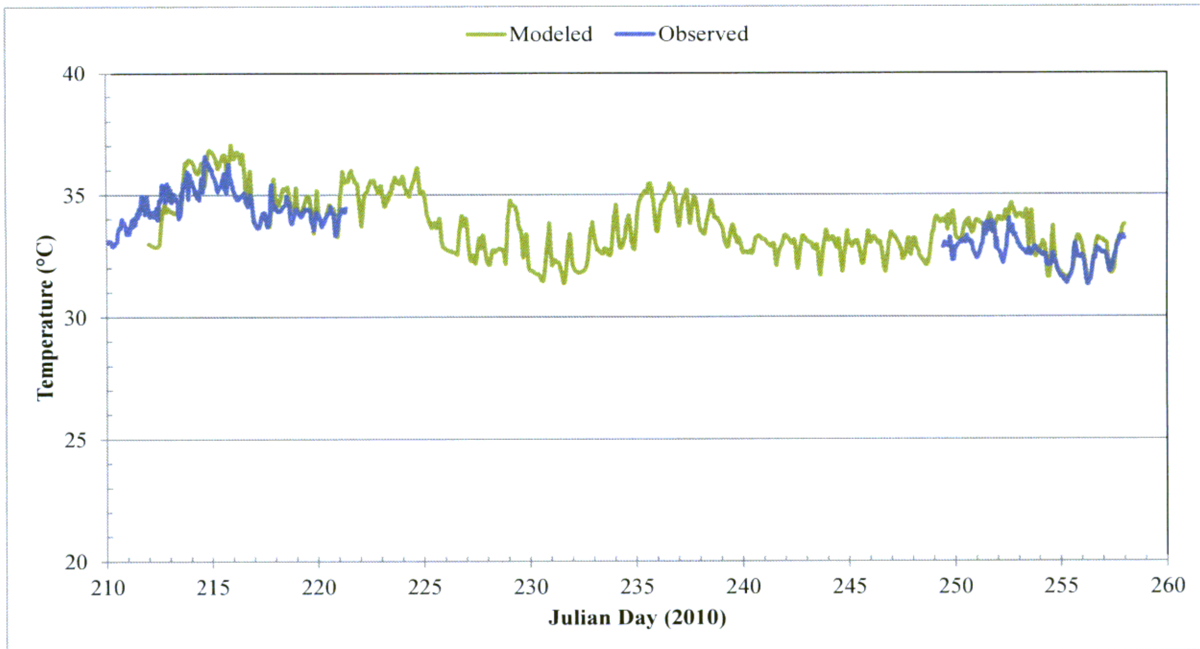


Figure D.20 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 17**.

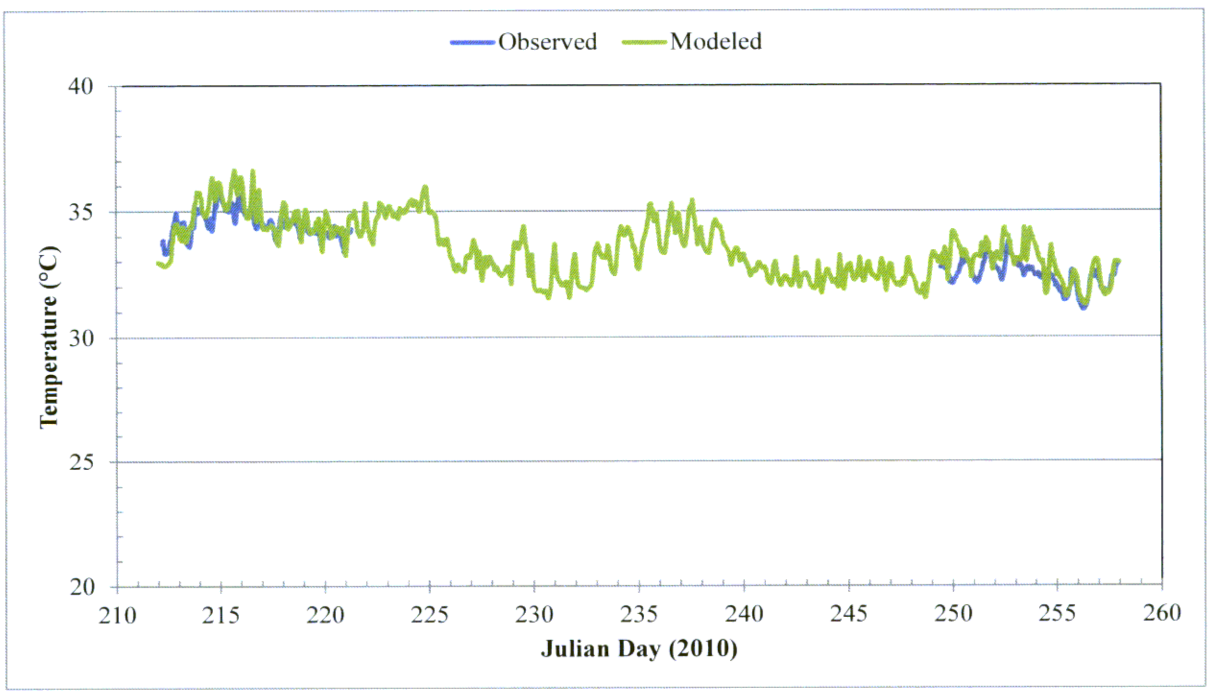


Figure D.21 Time-series plot of observed and simulated top-layer temperatures from August 1 to September 16 (Julian day 212 to 258) in 2010 at the macroinvertebrate plate **Station 18**.

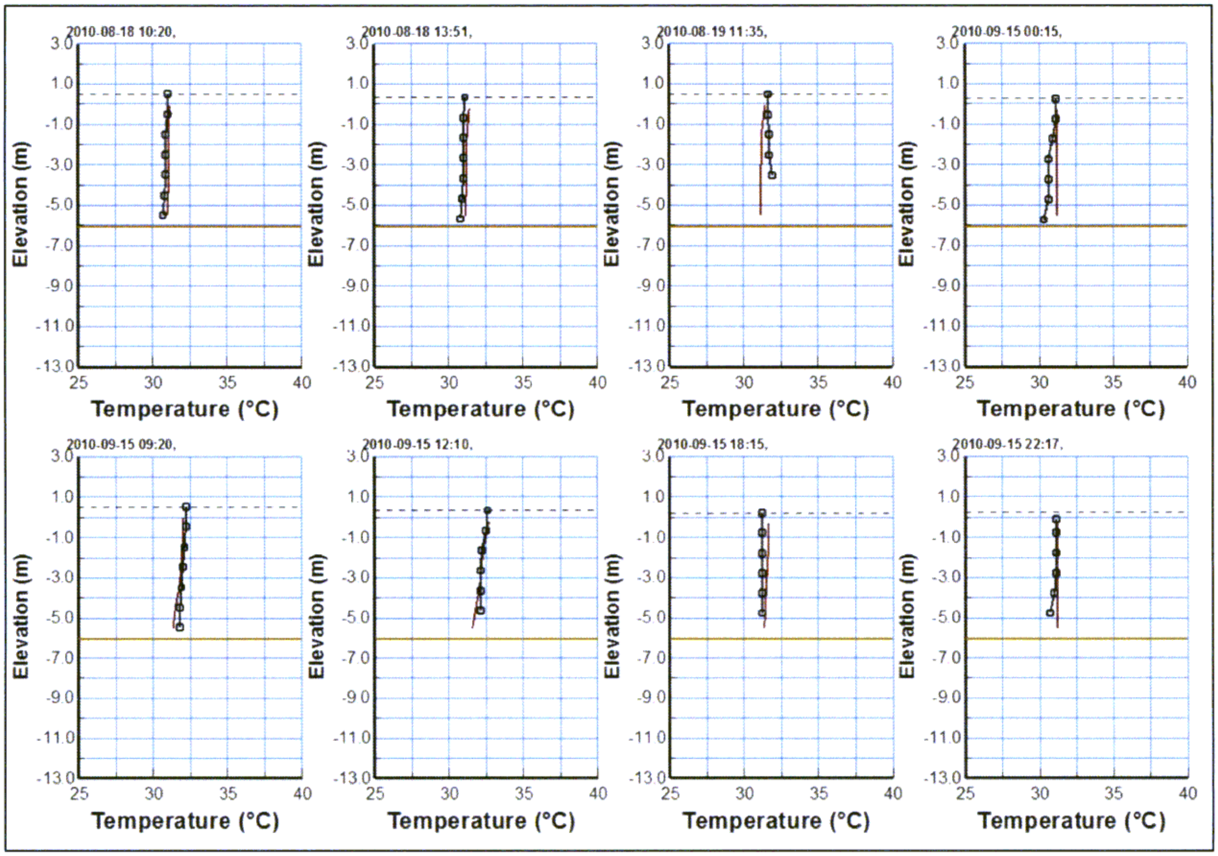


Figure D.22 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the **intake canal** on 8/18, 8/19, and 9/15, 2010.

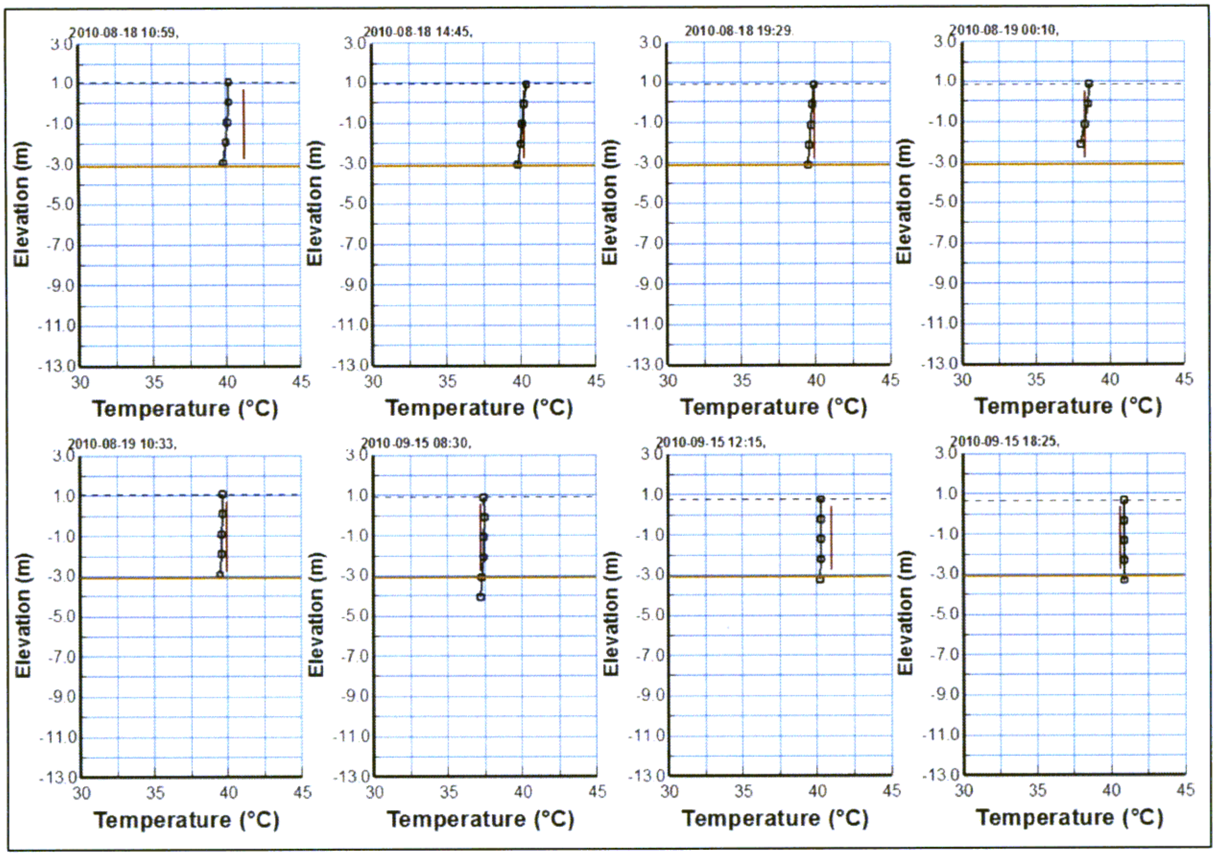


Figure D.23 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the **discharge canal** on 8/18, 8/19, and 9/15, 2010.

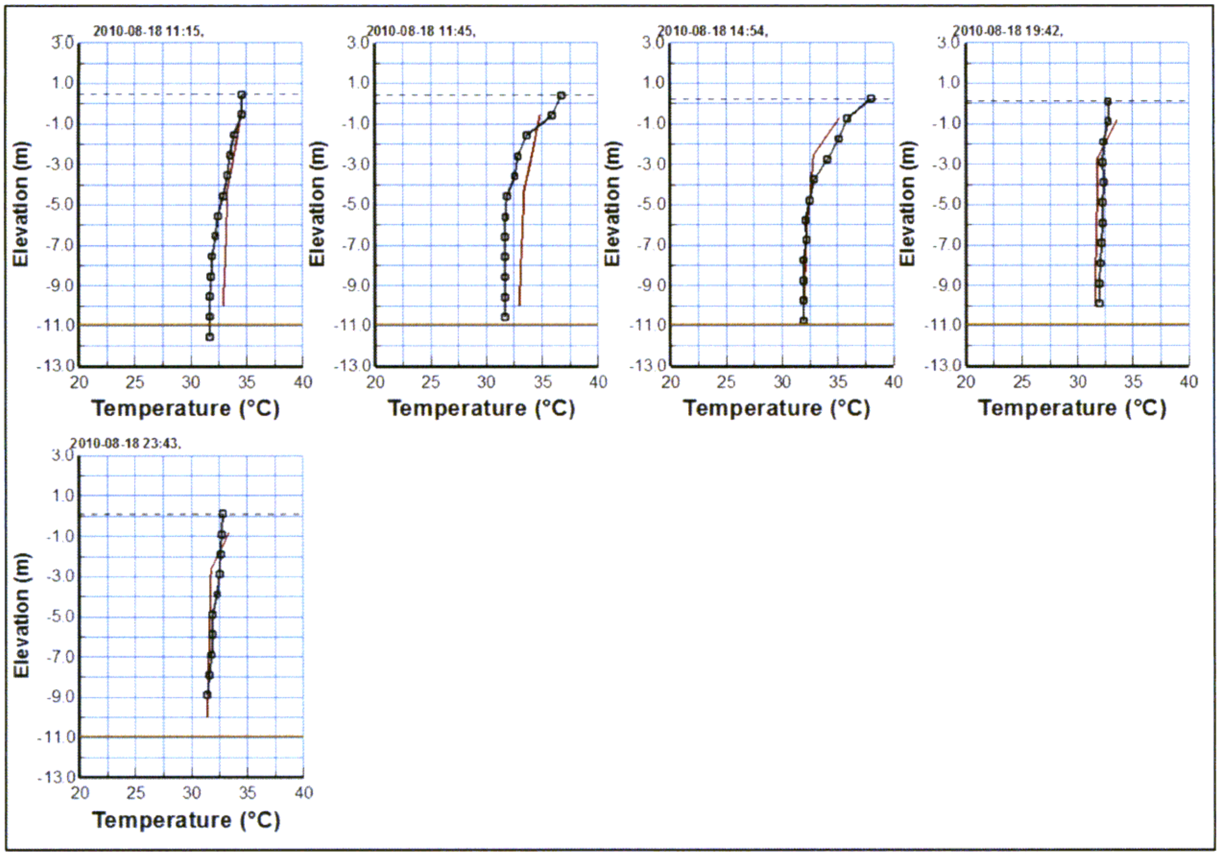


Figure D.24 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the **mixing zone** on 8/18, 2010.

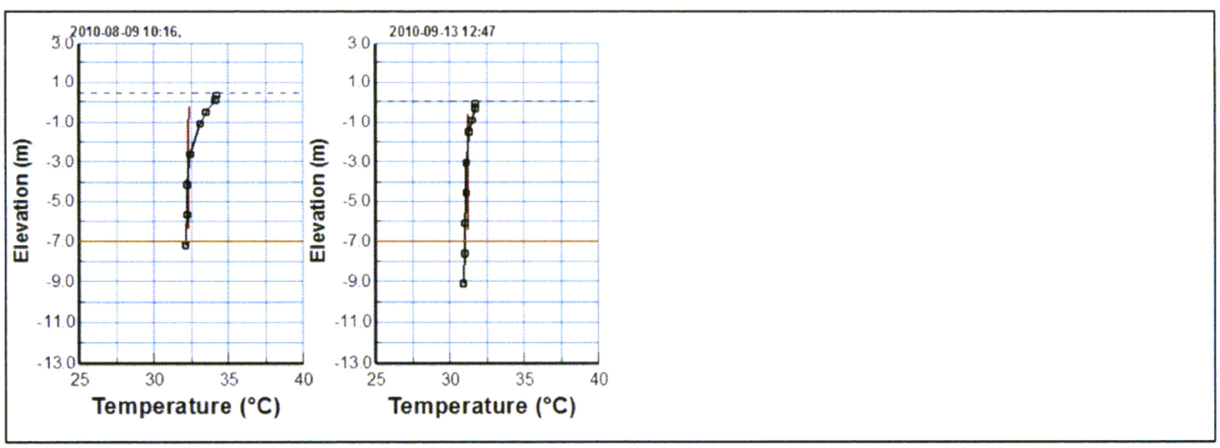


Figure D.25 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 3** on 8/9 and 9/13, 2010.

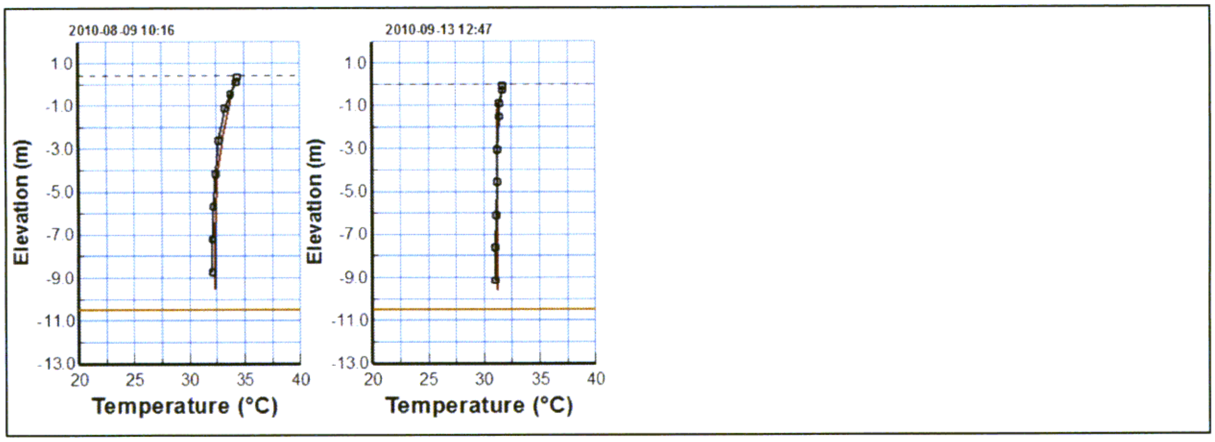


Figure D.26 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 4** on 8/9 and 9/13, 2010.

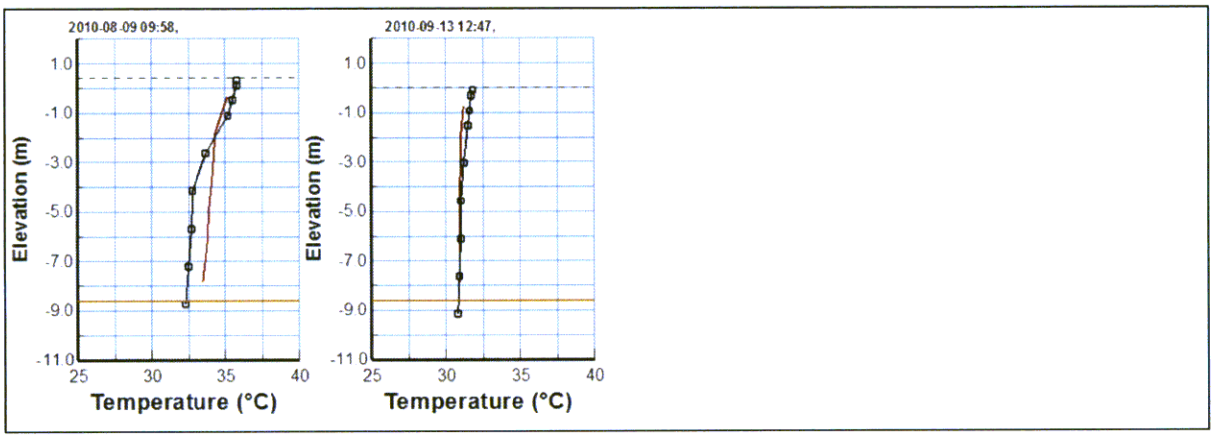


Figure D.27 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 6** on 8/9 and 9/13, 2010.

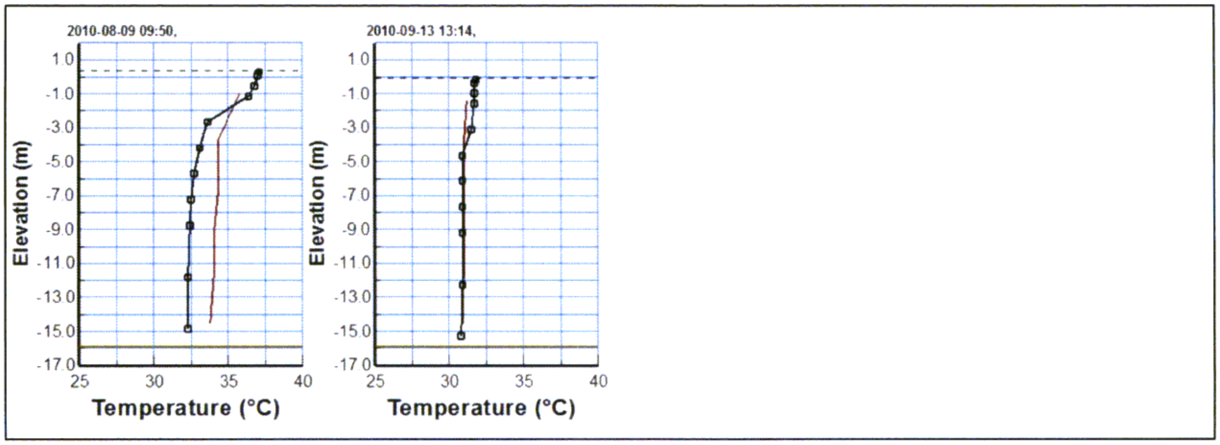


Figure D.28 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 7** on 8/9 and 9/13, 2010.

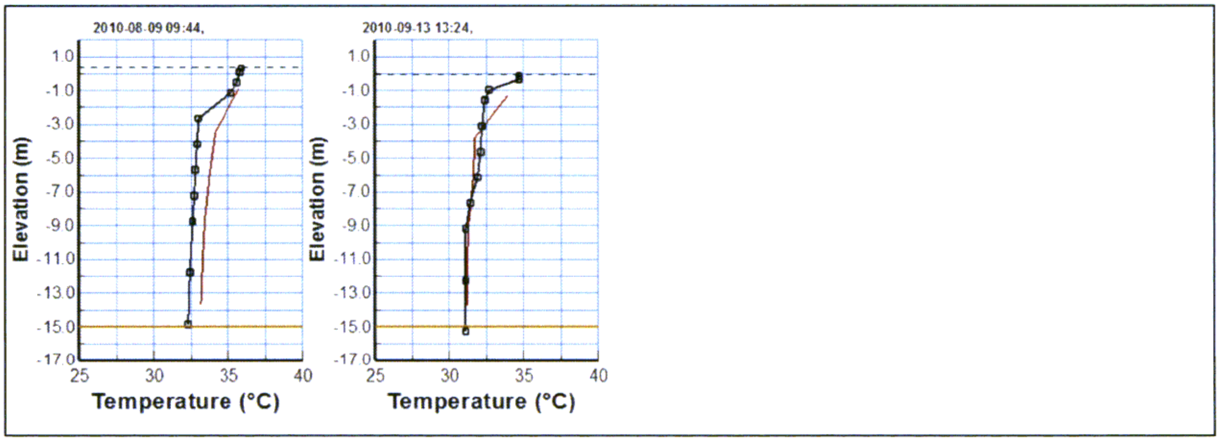


Figure D.29 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 8** on 8/9 and 9/13, 2010.

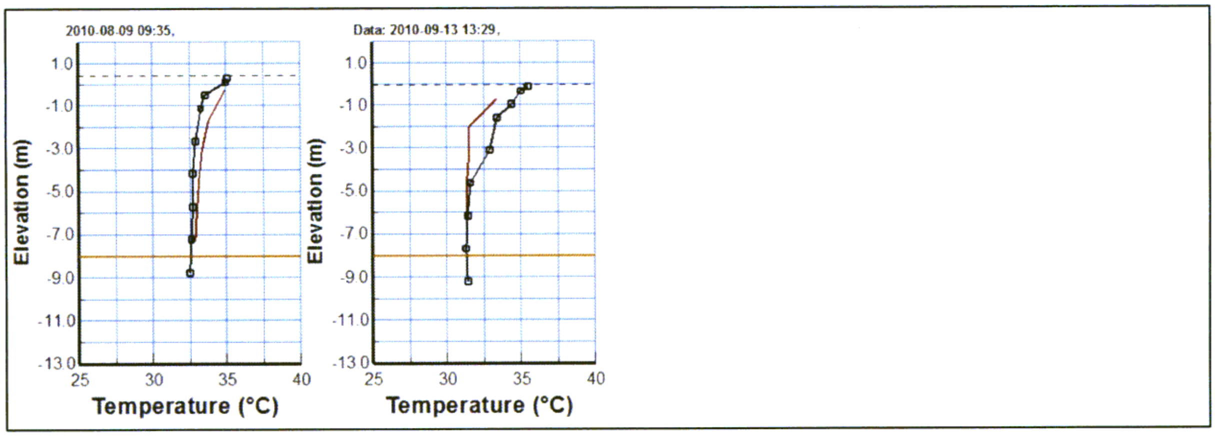


Figure D.30 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 9** on 8/9 and 9/13, 2010.

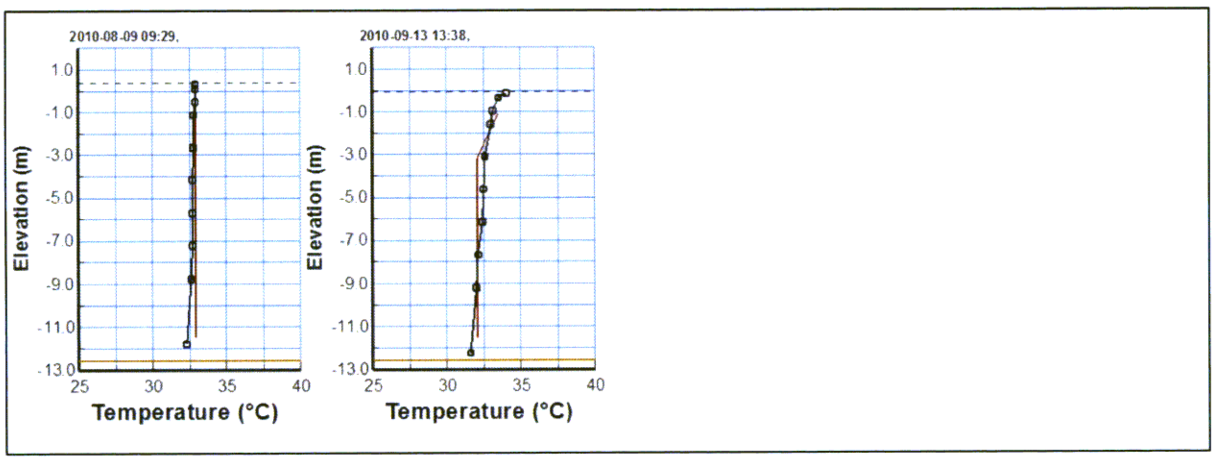


Figure D.31 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 10** on 8/9 and 9/13, 2010.

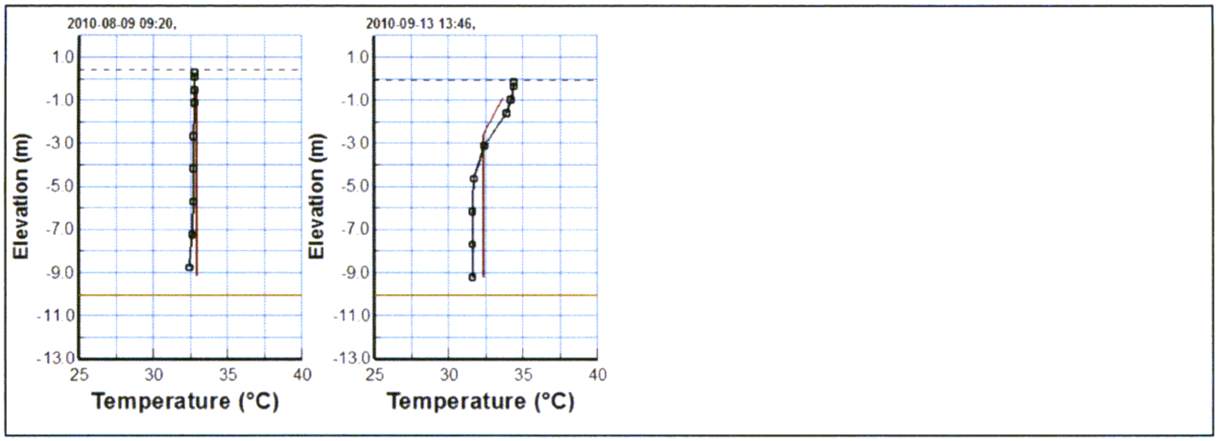


Figure D.32 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 11** on 8/9 and 9/13, 2010.

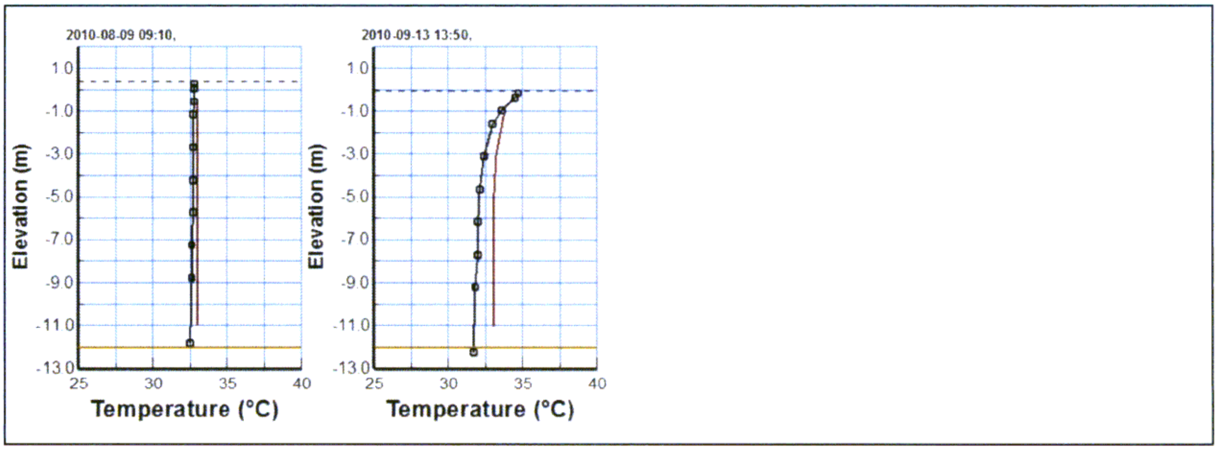


Figure D.33 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 13** on 8/9 and 9/13, 2010.

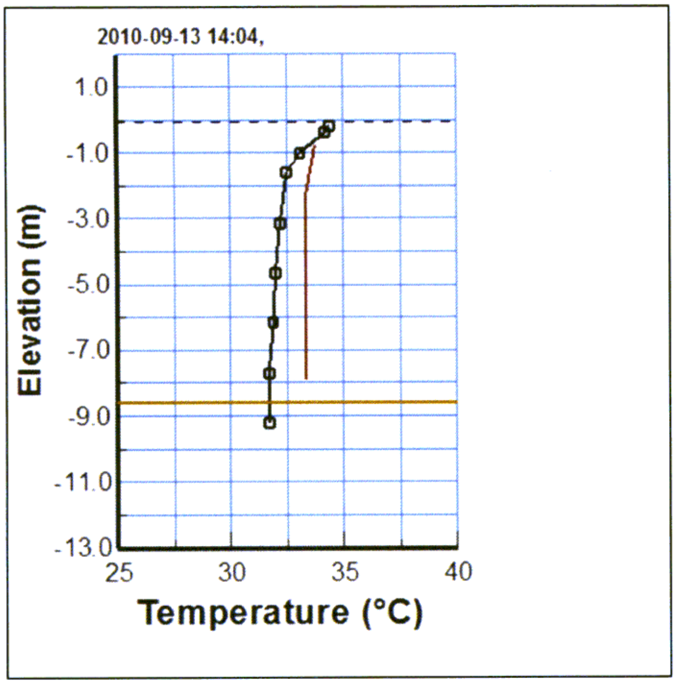


Figure D.34 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 14** on 9/13, 2010.

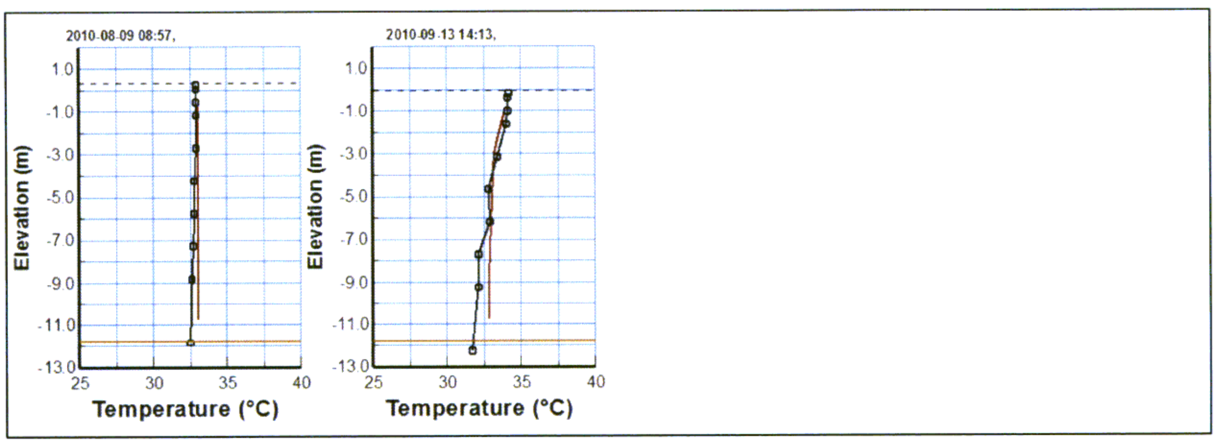


Figure D.35 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 16** on 8/9 and 9/13, 2010.

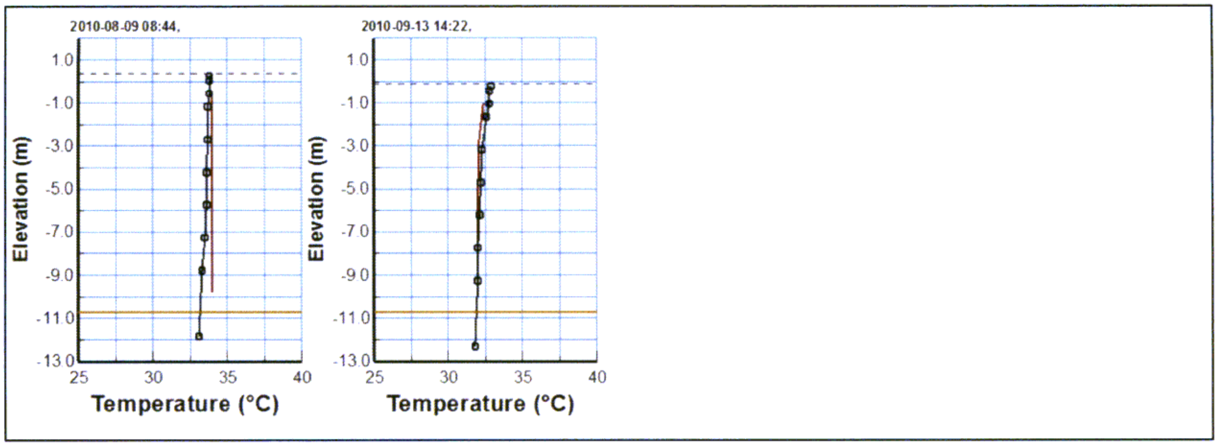


Figure D.36 Observed (lines with squares) and simulated (red lines) vertical temperature profiles at the macroinvertebrate plate **Station 17** on 8/9 and 9/13, 2010.

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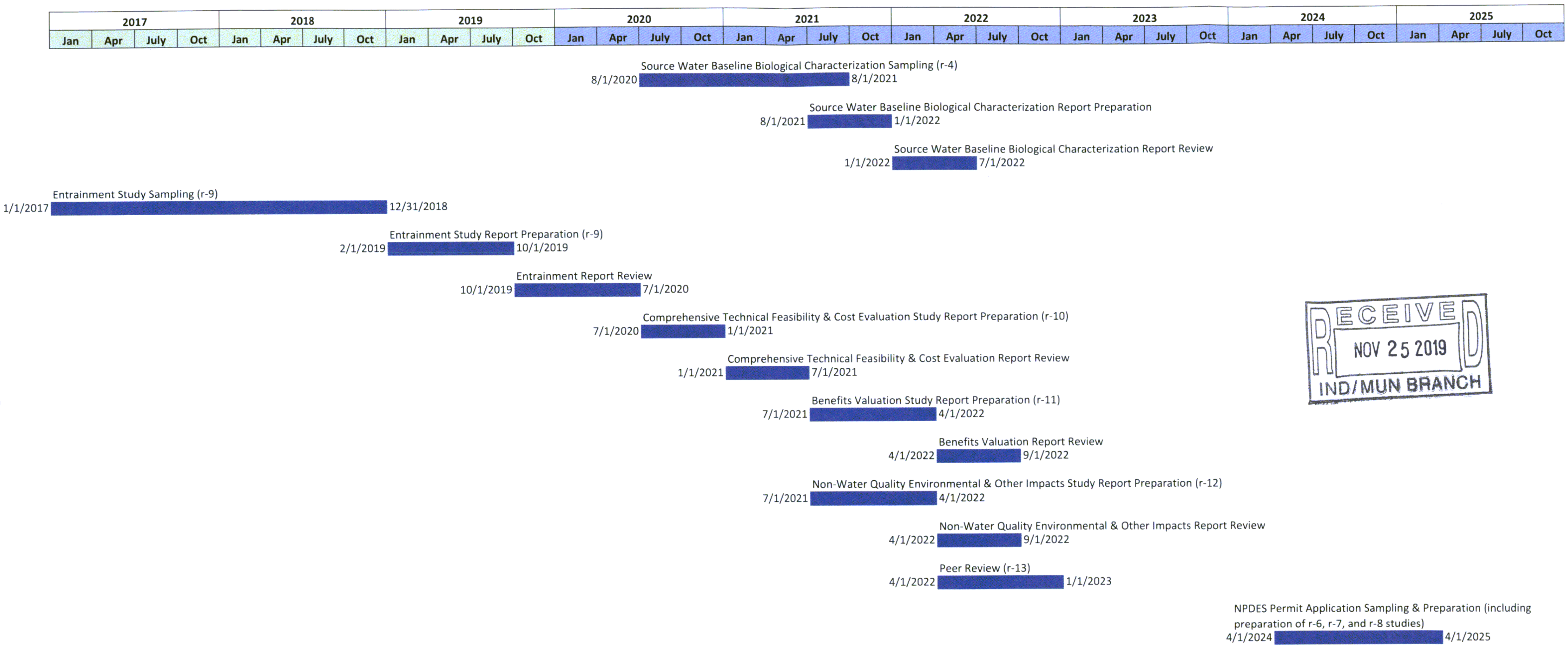
Plant Barry 316(b) Compliance Timeline



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316(b) INFORMATION:
SOURCE WATER PHYSICAL DATA, COOLING WATER INTAKE STRUCTURE DATA, AND COOLING WATER SYSTEM DATA

"r" Reports: (2), (3), and (5)

PLANT BARRY STEAM ELECTRIC GENERATING FACILITY

ALABAMA POWER COMPANY
BUCKS, ALABAMA

November 2018

Figure 1. J.M. Barry Steam Plant

GLOSSARY AND **ACRONYMS**

ADCP: Acoustic Doppler Current Profiler

APC: Alabama Power Company

cfs: cubic feet per second

cm: centimeter

CWIS: cooling water intake structure

ft: feet

HZI: hydraulic zone of influence

MGD: million gallons per day

msl: mean sea level

MW: megawatt

µS: microsiemens

NPDES: National Pollutant Discharge Elimination System

ppt: parts per thousand

s: second

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1. SUMMARY

1.1. Applicable Standards

EPA has promulgated and revised regulations per Congressional mandate in Section 316(b) of the Clean Water Act. The revised regulations[1] require Existing Facilities, as defined in 40 CFR 125.92(k), to submit information characterizing the cooling water source waterbody as well as the cooling water intake system and structure. Plant Barry is an existing facility per this definition since construction commenced prior to January 17, 2002.

James M. Barry Steam Plant (Plant Barry) is located on the Mobile River at river mile 30.5. Two cooling water intake structures (CWIS) are located on the southern shore of the barge/intake canal and provide cooling water for four units (Unit 3 has been retired). Units 1 and 2 are served by one CWIS, while Units 4 and 5 are served by the other CWIS. The salinity at this segment of the Mobile River is typically less than 0.5 parts per thousand, which, according to regulations, classifies the Barry segment of the Mobile River as a "tidal river"[2].

The Plant Barry Cooling Water Intake Structures (CWIS's) and cooling water systems have the capacity to withdraw 1,137 million gallons per day (MGD) of cooling water from the Mobile River, which is approximately 7% of the five (5) year mean annual flow of the Mobile River near the Plant. However, the actual three-year average intake flow for Plant Barry was 623 MGD.

Therefore, since Plant Barry is an existing facility withdrawing more than 125 MGD actual intake flow (AIF), the following application requirements are applicable:

40 CFR 122.21(r)(1)(ii)(A) "All existing facilities. The owner or operator of an existing facility defined at 40 CFR 125.92(k) must submit to the Director for review the information required under paragraphs (r)(2) and r(3) of this section and applicable provisions of paragraphs (r)(4), (5), (6), (7), and (8) of this section.

"(B) existing facilities greater than 125 mgd AIF. In addition, the owner or operator of an existing facility that withdraws greater than 125 mgd actual intake flow (AIF), as defined at 40 CFR 125.92(a), of water for cooling purposes must also submit to the Director for review the information required under paragraphs (r)(9), (10), (11), (12), and (13) of this section."

This report contains the information required by parts (r)(2), (3), and (5). As an introduction to each section and a checklist for the provided material, the relevant portions of the rule's requirements are quoted.

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[1] 40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System

[2] *Tidal river* means the most seaward reach of a river or stream where the salinity is typically less than or equal to 0.5 parts per thousand (by mass) at a time of annual low flow and whose surface elevation responds to the effects of costal lunar tides.

40 CFR 122.21(r)(2) ***Source water physical data.*** **These include: (i) A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located; (ii) Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies; (iii) Locational maps.**

2. SOURCE WATER PHYSICAL DATA

2.1. Source Waterbody

The intake for Plant Barry is located in a canal off of the Mobile River at mile marker 30.5. Figure 2 shows an excerpted portion of the USGS Mount Vernon Quadrangle Map with a 7.5 minute series. Figure 3 shows a quadrangle map of Mobile County near Plant Barry at the 1:150,000-scale, which shows Plant Barry is located on a relatively flat terrain about 15 to 20 feet above sea level. However, at this location, the Mobile River surface elevation is influenced by the tides as shown by USGS data.

Figure 4 shows the tidal effects on the gage height of the Mobile River over a 90-day period measured at the Barry Unit 1-5 intake structure.

Even though the variability in daily river stage with tidal influence is evident, the salinity has been demonstrated (see data) to be much less than 0.5 parts per thousand during time of the annual low flow. EPA's most recent Existing Facility Rule for Cooling Water Intake Structures has defined a freshwater river as having a salinity of less than 0.5 parts per thousand. Moreover, EPA technical documents have considered Plant Barry as an inland facility, meaning a non-coastal or non-tidal river.

Figure 2: Barry Steam Generating Plant Layout relative to the Mobile River

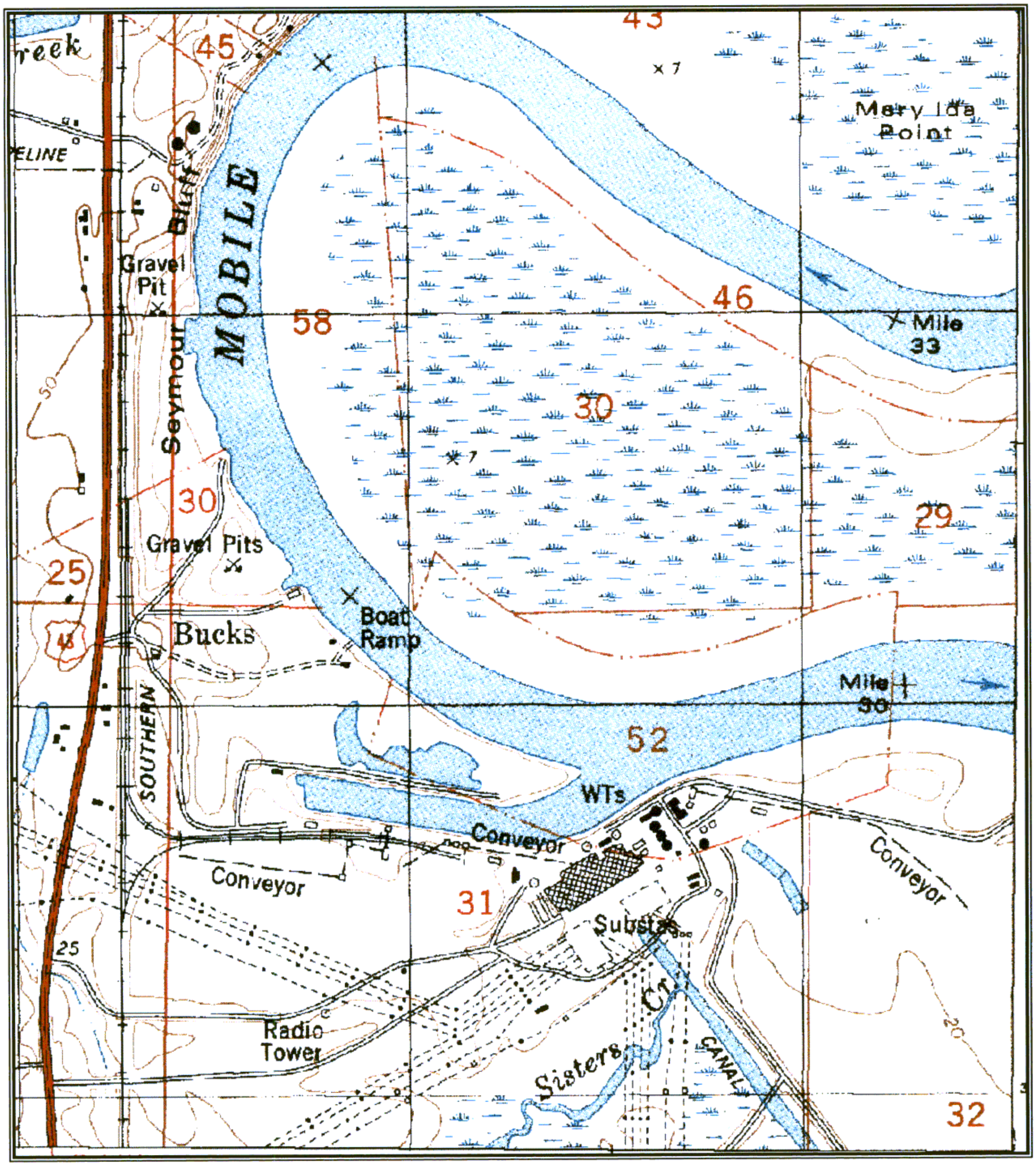
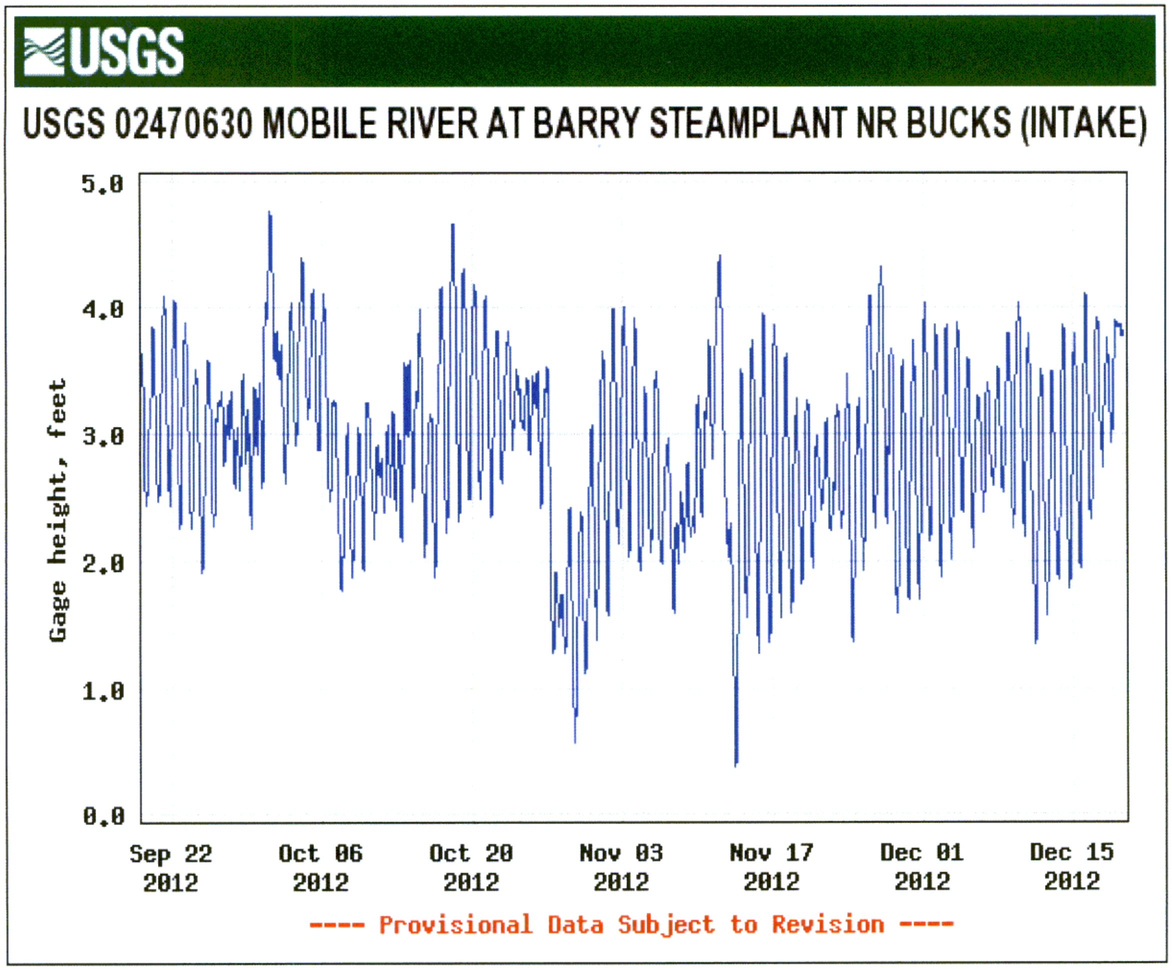


Figure 3: Topographic Map of the Mobile County near Plant Barry

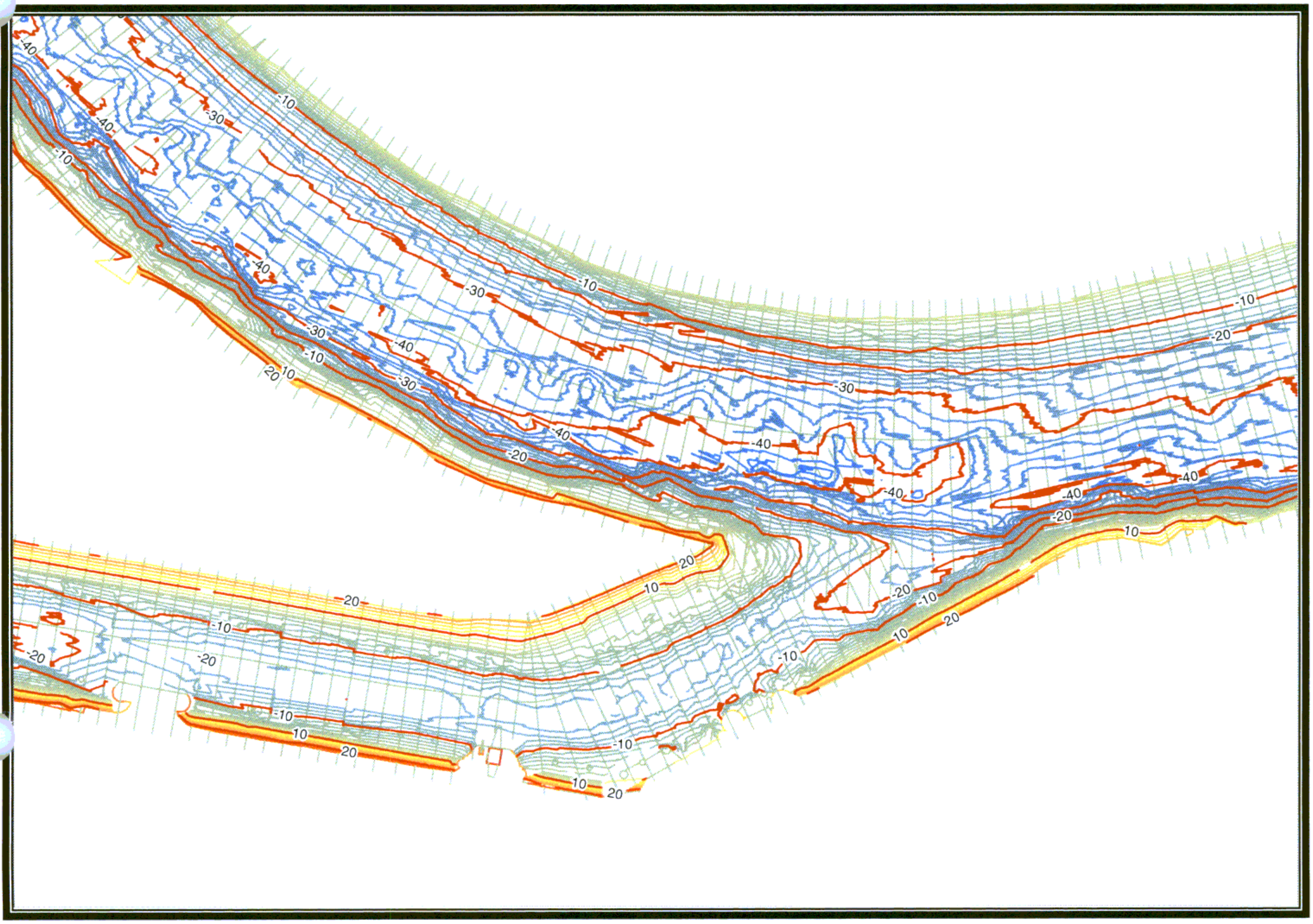
Figure 4: Mobile River Gage Height near Plant Barry



2.2. Water Depth

The water depth at the cooling water intake structures is approximately 20 feet, whereas, the water depth at the entrance of the canal is from 20 to 25 feet. The Mobile River, however, is up to 45 feet deep at the centerline near the canal entrance (See Figure 5).

Figure 5: Geomorphology (bathymetry) of the Barry Barge Canal and Mobile River at the vicinity of the barge canal with a surface water elevation of 2 feet mean sea level (msl).

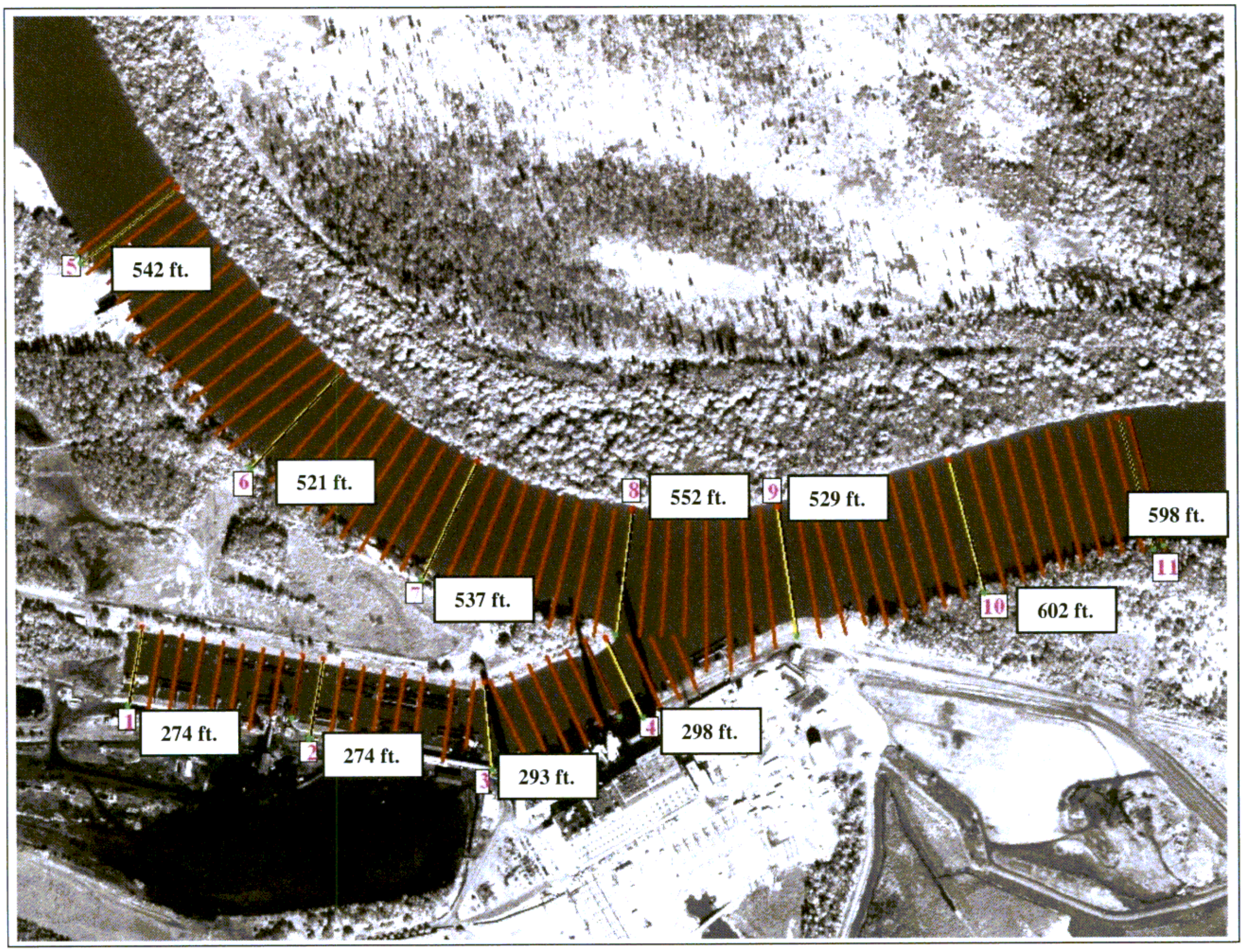


2.3. Aerial Dimensions

The cooling water intake structure is located on the Barry Barge Canal. The canal opens at a bend in the Mobile River from mile marker 30.4 to about river mile 30.6. The barge canal is approximately 2,800 feet long. The canal was first dug during construction of units 1-3 in 1953 (See Figure 6) for barge transport to coal un-loaders. The intake structures are also located on the canal, undoubtedly by design to keep them out of the pathway of normal rive debris. The width of the mouth of the barge canal varies depending on tidal stage but is generally around 800 feet. Beyond the mouth, the barge canal width remains fairly uniform around 300 feet. Figure 7 shows the width of the barge canal and Mobile River at several locations at a mean sea level of 2 feet.

Figure 6: Mouth of intake canal under construction in 1953.

Figure 7: Barry Barge Canal and Mobile River Transects



2.4. Salinity

Salinity is a measure of the amount of salts in the water. In 2000, one of the most severe droughts on record occurred resulting in record low flows in the Mobile River. The 7-day rolling average from July to November was at or below the 7Q10 flow (See Figure 8). Therefore, the potential for salt water to migrate upstream from Mobile bay was very high. Salinity samples were taken at several locations in the Mobile River near Plant Barry from February to December in 2000 (See Figure 9). The following graph (See Figure 10) shows that during this period the salinity at the Barry intake (Site 5) canal remained below 0.5 parts per thousand, while salt water intrusion was experienced near the Barry cooling water discharge into the Mobile River during September and October 2000 (Site 2). While the saltwater wedge is shown extending as far as Site 1, salinity was found only at depths around 30 feet. The intake canal, although farther downstream, had salinity values less than Site 1 but the depth is only about 15 feet deep.

Figure 8: River flow as compared to the 7Q10 during drought year 2000.

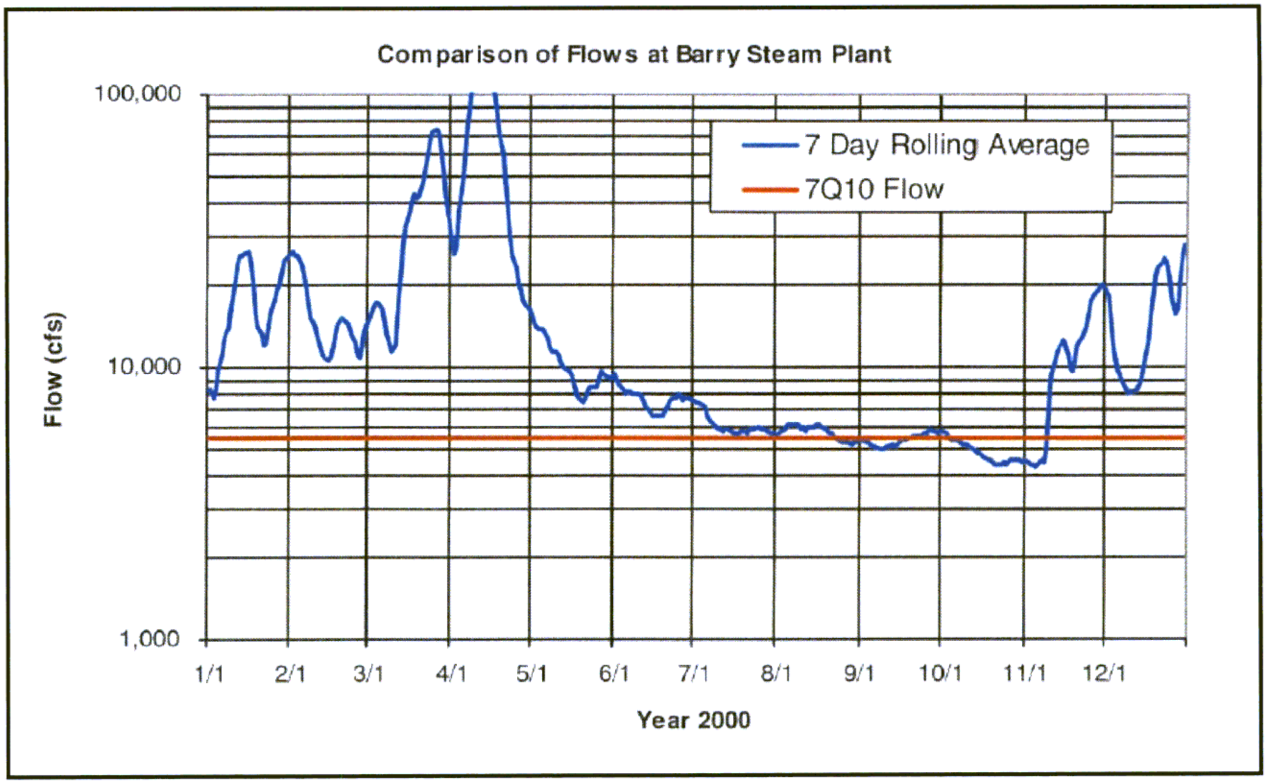


Table 1 shows more recent conductivity data, as a parametric to salinity. Conductivities at the upstream and mixing zone stations (see 316a report for a more complete description of the sampling locations) generally have conductivities in the freshwater range for much of the year, while the downstream location is much more susceptible to a saltwater wedge. However, there was one upstream sample and one mixing zone sample on September 23, 2010, with a conductivity result in the range typical of brackish water.

Table 1: Summary of water quality profile data measured during the plate deployment and retrieval for macroinvertebrate collection in 2010.

	2010	Parameters	Upstream				Mixing Zone				Downstream			
			Min	Mean	Max	5-ft	Min	Mean	Max	5-ft	Min	Mean	Max	5-ft
Spring	11-May	Temperature (°F)	73.6	73.8	75	73.8	73.8	74.3	75.4	74.3	74.1	74.5	75.4	74.5
		Dissolved Oxygen (mg/L)	5.66	5.75	5.90	5.77	5.67	5.77	5.86	5.79	5.67	5.78	5.87	5.80
		Conductivity (µS/cm)	145	146	146	146	146	147	149	147	146	147	148	147
	27-May	Temperature (°F)	79.2	79.4	79.7	79.4	79.5	80.1	80.8	80.1	80.1	80.3	80.6	80.3
		Dissolved Oxygen (mg/L)	6.90	7.00	7.10	7.03	6.83	7.01	9.62	6.99	6.83	6.93	7.01	6.97
		Conductivity (µS/cm)	145	146	146	145	146	147	149	147	147	148	149	148
Summer	14-Jul	Temperature (°F)	88.7	89.9	93.0	90.0	89.2	91.8	100.2	92.3	89.2	91.1	93.0	91.5
		Dissolved Oxygen (mg/L)	5.90	6.74	7.81	6.98	5.83	6.37	7.47	6.53	5.59	6.09	6.90	6.17
		Conductivity (µS/cm)	200	215	226	214	200	211	236	212	196	206	216	206
	29-Jul	Temperature (°F)	89.2	89.8	90.5	89.9	89.2	91.8	98.8	92.7	90.0	91.6	97.9	92.2
		Dissolved Oxygen (mg/L)	5.84	6.05	6.42	6.09	5.70	6.13	7.00	6.29	5.51	6.11	6.92	6.36
		Conductivity (µS/cm)	232	242	250	241	231	236	241	236	230	237	245	237
	9-Aug	Temperature (°F)	89.8	90.9	94.1	91.2	90.1	92.3	98.8	93.7	90.5	91.8	93.0	91.9
		Dissolved Oxygen (mg/L)	5.56	6.20	7.20	6.31	5.22	5.61	6.14	5.82	5.06	5.28	5.54	5.31
		Conductivity (µS/cm)	194	209	220	210	195	214	239	211	207	221	244	221
Fall	13-Sep	Temperature (°F)	87.3	88.3	89.4	88.6	87.4	90.0	95.9	90.8	88.5	90.6	94.5	91.0
		Dissolved Oxygen (mg/L)	5.66	6.12	6.69	6.31	5.24	5.88	6.75	6.21	5.06	5.73	6.66	5.90
		Conductivity (µS/cm)	243	270	285	271	255	268	285	273	254	273	291	272
	23-Sep	Temperature (°F)	85.5	87.0	90.1	87.0	87.6	90.2	94.8	91.4	87.6	90.0	92.8	91.0
		Dissolved Oxygen (mg/L)	1.11	5.41	6.10	5.65	0.86	4.16	6.23	5.60	0.75	3.99	6.09	5.43
		Conductivity (µS/cm)	247	609	7,940	276	328	3,308	11,430	557	508	5,103	17,390	1,191
	30-Sep	Temperature (°F)	82.6	83.0	83.7	83.1	83.5	84.3	84.7	84.3	84.0	85.0	87.1	85.0
		Dissolved Oxygen (mg/L)	5.71	6.00	6.40	6.06	5.81	5.99	6.14	6.01	2.90	5.88	6.98	6.04
		Conductivity (µS/cm)	253	268	282	269	270	279	288	278	269	621	3,650	425

Water quality profile data was measured during the plate deployment and retrieval from macroinvertebrate collection in 2010. Profiles were performed at the deepest point near each station. Measurements were taken at 0, 1, 3, 5, 10, 15, 20, 25, and 30 ft. depths, continuing in 10-ft. intervals, if necessary. The minimum, maximum, and mean values represent measurements from the seven stations in the upstream zone, the six stations in the mixing zone, and the five stations in the downstream zone. The 5-ft. measurements are the averages of the measurements taken at the 5-ft. depth at all stations within the respective zone.

Figure 9: Sampling locations for salinity during the 2000 drought.

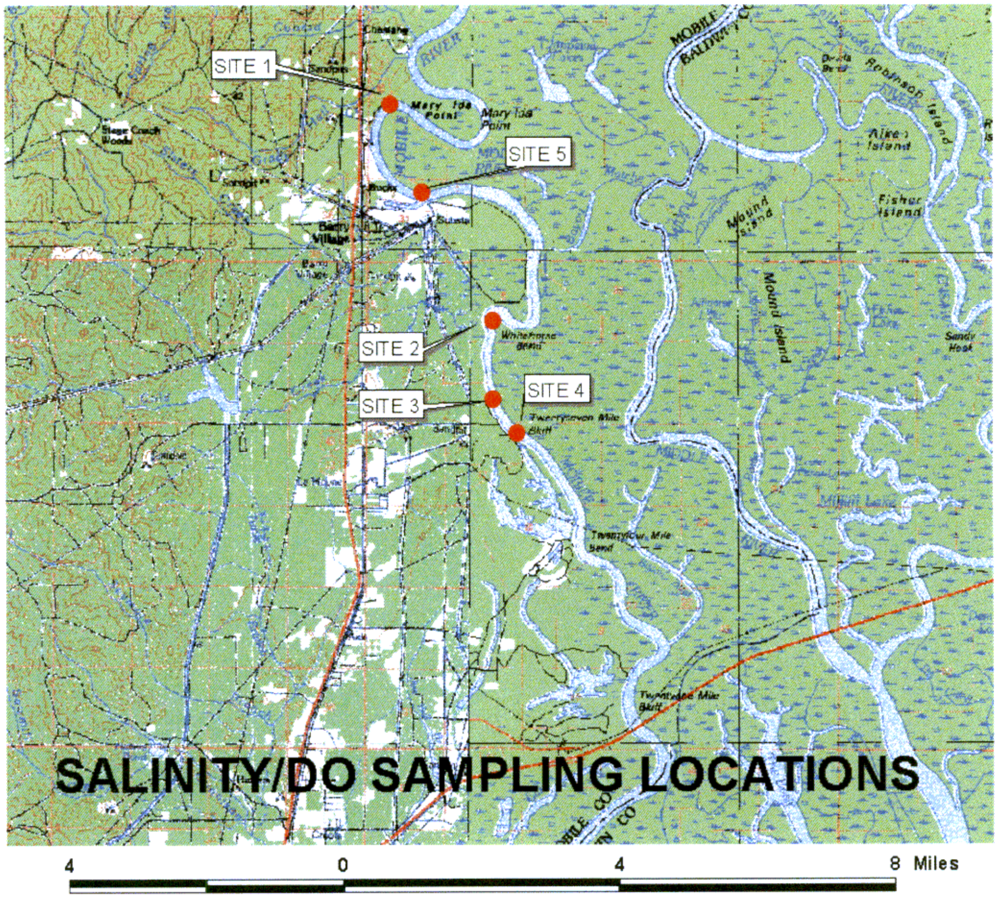
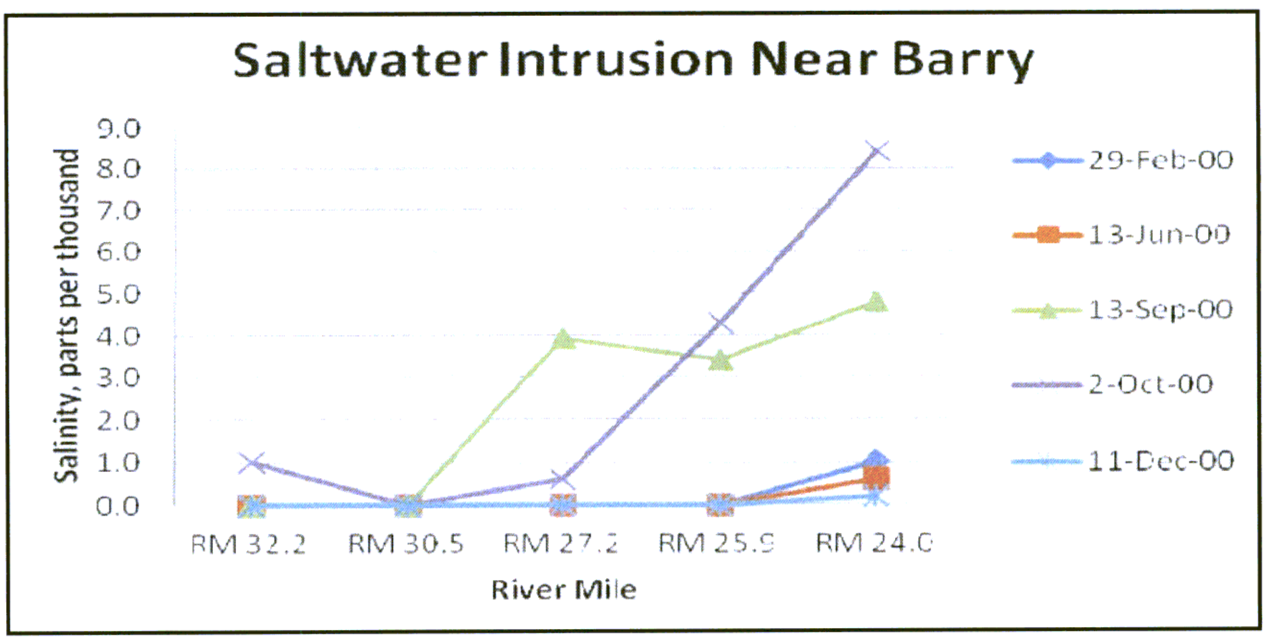


Figure 10: Depth averaged salinity at various locations in Mobile River near Plant Barry during a drought year (2000).



2.5 Temperature Regimes

The monthly average, maximum, and minimum temperatures at Barry's intakes from 2010 to 2017 are shown in Table 2. Generally, the monthly average intake temperatures reach a minimum 53°F in January and peak at 90°F during August.

Table 2: Plant Barry Daily Average Intake Temperatures, 2010-2017

Plant Barry Intake Temperatures (°F) 2010-2017			
Month	**Average**	**Maximum**	**Minimum**
January	53	62	43
February	55	65	46
March	62	74	47
April	70	80	61
May	78	90	68
June	86	93	77
July	89	94	79
August	90	96	83
September	87	95	79
October	78	86	68
November	67	77	57
December	59	68	52

2.6 Hydrological and Geomorphological Features

As mentioned in Section 2.1, the water depth is a strong function of the tidal cycle. Figure 11 shows the cross sections of the Mobile River and Barry Barge Canal examined at many locations. Depths along the cross sections labeled 1, 4, 8, and 9 on Figure 11 are graphed below in Figures 12, 13, 14, and 15. The cross sections are shown as going down river from right bank to left bank. As one would expect, because the intake canal is located at a bend in the river, the right bank has been cut by the river flow and has a much steeper slope toward the maximum water depth than the left bank, whereas the barge canal's right and left bank slopes are similar.

Figure 11: Widths of Barry Barge Canal and the Mobile River at Various Transects.

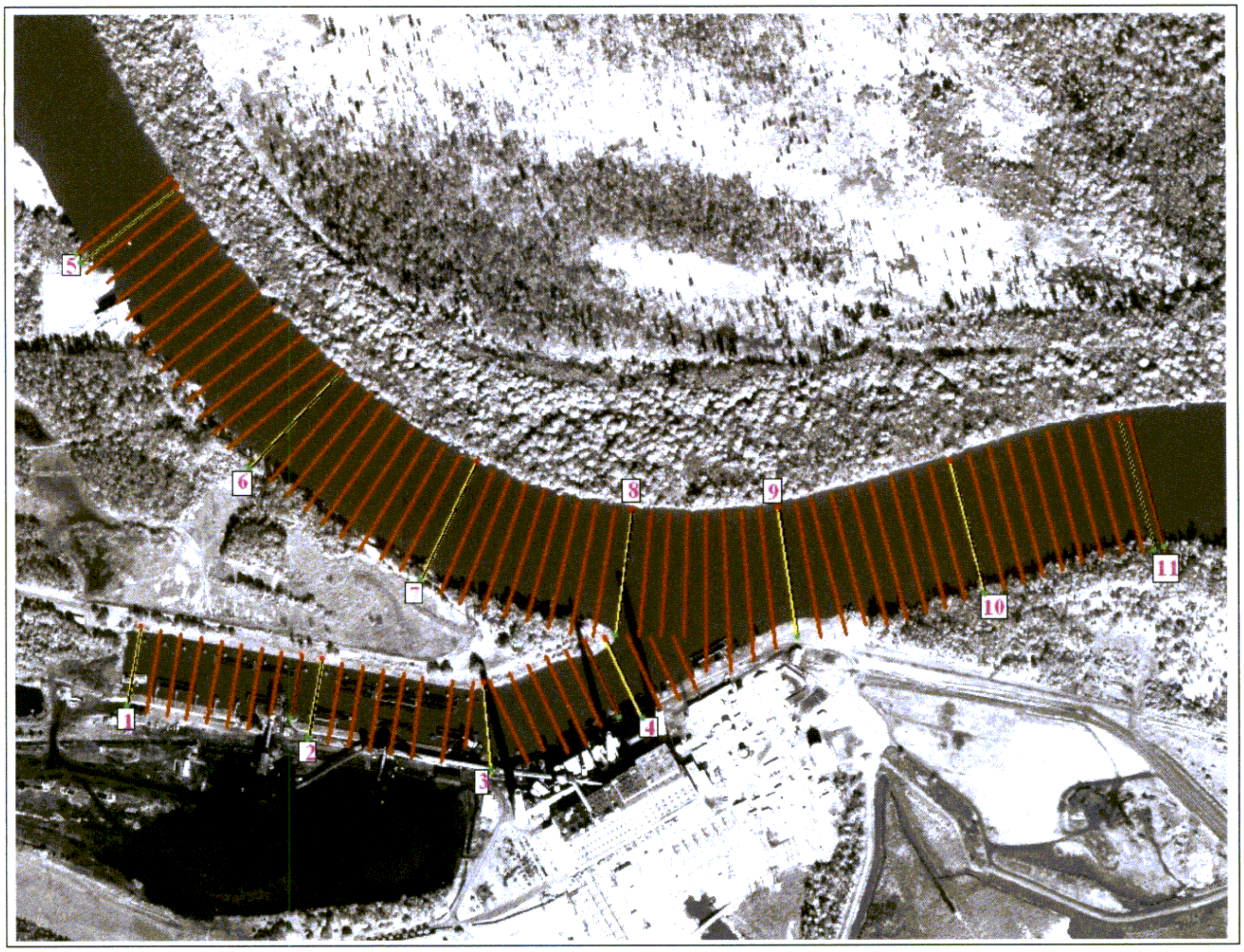


Figure 12: Bathymetric Profile at Transect Location 1 in the Plant Barry Barge Canal

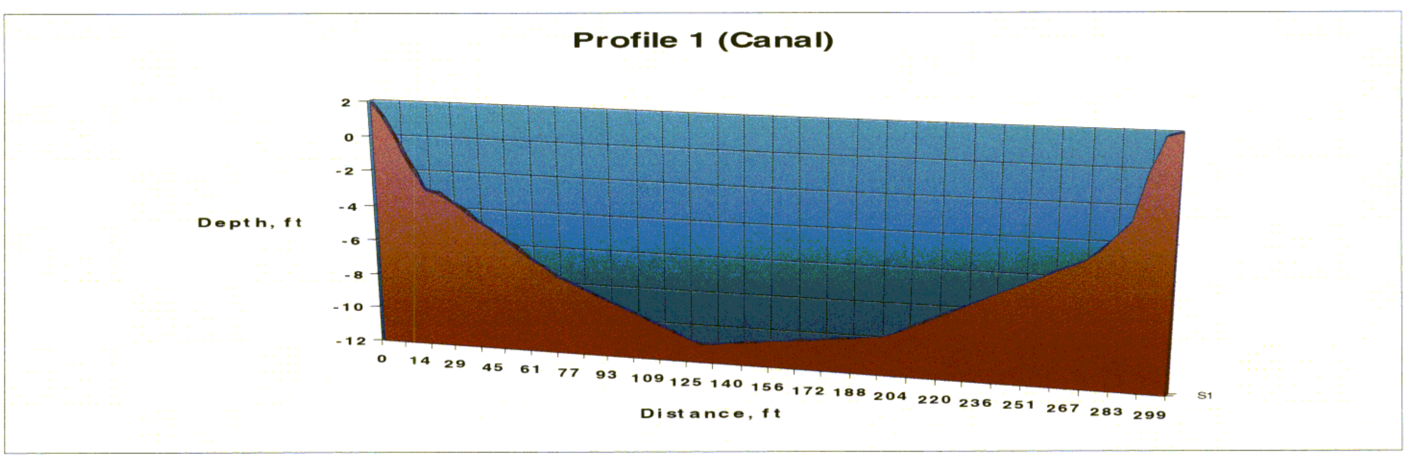


Figure 13: Bathymetric Profile at Transect Location 4 in the Plant Barry Barge Canal

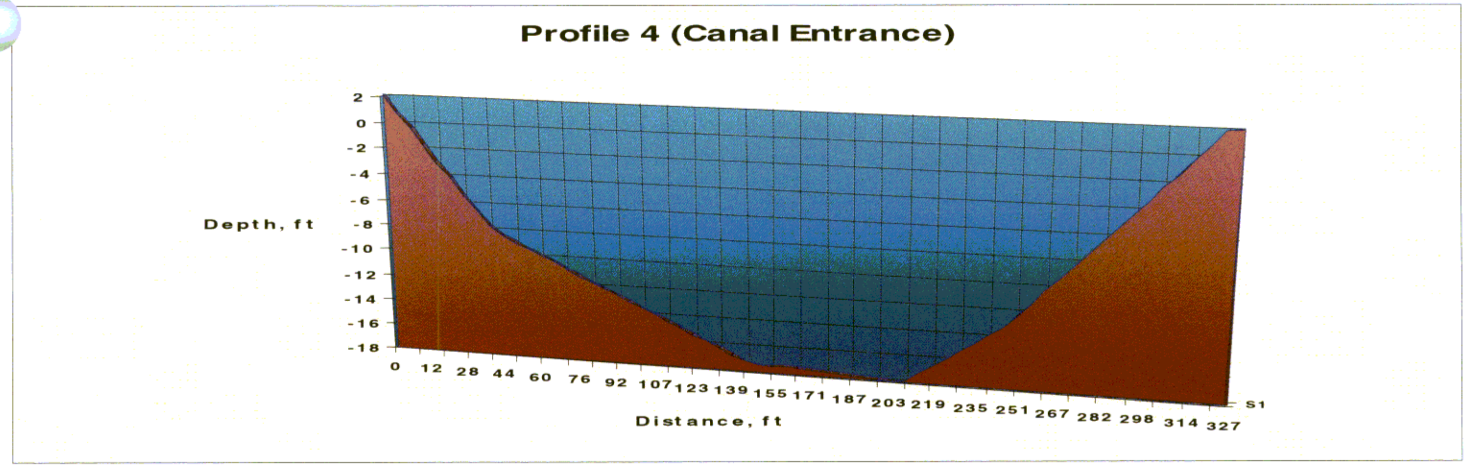


Figure 14: Bathymetric Profile at Transect Location 8 in the Mobile River

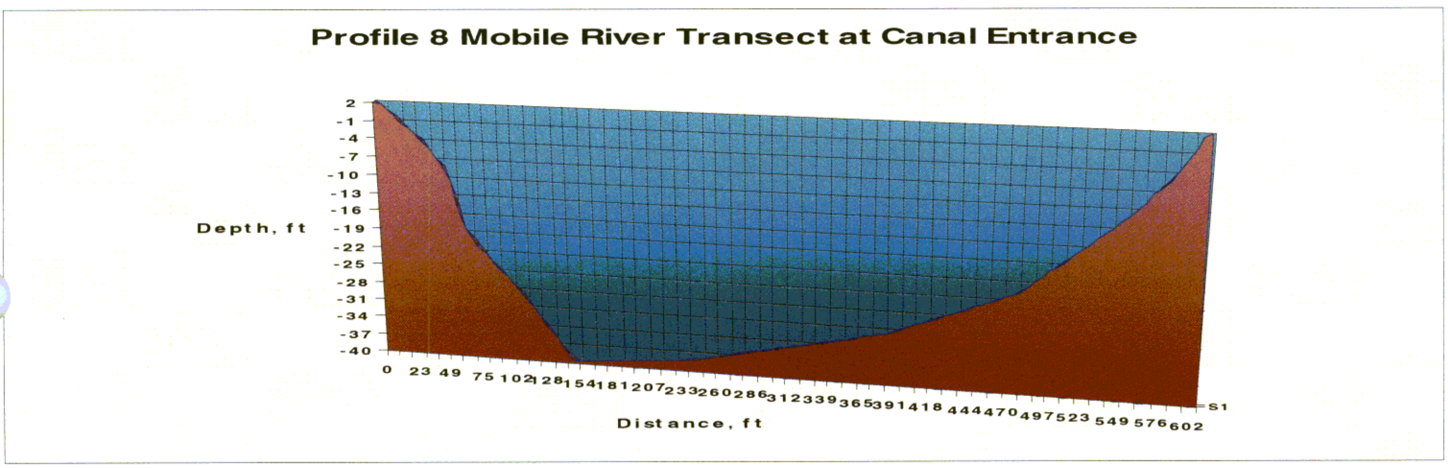
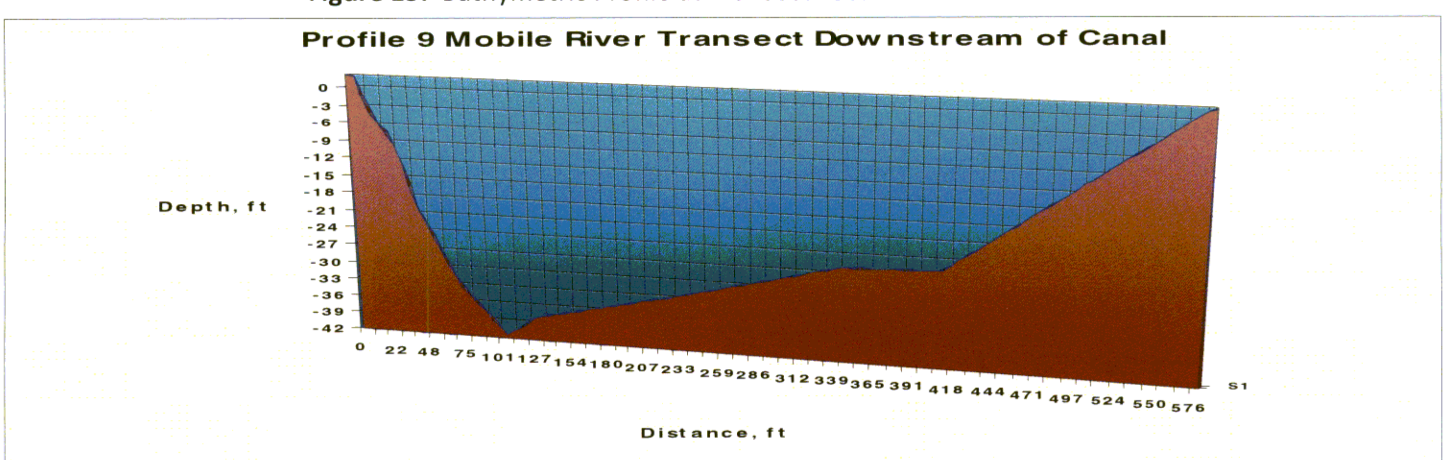
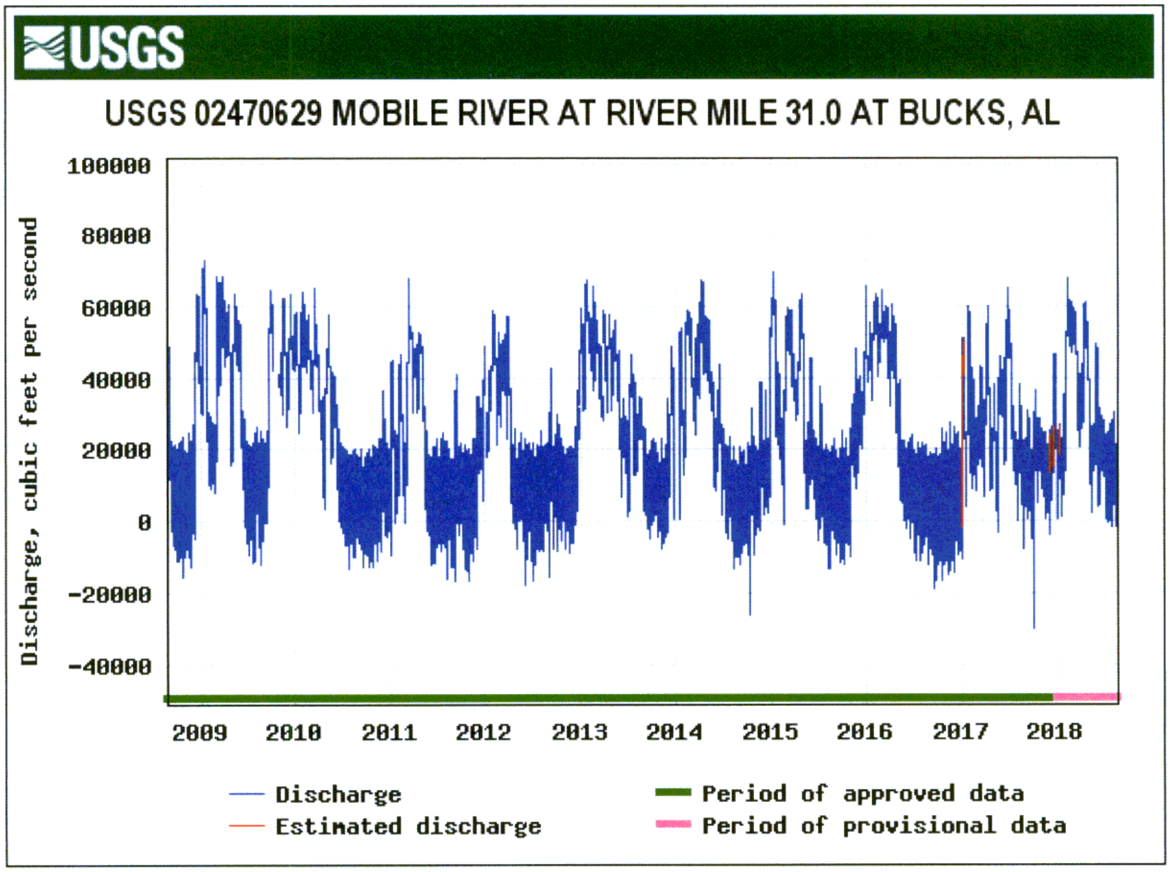


Figure 15: Bathymetric Profile at Transect Location 9 in the Mobile River



The continual river flow of the Mobile River measured every 30 minutes from August 24, 2008, to August 24, 2018, is shown graphically on Figure 16. The data is provided by the USGS via a doppler side scanning sonar located 0.5 miles upstream of Plant Barry's Barge Canal. The Mobile River's average daily flow between October 1, 2010, and August 24, 2018, was 15,575 million gallons per day (mgd) [24,099 cubic feet per second (cfs)]. The maximum and minimum daily flows were 32,251 mgd (49,900 cfs) and 3,619 mgd (5,600 cfs), respectively.

Figure 16: Mobile River Flow at Mile 31.0 for 2008-2018



2.7 Area of Influence

APC conducted a survey to quantify the area of hydraulic influence attributable to the Plant Barry CWIS using Acoustic Doppler current profiling (ADCP) technology. Two ADCP surveys were conducted on August 24, 2004, and September 21, 2004, with 10 of 10 circulating water pumps operating. Based on dye studies performed in 1991-1993 by Southern Company Services, intake flows at full capacity would be 1137 MGD or 1759 cfs. The intake flow was 1137 MGD or 1759 cfs (100% of full capacity) during both surveys.

Plant Barry is located on the Mobile River and the average flow during the August 24, 2004, and September 21, 2004, monitoring event were 7,956 cfs and 53,845 cfs, respectively. The August

24, 2004, survey represented low flows typical during high tide. As discovered during earlier surveys, river flows at high tide represent the lowest daily flow and river flows at low tide represent the highest daily flow. The September 21, 2004, survey represented flows at or near full bank conditions following the Hurricane Ivan storm. The typical range of flows in this section of the Mobile River range between 10,000 and 50,000 cfs.

During both survey events, the portion of the Mobile River adjacent to the intake canal and the area surrounding both CWIS were surveyed in both the upstream and downstream direction over a sufficient distance to define the hydraulically affected zone. Acoustic Doppler profile data were collected by navigating the boat and ADCP unit perpendicular to the shoreline and using twelve transects during the August survey and sixteen transects during the September survey. This hydraulic investigation was initiated by reviewing the flow vector data (i.e. velocity magnitude and direction) and allowed the delineation of the hydraulically affected portion of the Mobile River in the vicinity of the intake canal and both CWISs. The boundary demarcating the area of greatest extent of hydraulic influence from Plant Barry was determined by the occurrence of water velocities and vectors dominantly related to the CWIS.

The extent of hydraulic influence measured on August 24, 2004, was associated with a river flow of approximately 7,956 cfs, and the zone of influence occupied an area of 7.9 acres in the Mobile River and intake canal (Figure 17). The extent of hydraulic influence measured on September 21, 2004, was associated with a river flow of approximately 53,845 cfs, and the zone of influence occupied an area of 3.8 acres in the Mobile River and intake canal (Figure 18).

Figure 17: Hydraulic Zone of Influence at Plant Barry – Low River Flow Conditions

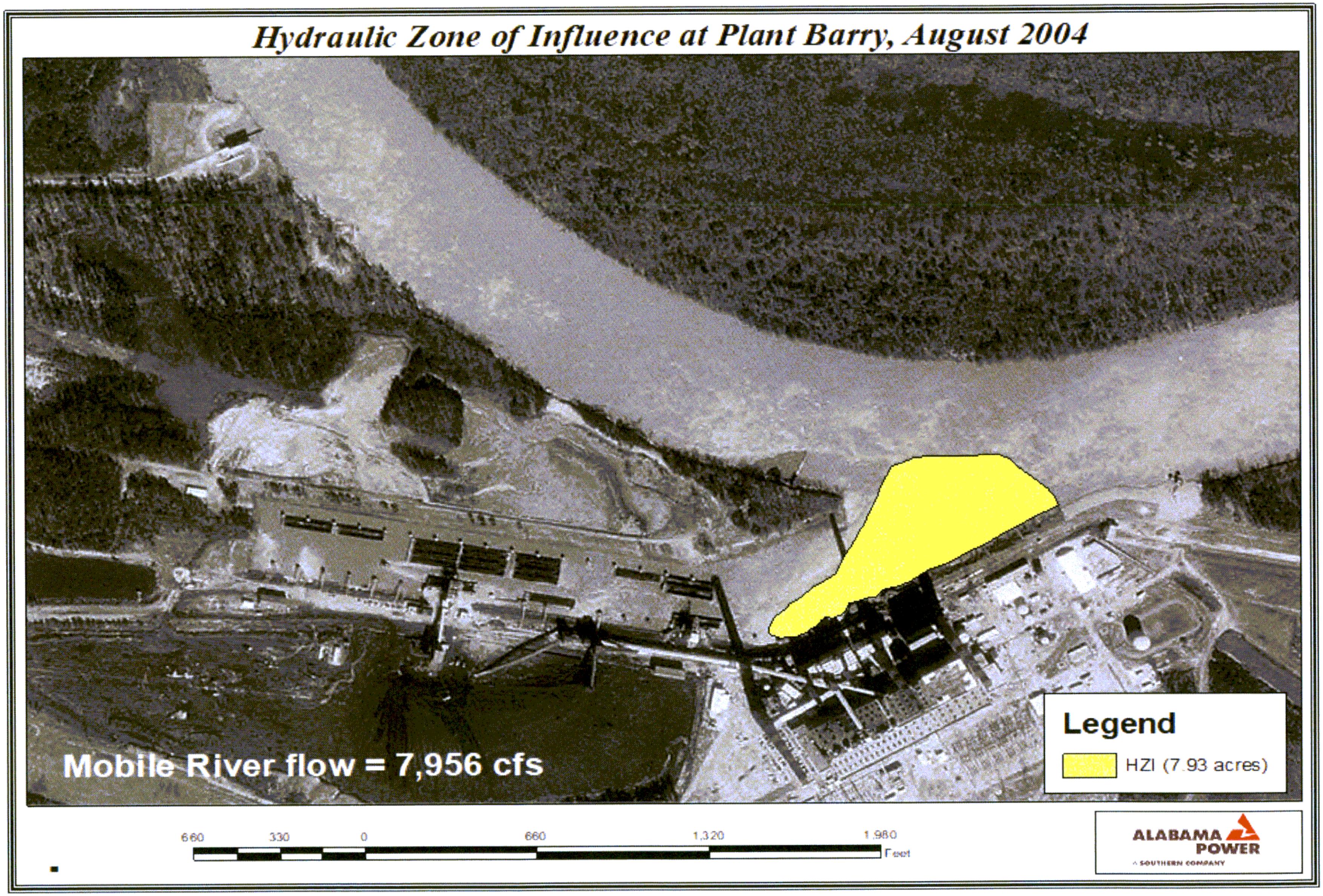
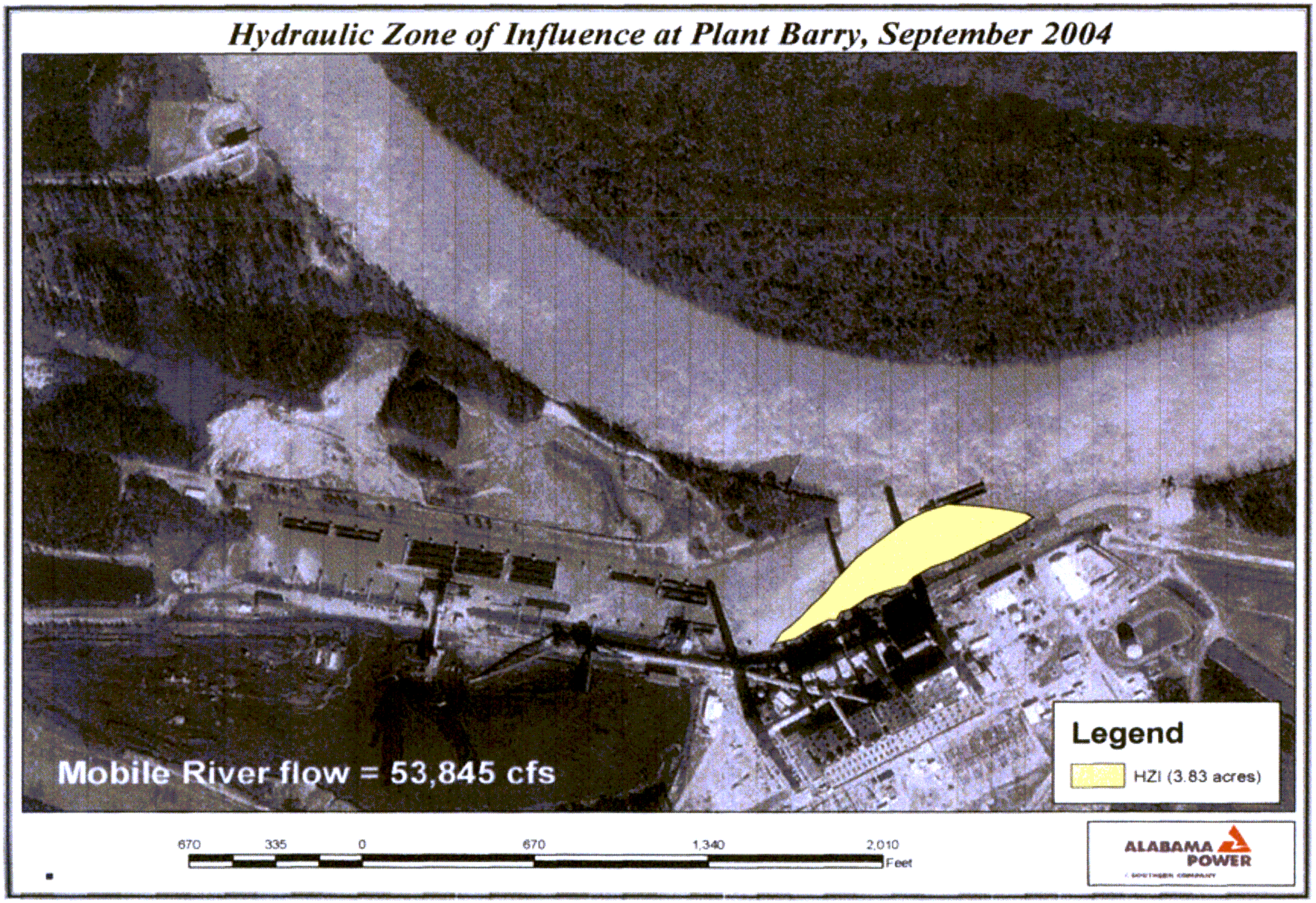


Figure 18: Hydraulic Zone of Influence at Plant Barry – High River Flow Conditions



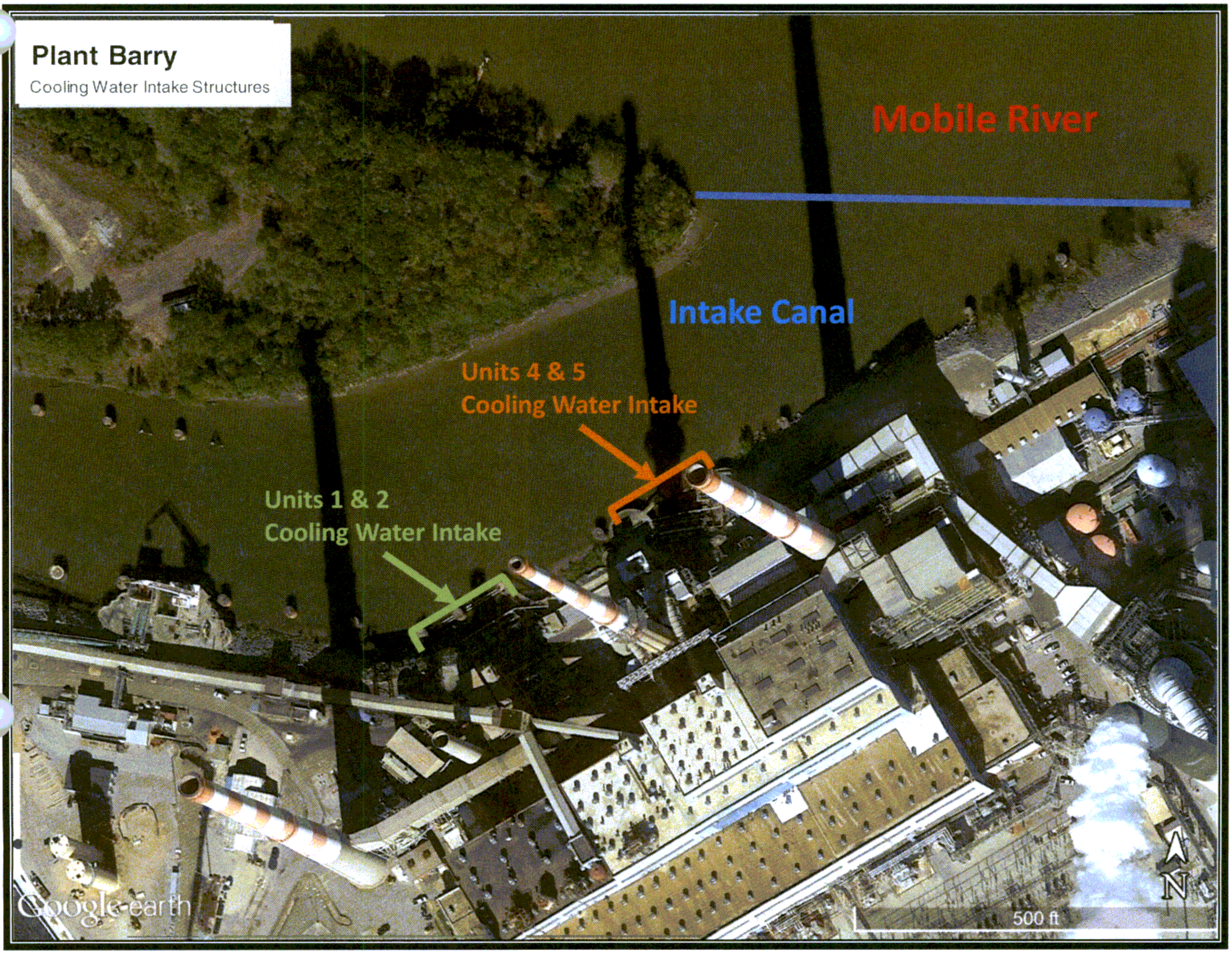
40 CFR 122.21(r)(3) *Cooling water intake structure data*. These include: (i) A narrative description of the configuration of each of your cooling water intake structures and where it is located in the water body and in the water column; (ii) Latitude and longitude in degrees, minutes, and seconds for each of your cooling water intake structures; (iii) A narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation, number of days of the year in operation and seasonal changes, if applicable; (iv) A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges; and (v) Engineering drawings of the cooling water intake structure.

3 COOLING WATER INTAKE STRUCTURE DATA

3.1 Intake Structure for Units 1 & 2

The CWIS for Units 1 & 2 is located on the plant side (south shore) of the intake canal (Figure 19). This CWIS was previously also used for Unit 3, however, Unit 3 has been taken out of service and dismantled. This CWIS is divided into six screen bays, each about 11 feet (ft) wide. Each bay has stainless steel trash racks with 3 ½ in. x 5/6 in. bars that are 4 inch on-center and have 3 1/6 in. clear openings. The trash racks are manually cleaned on a daily to weekly frequency depending on the extent of debris blockage. The Units 1 & 2 CWIS also has a pontoon supported debris rack consisting of a pontoon structure with vertical rods extending into the water. The rods are 6.5 ft in length and spaced 8" apart. The pontoon is located about 20 ft upstream (i.e., north) of the trash racks in front of the intake structure. Six traveling water screen bays are located downstream of the pontoon/rod buffer as shown on Figures 20 & 21. Each screen is 10 ft wide with a screen mesh size of 9.5 mm (3/8 in.). The screens are designed for continuous operation at a maximum of 10 fpm. The screens have been modified with the addition of scrapers on some of the screen baskets to aid in removal of debris along the bottom seal. A high-pressure front backwash system is used to remove fish and debris from the screens where it then flows down a concrete sluiceway into a trash basket for disposal.

Figure 19: Aerial Photo of Plant Barry with CWISs Located in the Intake Canal



Since 2007, as a manufacturer's demonstration, one screen was replaced with a hydrolox plastic resin screen mesh. Operationally, the advantage of the hydrolox screen is non-moving parts at the bottom of the screen assembly where the screen is submerged. Conventional screens have sprockets on the bottom of the screen assemblies which wear and periodically fail necessitating removal of the screen for rebuilding.

Figure 20: Plan view of Units 1 & 2 Cooling Water Intake Structure with 6 Bays

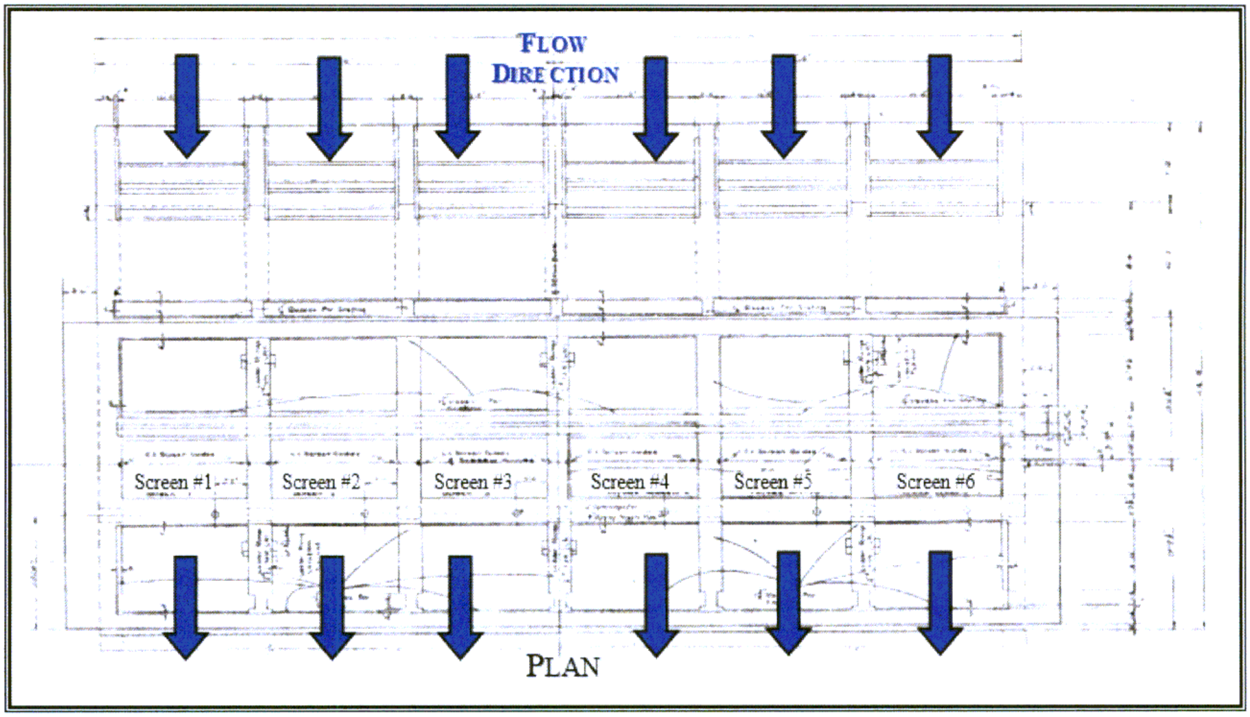
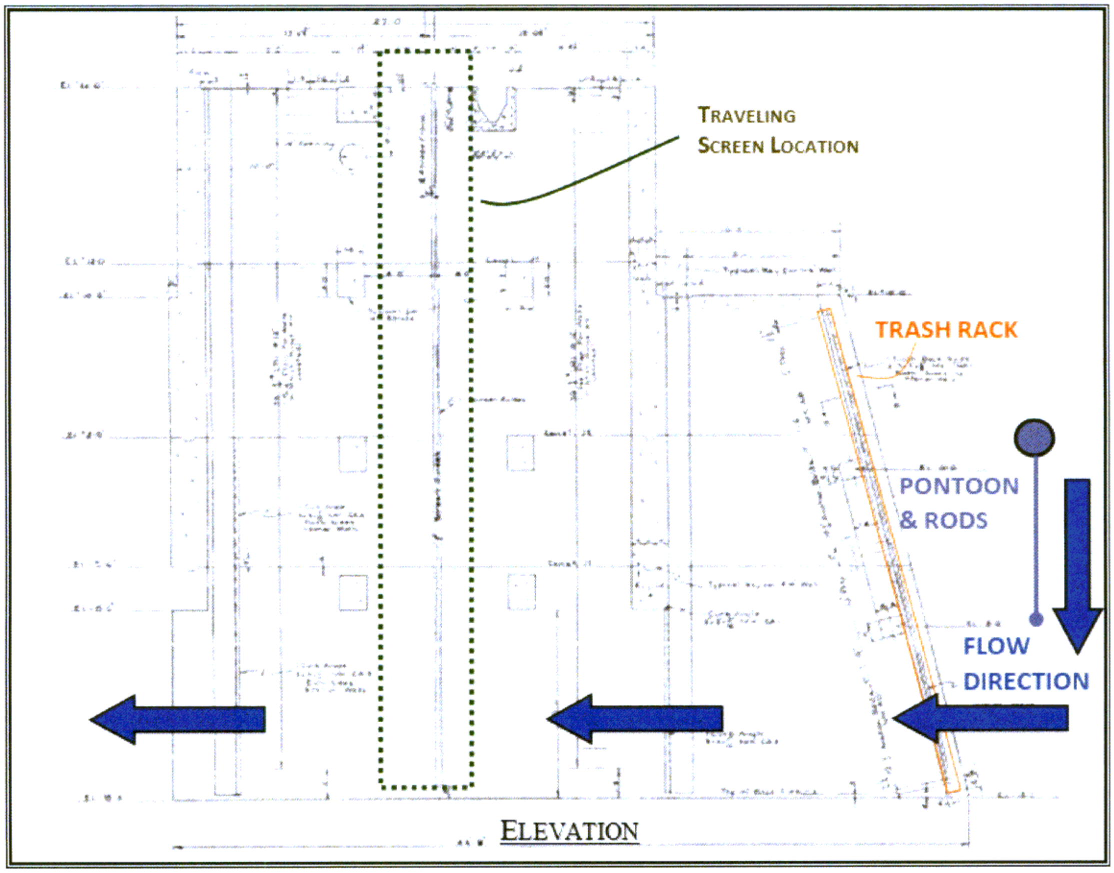


Figure 21: Configuration of Units 1 & 2 Intake Structure Screen Bay



Cooling water is withdrawn from the Barry Intake Canal, through the Units 1 & 2 trash racks and into the intake structure underflow opening from 17.5 feet msl up to -8 feet msl. The cooling water then passes through 3/8-inch square mesh travelling screens with a basket width of 10 ft. Screened cooling water then flows into two common intake tunnels. Units 1 & 2 each have two circulating water pumps, one in each tunnel. According to design data, Units 1 and 2 each use a total of 89,000 gpm. However, the maximum flow achieved in dye studies was 81,800 gpm (8.0% lower than design) for each Unit 1 and 2.

3.2 Intake Structure for Units 4 & 5

The CWIS for Units 4 & 5 is located just east of the CWIS for Units 1 & 2, and closer to the entrance of the barge canal. It is divided into five screen bays that are about 11 ft wide and equipped with trash racks and vertical travelling screens (Figures 22, 23, 24, & 25). The stainless-steel trash racks are made of 3 ½ in. x 5/6 in. bars spaced 4 in. on-center with 3 1/6 in. clear openings. Debris on the trash racks is removed using a Backett-Bosker trash rake. A pontoon supported vertical rod bed, similar to the one used in front of Units 1 & 2, is also utilized in front of the intake structure to prevent debris from reaching the intake structure. Five traveling water screen bays are located downstream of the trash racks.

In early 2013, five traveling water screens (TWSs) manufactured by Hydrolox were installed. Each intake bay features one 3.0 m (10 ft) wide through-flow TWS. Each TWS is 13.7 m (45 ft) in length with approximately 6.4 m (21 ft) of the screen submerged at low tide. The Hydrolox screens are equipped with fish buckets (i.e., Ristroph modified) to allow impinged fish protection from screen spray wash water and transport to a fish return trough. The fish protection advantages of the Hydrolox screens over conventional mesh wire screens are a smoother screen face, smaller mesh openings, and less turbulent transition from fish buckets to the return trough. The top of the screen is dog-legged allowing the fish buckets to rotate over and empty into a return trough with minimal falling distance. That is, there is a smoother, more gentle transition and transfer of fish from the screen face to the temporary return trough than with a Ristroph modified conventional screen.

Figure 22: Configuration of Units 4 & 5 Intake Structure Bay

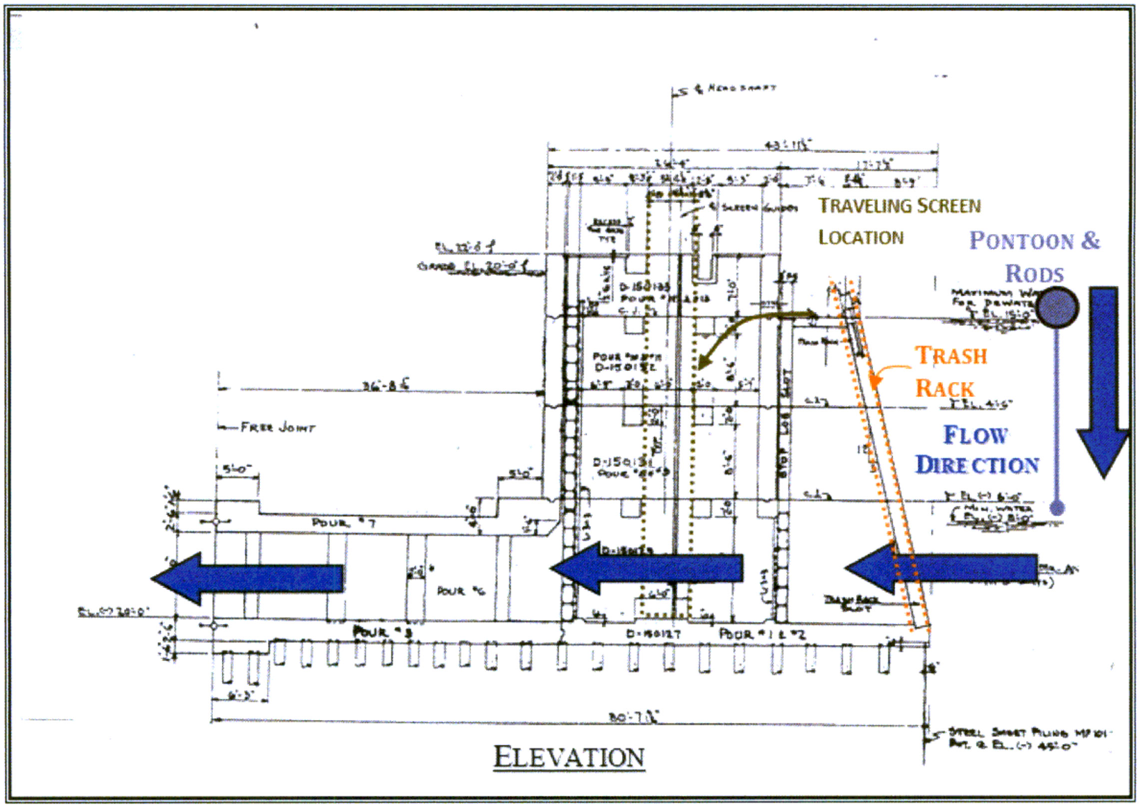


Figure 23: Plan View of Units 4 & 5 Intake Structure

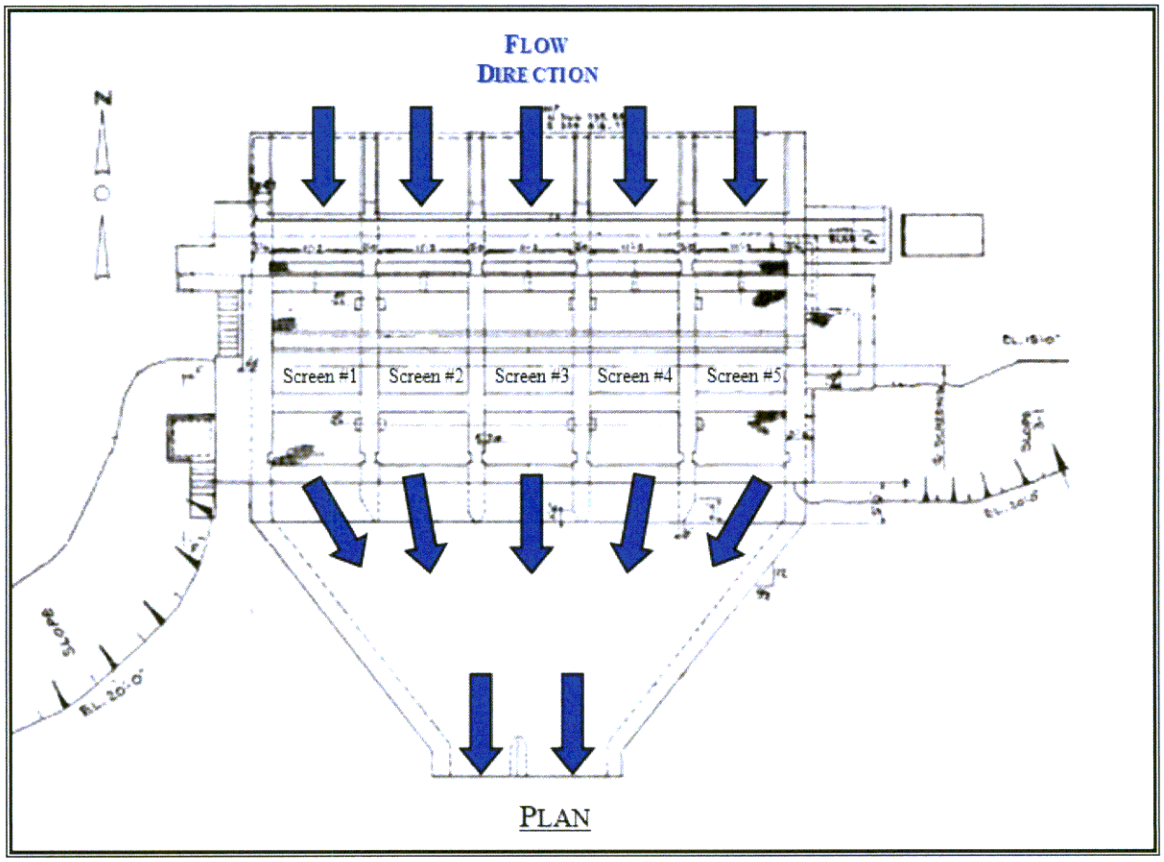


Figure 24: Units 4 & 5 Intake Traveling Screen Front Elevation

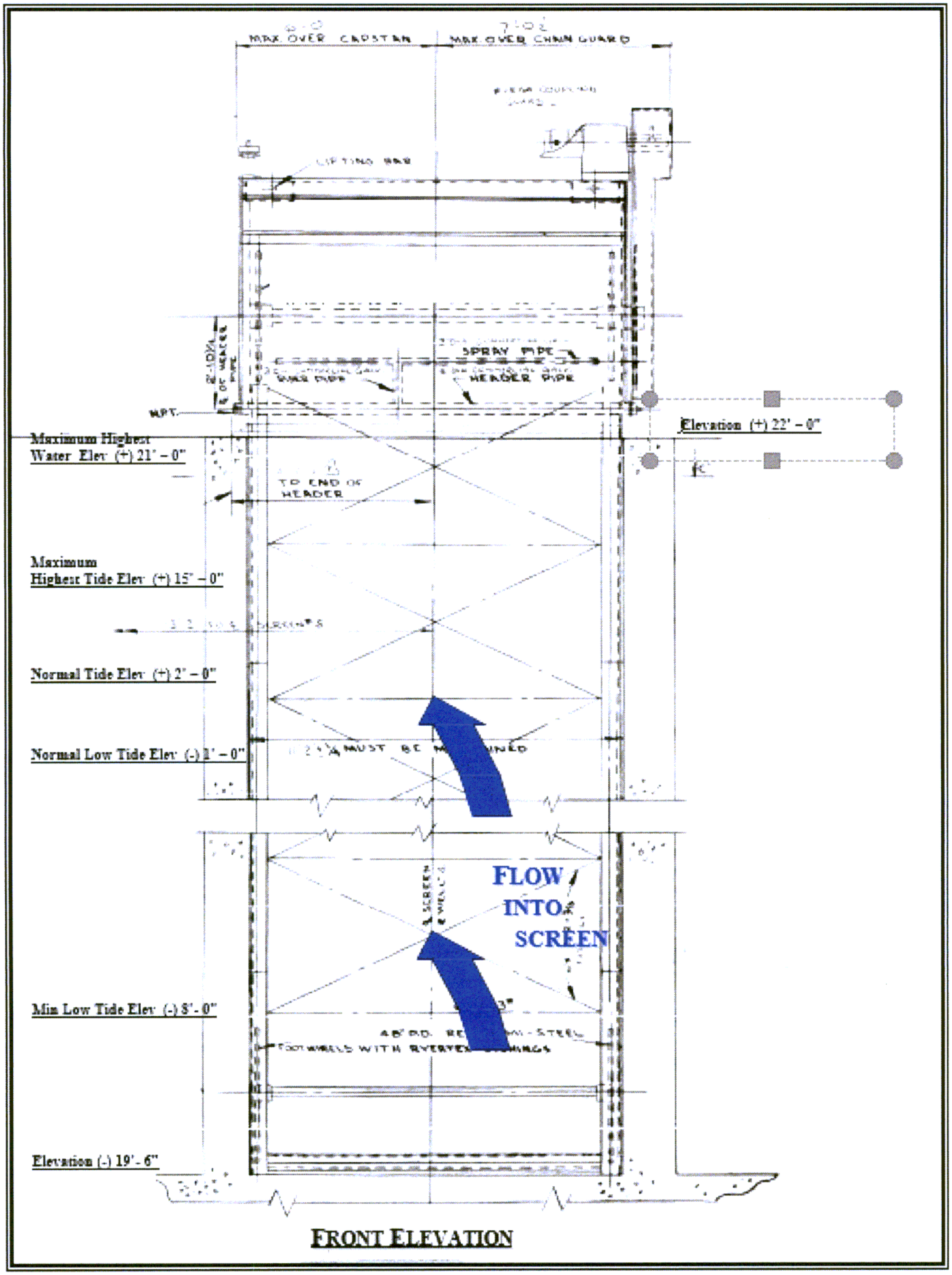
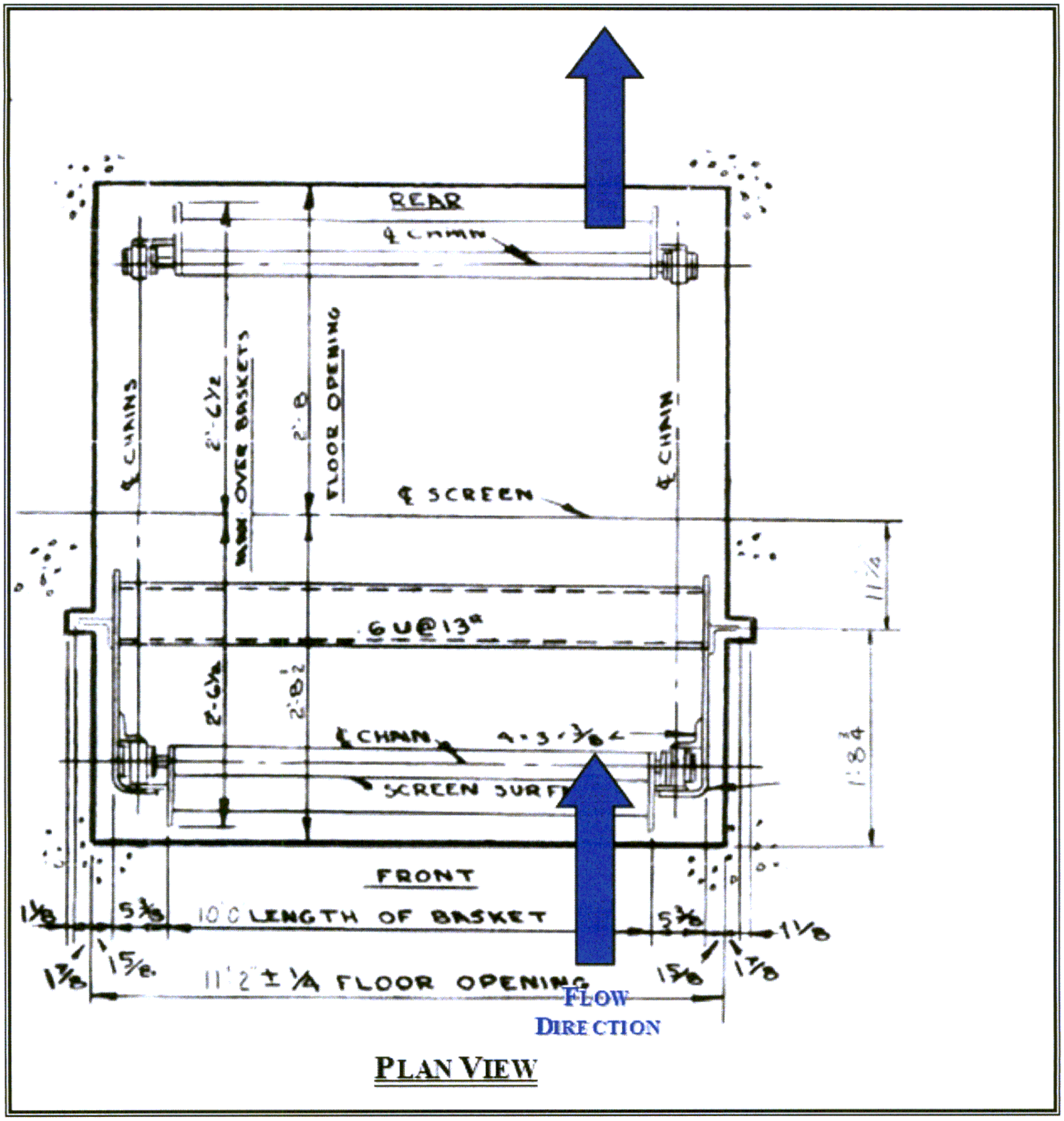


Figure 25: Units 4 & 5 Intake Traveling Screen Horizontal Cross-Section



4.2 Latitude and Longitude

The Unit 4 & 5 intake structure is located at a latitude of 31° 0′ 27.154″ N and longitude 88° 0′ 40.758″ W about 210 feet northeast of the Unit 1 & 2 intake structure. The Unit 1 & 2 intake structure is located at latitude 31° 0′ 25.747″ N and longitude 88° 0′ 43.507″ W. The Unit 6 & 7 intake is from the Unit 1 & 2 discharge tunnel. Units 6 & 7 utilize closed cycle cooling, therefore, only makeup water is withdrawn from the Unit 1 & 2 tunnel. The location of Unit 6 & 7 withdrawal is at latitude 31° 0′ 18.991″ N and longitude 88° 0′ 36.359″ W.

3.3 Operation of CWIS

The operation of each of the cooling water intake structures is comparable to the operation of the cooling water system. See Section 4.2 for a narrative of the operation of the cooling water system.

3.4 Water Balance

See Diagram from NPDES Permit in the *Cooling Water System Data* section.

3.5 Drawings

See Engineering Drawings in Figures 26 through 31.

Figure 26: Plant Barry Unit 1 & 2 Cooling Water Intake Structure

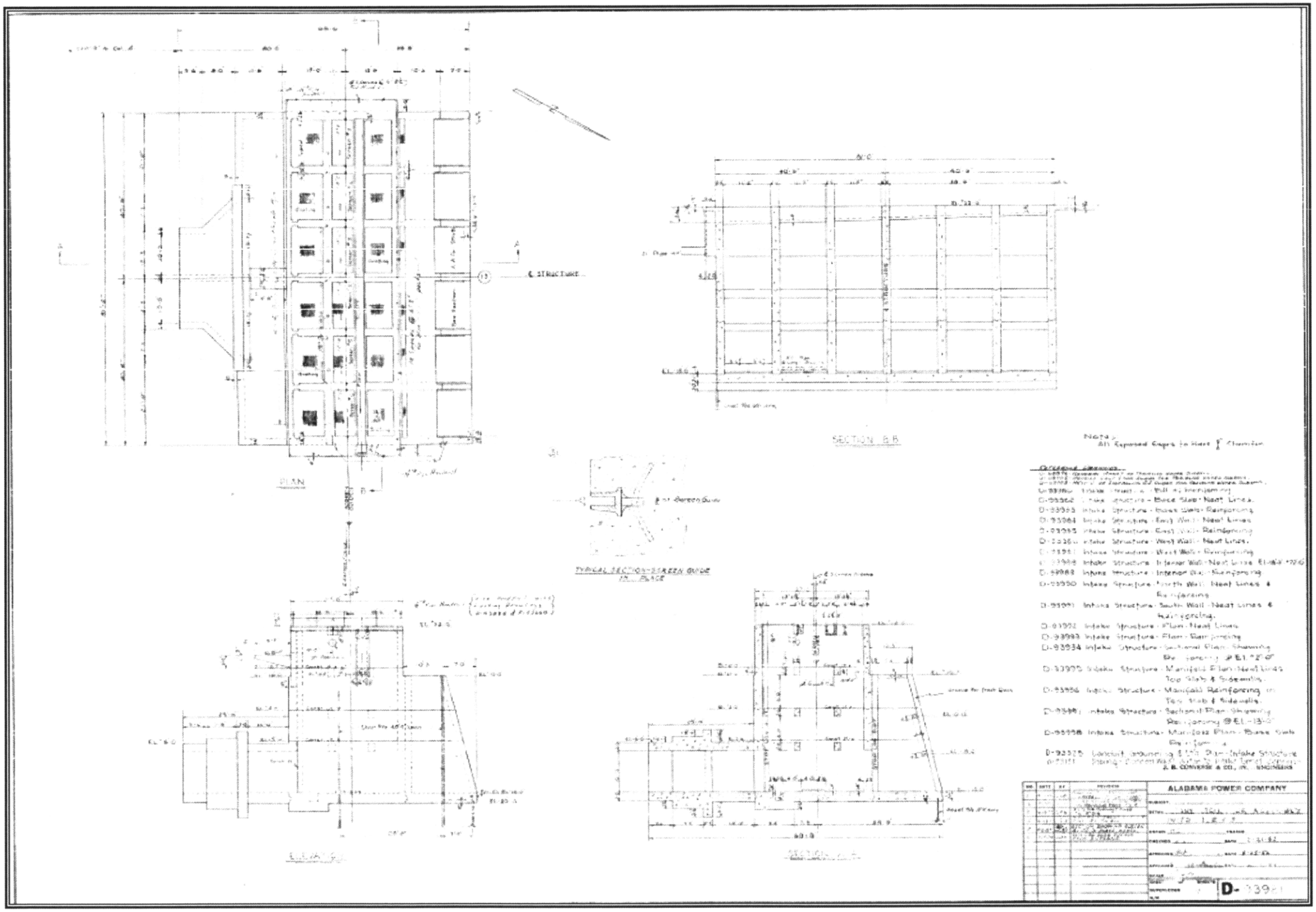


Figure 27: Plant Barry Unit 1 & 2 Screen Configuration

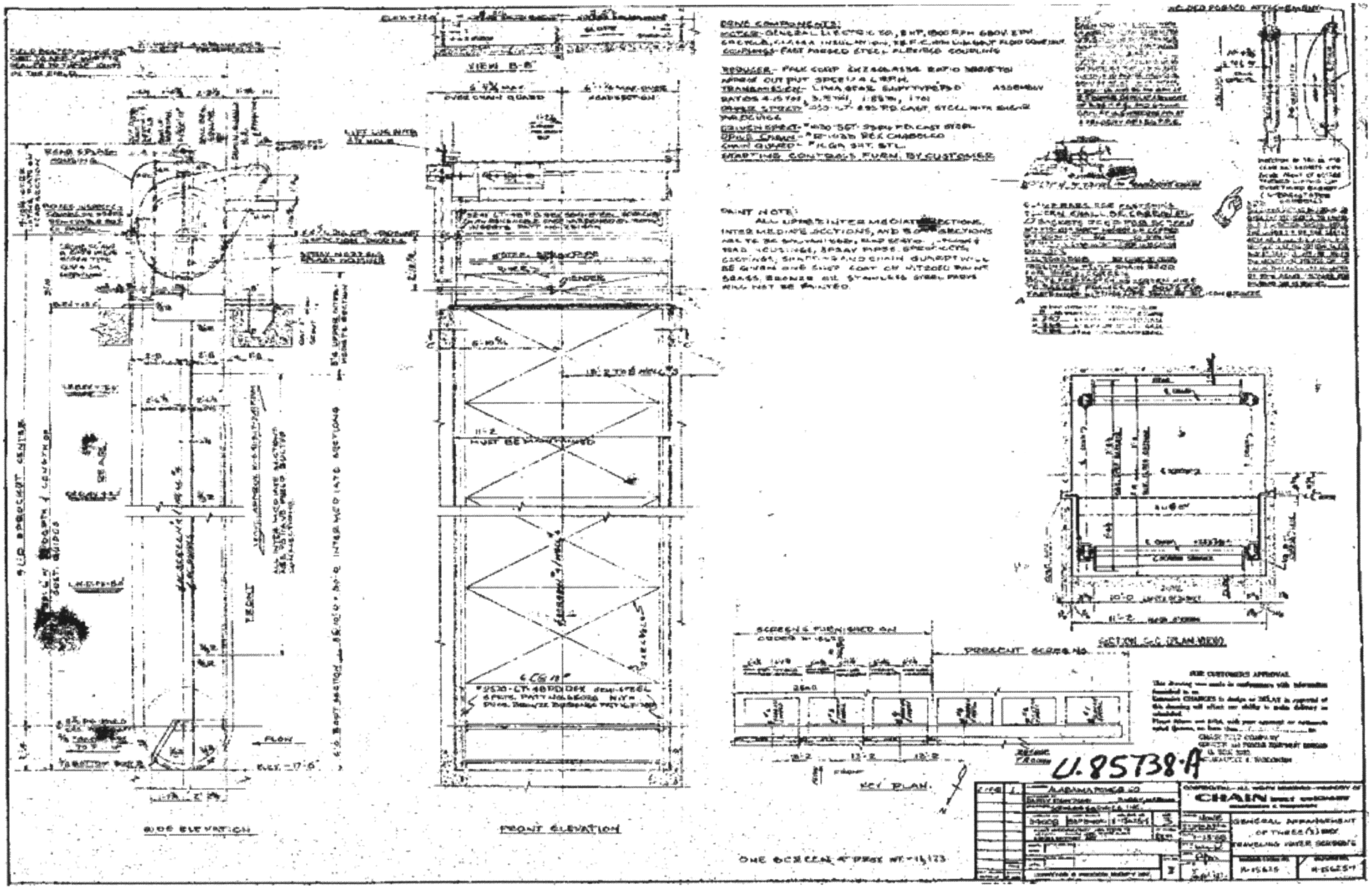


Figure 28: Plant Barry Unit 4 & 5 Intake Structure

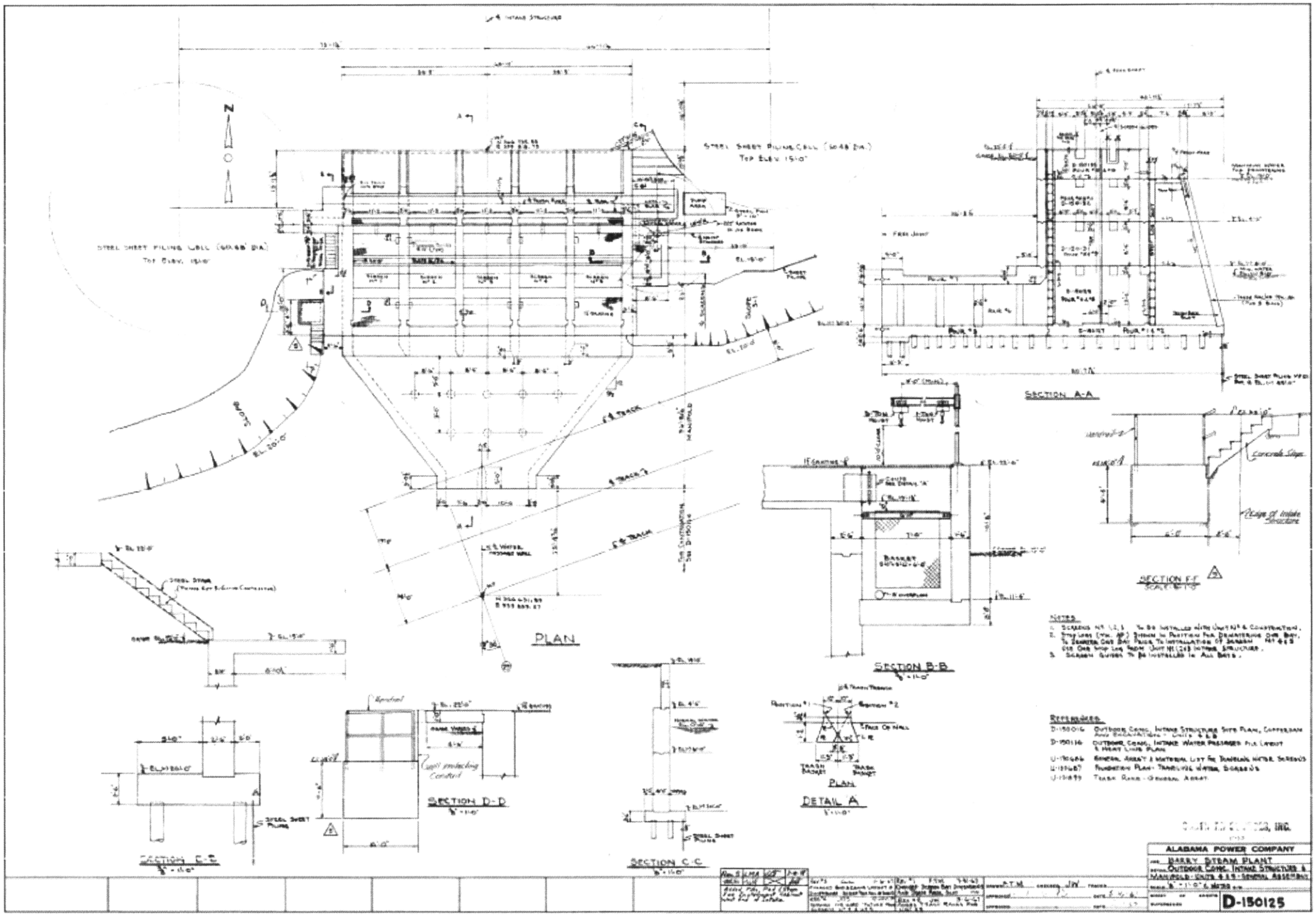


Figure 29: Plant Barry Unit 4 & 5 Screen Configuration

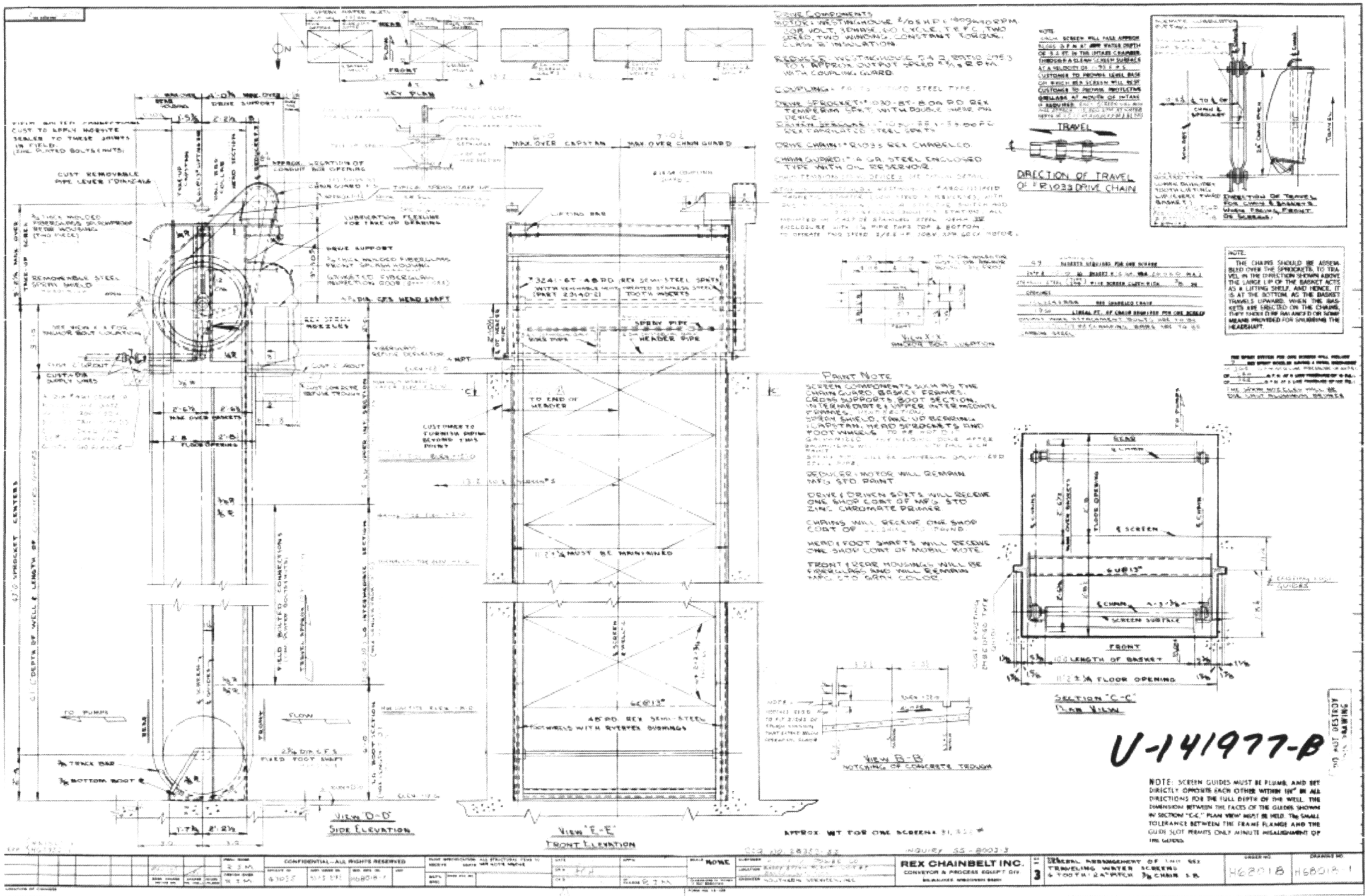


Figure 30: Plant Barry Hydrolox Screen Configuration

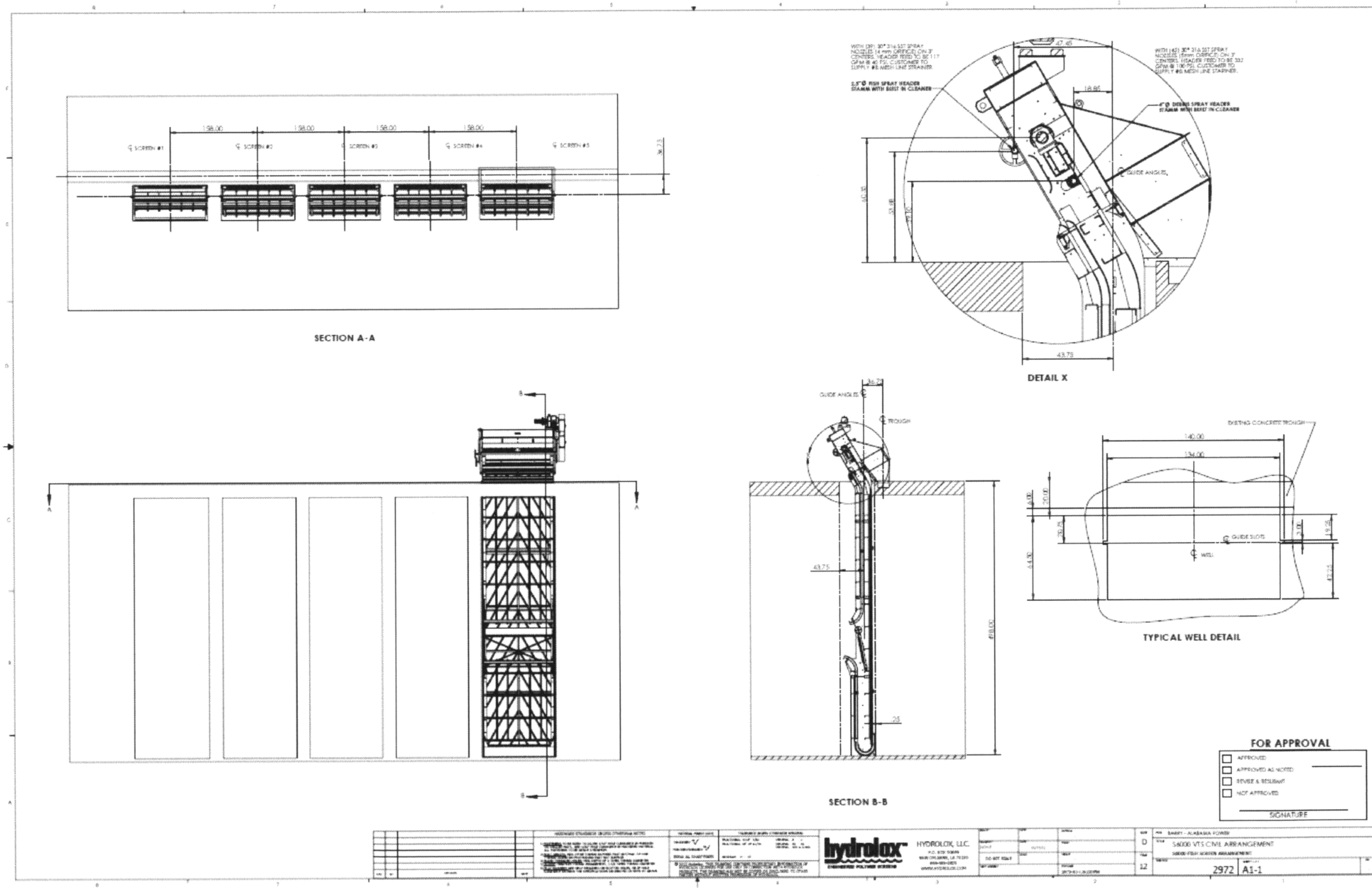
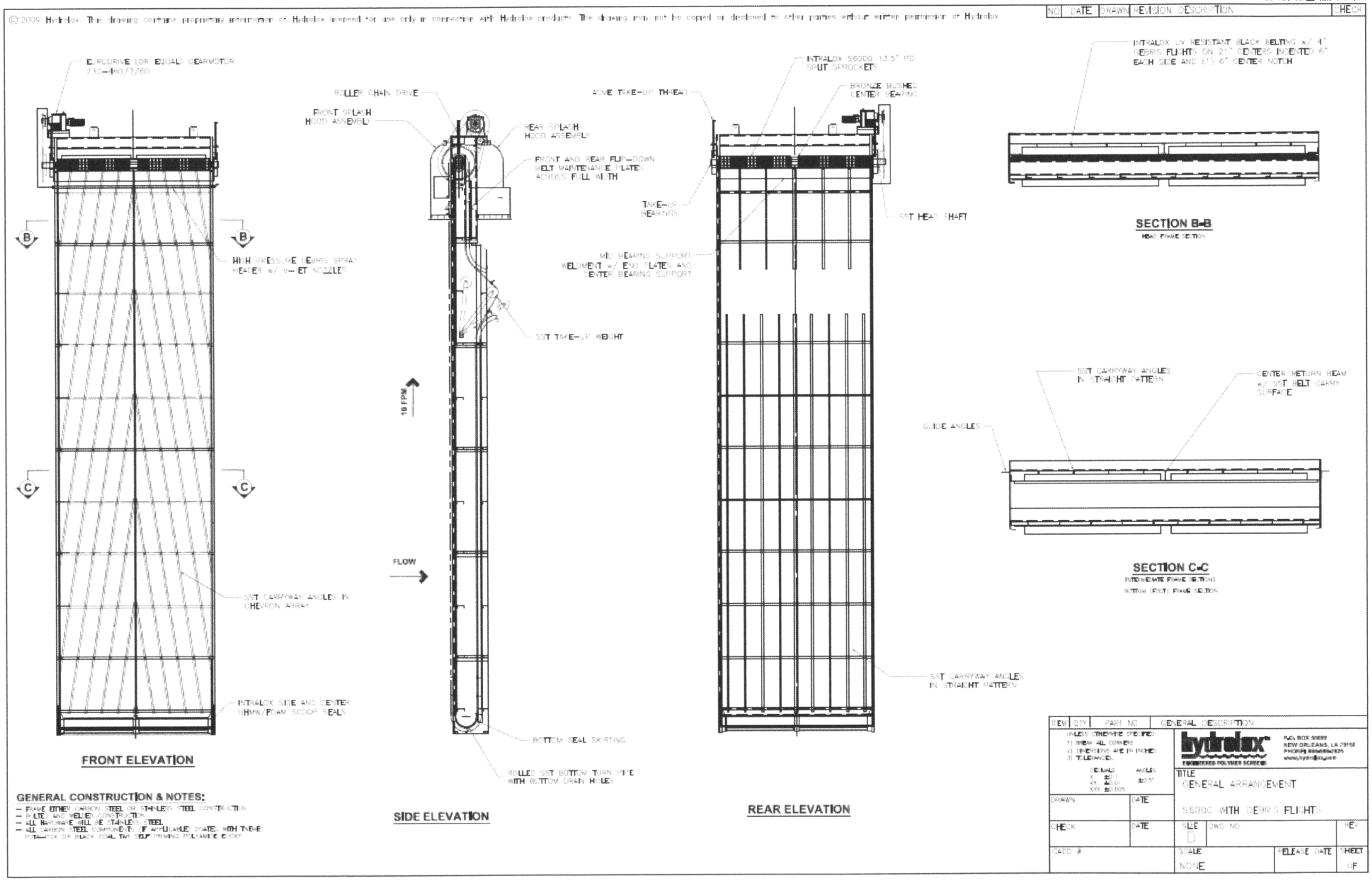


Figure 31: Plant Barry Hydrolox Screen



40 CFR 122.21(r)(5) *Cooling water system data.* Existing facilities defined in part 125.92(k) of this chapter must provide the following information for each cooling water intake structure they use: (i) A narrative description of the operation of the cooling water system, its relationship to cooling water intake structures, the proportion of the design intake flow that is used in the system, the number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable; the proportion of design intake flow used for contact cooling, non-contact cooling, and process uses; a distribution of water reuse to include cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling; a description of reductions in the total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals; a description of any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows; the proportion of the source waterbody withdrawn (on a monthly basis); (ii) Design and engineering calculations prepared by a qualified professional and supporting data to support the description required by paragraph (r)(5)(i) of this section; and (iii) Description of existing impingement and entrainment technologies or operational measures and a summary of their performance, including but not limited to reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage.

4. COOLING WATER SYSTEM DATA

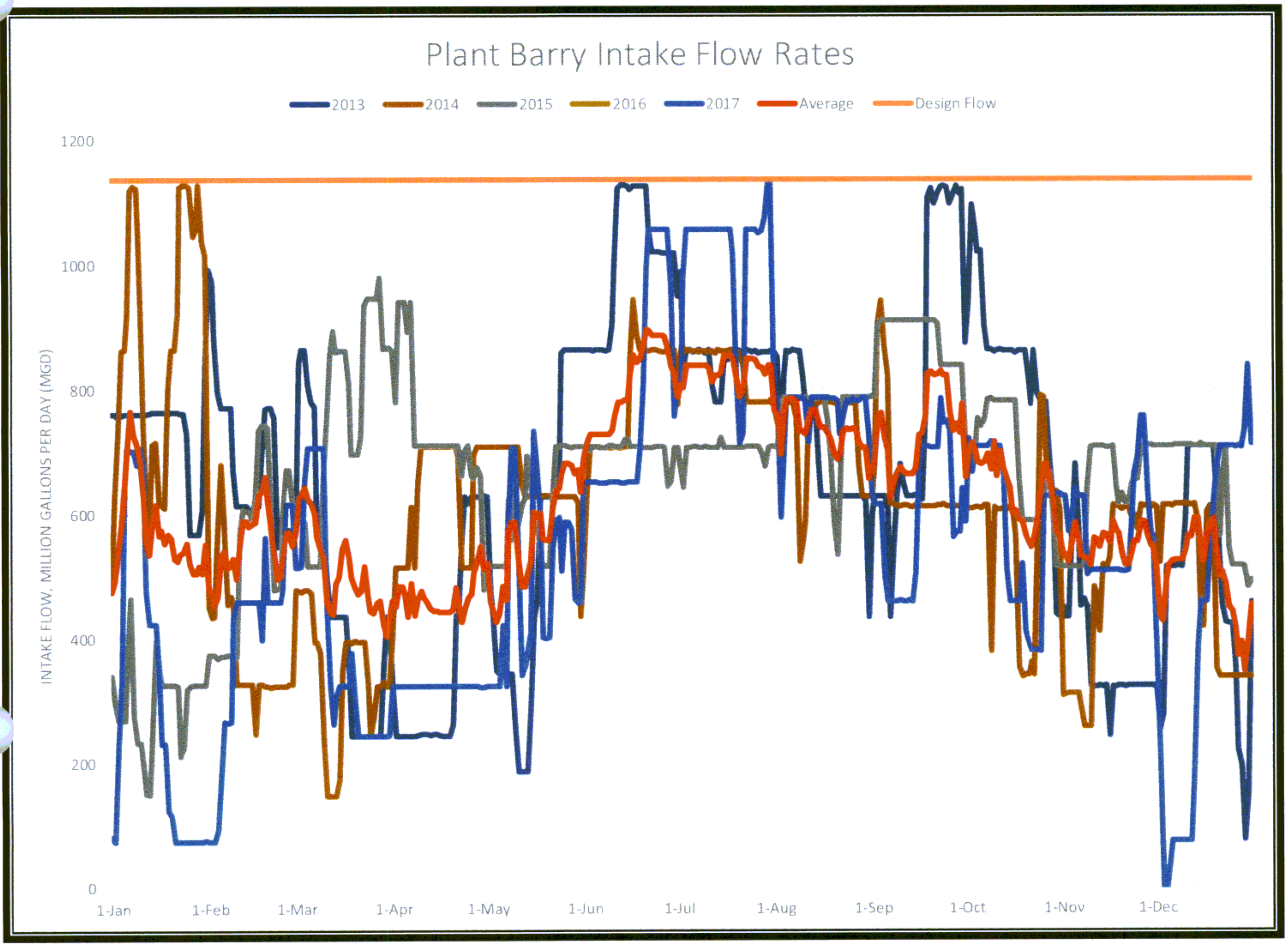
4.1. Operation

It has been established in the *Source Water Physical Data* section that Plant Barry is located on a freshwater stream. Moreover, Plant Barry uses once-through cooling for Units 1, 2, 4 & 5 and closed-cycle cooling for Units 6 & 7.

Plant Barry's cooling water system is composed of the cooling water intake structures, which are located on the Barge Canal, and associated intake tunnels leading to the intake pumps used to convey cooling water and circulate it throughout the facility as required to support contact and non-contact cooling uses, and then discharges it to a receiving waterbody.

The Plant Barry cooling water system is a continuously used system. Figure 32 illustrates Plant Barry's range of monthly average intake flowrates from January 2013 to December 2017. The intake flows over these five years are representative of the recent operation of the plant. As shown on the chart, from June through August, the condenser cooling requires intake flows which approach the design capacity.

Figure 32: Plant Barry Intake Flow Rates, 2013 through 2017



4.2. Design Intake Flow

The average daily flow withdrawn from Mobile River over the past five years for Units 1-5 was 623 MGD. The normal mode of operation for Plant Barry, especially in the summer, is to use two pumps per each of the units which had a total design capacity of 1,137 MGD. The maximum percentage of average intake design capacity utilized from 2013 to 2017 was 73%, which occurred during the month of July.

Figure 33: Plant Barry Monthly Average Intake Design Capacity Utilization, 2013 through 2017

	Average Intake Flow (2013-2017) MGD	Proportion of the Design Intake Flow Utilized *Design Intake Flow = 1,137 MGD*
January	576.60	51%
February	549.72	48%
March	513.53	45%
April	466.57	41%
May	566.96	50%
June	804.20	71%
July	831.81	73%
August	736.24	65%
September	732.99	64%
October	640.40	56%
November	551.55	49%
December	498.18	44%

The water withdrawn through the CWIS is primarily used as non-contact cooling water. A small portion is used for process water (approximately 2%). The proportion of the design intake flow used for these purposes is presented in Table 3.

Table 3: Intake Water Usage

Intake Water Use	Proportion of Design Intake Flow
Contact Cooling Water	0%
Non-Contact Cooling Water	98%
Process Water	2%

4.3. Recycle and Reuse

As previously mentioned, Units 6 & 7 utilize closed cycle cooling and withdraw makeup water from the Unit 1 & 2 cooling water discharge tunnel. Currently there is no recycle of process water at Plant Barry.

4.4. Proportion of Source Waterbody Withdrawn

During the period from 2014 to 2017, the maximum proportion of the source waterbody withdrawn on a monthly basis was 17 percent which occurred during the month of September

(Table 4). An average of 6 percent or less of the source waterbody is withdrawn on a monthly basis for seven months of the year.

Table 4: Proportion of Source Waterbody Withdrawn

	Monthly Average Stream Flow (2014-2017) MGD	Monthly Average Withdrawal (2014-2017) MGD	Proportion of Source Waterbody Withdrawn
January	25,819	564	2%
February	21,043	535	3%
March	22,927	548	2%
April	23,257	516	2%
May	14,270	605	4%
June	12,568	791	6%
July	9,197	863	9%
August	5,536	780	14%
September	4,293	741	17%
October	5,846	617	11%
November	8,253	623	8%
December	16,285	523	3%

4.5. Design and Engineering Calculations

The proportion of the design intake flow that is used in the system was determined by averaging monthly historical intake withdrawal flows during the period from 2013 to 2017, and then dividing these values by the design intake capacity. For example:

$$\text{Proportion of the Design Intake Flow Used January (2013–2017)} = \frac{576.60\ \text{MGD}}{1{,}137\text{MGD}} * 100\% = 51\%$$

The proportion of the source waterbody withdrawn on a monthly basis was determined by averaging monthly historical intake withdrawal flows during the period from 2014 to 2017, and then dividing these values by the average monthly stream flows during the period from 2014 to 2017. For example:

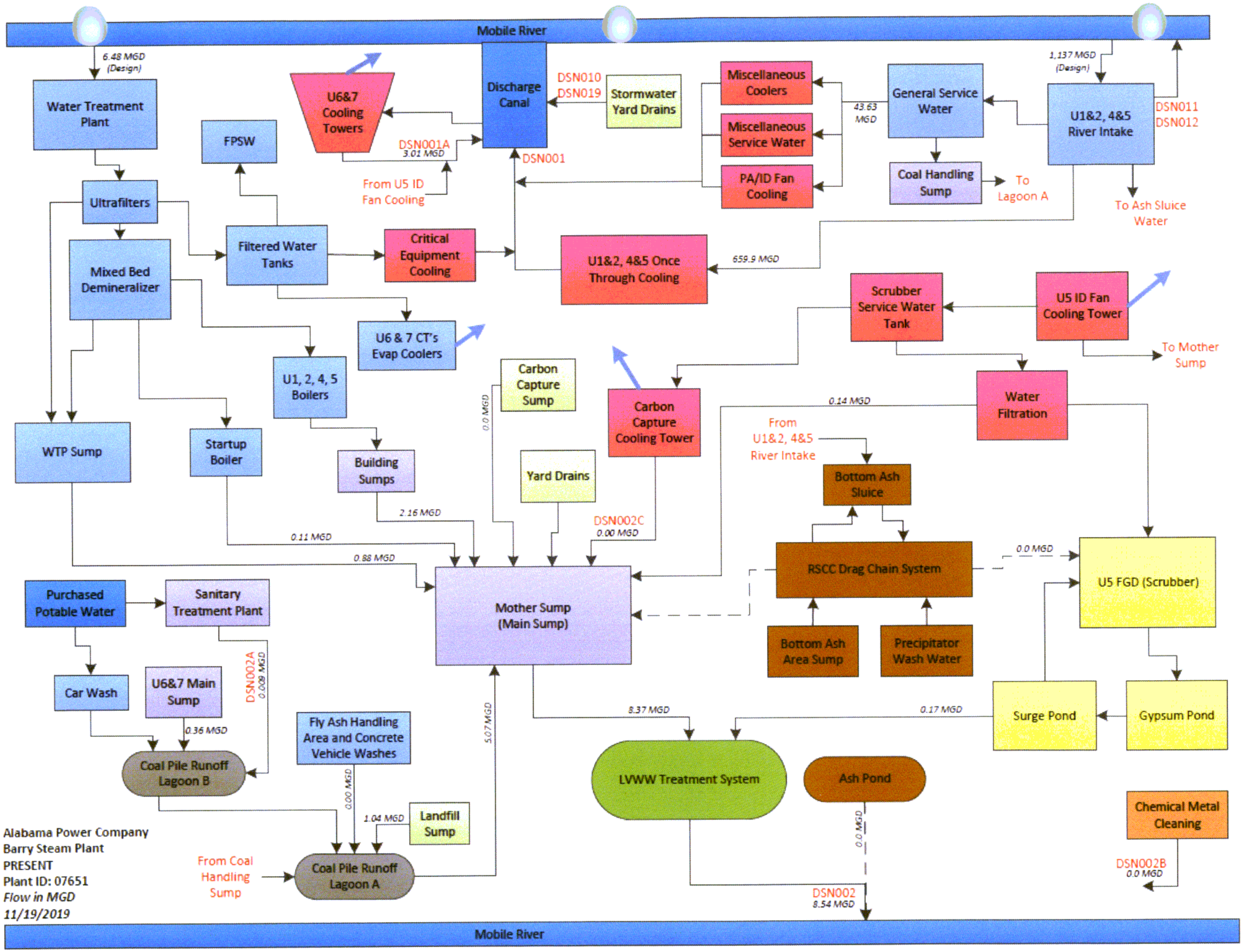
$$\text{Proportion of Source Waterbody Withdrawn During July} = \frac{863\ \text{MGD}}{9{,}197\text{MGD}} * 100\% = 9\%$$

4.6. Description of Existing Impingement and Entrainment Technologies

The Best Technology Available (BTA) Standards for Impingement Mortality and Entrainment are established and presented in 40 CFR 125.94. One of these BTA standards is the operation of modified travelling screens [See 40 CFR 125.94(c)(5)] as defined in 40 CFR 125.92(s).

As previously mentioned, Plant Barry has installed five traveling water screens (TWSs) manufactured by Hydrolox in the Unit 4 & 5 cooling water intake structure. Each intake bay features one 3.0 m (10 ft) wide through-flow TWS. Each TWS is 13.7 m (45 ft) in length with approximately 6.4 m (21 ft) of the screen submerged at low tide. The Hydrolox screens are equipped with fish buckets (i.e., Ristroph modified) to allow impinged fish protection from screen spray wash water and transport to a fish return trough. The fish protection advantages of the Hydrolox screens over conventional mesh wire screens are a smoother screen face, smaller mesh openings, and less turbulent transition from fish buckets to the return trough. The top of the screen is dog-legged allowing the fish buckets to rotate over and empty into a return trough with minimal falling distance. That is, there is a smoother, more gentle transition and transfer of fish from the screen face to the temporary return trough than with a Ristroph modified conventional screen.

Plant Barry plans to install additional modified traveling screens manufactured by Hydrolox on the remaining intake structure.



Mobile River
6.48 MGD (Design)
Water Treatment Plant
U6&7 Cooling Towers
Discharge Canal
DSN010
DSN019
Stormwater Yard Drains
Miscellaneous Coolers
Miscellaneous Service Water
PA/ID Fan Cooling
43.63 MGD
General Service Water
1,137 MGD (Design)
U1&2, 4&5 River Intake
DSN011
DSN012
FPSW
DSN001A
3.01 MGD
DSN001
From U5 ID Fan Cooling
Coal Handling Sump
To Lagoon A
To Ash Sluice Water
Ultrafilters
Filtered Water Tanks
Critical Equipment Cooling
U1&2, 4&5 Once Through Cooling
659.9 MGD
Mixed Bed Demineralizer
Scrubber Service Water Tank
U5 ID Fan Cooling Tower
U6 & 7 CT's Evap Coolers
To Mother Sump
U1, 2, 4, 5 Boilers
Carbon Capture Sump
0.0 MGD
Carbon Capture Cooling Tower
Water Filtration
0.14 MGD
WTP Sump
Startup Boiler
Building Sumps
From U1&2, 4&5 River Intake
Yard Drains
Bottom Ash Sluice
2.16 MGD
DSN002C
0.00 MGD
0.11 MGD
0.88 MGD
RSCC Drag Chain System
0.0 MGD
U5 FGD (Scrubber)
Purchased Potable Water
Sanitary Treatment Plant
Mother Sump (Main Sump)
Bottom Ash Area Sump
Precipitator Wash Water
DSN002A
0.009 MGD
Car Wash
U6&7 Main Sump
0.36 MGD
Fly Ash Handling Area and Concrete Vehicle Washes
5.07 MGD
8.37 MGD
0.17 MGD
Surge Pond
Gypsum Pond
Coal Pile Runoff Lagoon B
LVWW Treatment System
Ash Pond
0.00 MGD
1.04 MGD
Landfill Sump
0.0 MGD
Chemical Metal Cleaning
Alabama Power Company
Barry Steam Plant
PRESENT
Plant ID: 07651
Flow in MGD
11/19/2019
From Coal Handling Sump
Coal Pile Runoff Lagoon A
DSN002
8.54 MGD
DSN002B
0.0 MGD
Mobile River

Attachment A

11. c) Subsidiary Corporation(s) of Applicant:

Alabama Energy Partners
600 North 18th street
Birmingham, Alabama 35291

Alabama Property Company
600 North 18th street
Birmingham, Alabama 35291

Southern Electric Generating Company
600 North 18th street
Birmingham, Alabama 35291

11. d) Corporate Officers:

Mark A. Crosswhite
President, Chief Executive Officer and Director
600 North 18th Street
Birmingham, Alabama 35291

Philip C. Raymond
Executive Vice President, Chief Financial Officer and Treasurer
600 North 18th street
Birmingham, Alabama 35291

Zeke W. Smith
Executive Vice President
600 North 18th Street
Birmingham, Alabama 35291

Alexia B. Borden
Senior Vice President and General Counsel
600 North 18th Street
Birmingham, Alabama 35291

Jim P. Heilbron
Senior Vice President and Senior Production Officer
600 North 18th Street
Birmingham, Alabama 35291

Ronald Q. Patterson
Vice President and Assistant Treasurer
600 North 18th Street
Birmingham, Alabama 35291

Attachment B

Fossil Plants

	Permit Type	Permit Number	Effective Date	Expiration Date	
Barry Steam Plant	Acid Rain		1/1/2009	12/31/2013	Submitted 6/13/2018
	LANDFILL	Mobile County #126	8/25/2019	8/24/2020	
	LANDFILL	ADEM #49-18	1/22/2014	8/21/2019	Submitted 01/21/2019
	NPDES	AL-0002879	11/1/2008	10/31/2013	
	Title V	503-1001	12/20/2010	12/31/2015	Submitted 2/18/2016
	AIR	503-1001-X008	9/14/2010		
	AIR	503-1001-X009	11/6/2014		
	AIR	503-1001-X010	11/6/2014		
	AIR	503-1001-X011	12/8/2015		
E B Harris Generating Plant	Acid Rain		6/8/2016	6/7/2021	
	BMP	3/31/2003	11/5/2012	11/5/2015	
	NPDES	AL-0074179	8/1/2018	7/31/2023	
	Title V	201-0010	6/8/2016	6/7/2021	
Gadsden Steam Plant	Acid Rain		1/1/2005	12/31/2009	
	LANDFILL	ADEM #28-05	1/9/2016	1/8/2021	
	NPDES	AL-0002887	2/1/2017	1/31/2022	
	Title V	307-0002	1/31/2017	1/30/2022	
Gaston Steam Plant	Acid Rain		1/1/2009	12/31/2013	Submitted 6/13/2018
	AIR	411-0005-X012	6/4/2013		
	AIR	411-0005-X013	2/14/2014		
	AIR	411-0005-X014	2/14/2014		
	AIR	411-0005-X015	2/14/2014		
	AIR	411-0005-X005	4/14/2015		
	LANDFILL	ADEM #59-14	1/9/2016	1/8/2021	
	NPDES	AL-0003140	12/1/2001	6/30/2012	Submitted 5/7/2018
	Title V	411-0005	12/20/2010	12/31/2015	Submitted 2/20/2017
	USCG	AID200100702269	3/1/2004		
Gorgas Barge Loading Facility #2	NPDES	AL-0025551	10/1/1992	9/30/2013	Submitted 5/16/2018
Gorgas Steam Plant	Acid Rain		1/1/2009	12/31/2013	Submitted 6/13/2018
	AIR	414-0001-X012	11/12/2013		
	LANDFILL	ADEM #64-10	1/9/2016	1/8/2021	
	NPDES	AL-0002909	10/1/2001	9/5/2012	
	Title V	414-0001	12/20/2010	12/31/2015	Submitted 2/18/2016
Greene County Steam Plant	Acid Rain		1/1/2005	12/31/2009	Submitted 7/24/2008
	LANDFILL	ADEM #32-02	1/9/2016	1/8/2021	
	NPDES	AL-0002917	4/1/2019	3/31/2024	
	Title V	405-0001	8/29/2003	8/28/2008	Submitted 2/18/2016
	AIR	405-0001-X012	10/5/2015		
	AIR	405-0001-X013	10/5/2015		
Miller Steam Plant	LANDFILL	ADEM #37-16	12/22/2016	12/21/2021	
	NPDES	AL-0027146	10/1/2001	1/31/2012	Submitted 6/13/2017
	Title V	4-07-0011-04	1/11/2017	1/10/2022	
Plant H Allen Franklin	Acid Rain		6/8/2016	6/7/2021	
	NPDES	AL-0073555	6/1/2012	5/31/2017	
	Title V	206-0036	6/8/2016	6/7/2021	
Theodore Cogenerating Plant	Acid Rain		4/1/2016	3/31/2021	
	NPDES	AL-0072290	1/1/2015	12/31/2019	Submitted 7/3/2019
	Title V	503-8073	4/1/2016	3/31/2021	
	AIR	503-8073-X003	5/3/2016		
	AIR	503-8073-X004	5/3/2016		
Washington County Cogenerating Plant	Acid Rain		4/1/2016	3/31/2021	
	NPDES	AL-0071951	2/1/2014	1/31/2019	Submitted 8/3/2018
	Title V	108-0018	4/1/2016	3/31/2021	

Hydro Plants

	Permit Type	Permit Number	Effective Date	Expiration Date
Bankhead Dam	NPDES	ALG360001	2/1/2016	1/31/2021
Bouldin Dam	NPDES	ALG360005	2/1/2016	1/31/2021
Holt Dam	NPDES	ALG360003	2/1/2016	1/31/2021
Jordan Dam	NPDES	ALG360016	2/1/2016	1/31/2021
Lay Dam	NPDES	ALG360006	2/1/2016	1/31/2021
Logan Martin Dam	NPDES	ALG360004	2/1/2016	1/31/2021
Logan Martin Batch Plant	NPDES	ALG110208	2/1/2016	1/31/2021
Martin Dam	NPDES	ALG360014	2/1/2016	1/31/2021
Mitchell Dam	NPDES	ALG360015	2/1/2016	1/31/2021

Neely Henry Dam	NPDES	ALG360002	2/1/2016	1/31/2021
R L Harris Dam	NPDES	ALG360017	2/1/2016	1/31/2021
Smith Dam	NPDES	ALG360008	2/1/2016	1/31/2021
Thurlow Dam	NPDES	ALG360013	2/1/2016	1/31/2021
Weiss Dam	NPDES	ALG360007	2/1/2016	1/31/2021
Yates Dam	NPDES	ALG360010	2/1/2016	1/31/2021

Birmingham Division	Permit Type	Permit Number	Effective Date	Expiration Date
Birmingham Division Garage	AIR	4-07-2034-002	7/20/1998	
County Hwy 45	AIR	4-07-1184-8601	4/15/1986	
Gardendale Crew Headquarters	AIR	4-07-1670-8601	4/15/1986	
General Services Complex	AIR	411-G059-X001	8/17/1998	
	AIR	4-07-1116-8601	4/15/1986	
Hueytown Crew Headquarters	NPDES	ALG140133	10/1/2012	9/30/2017
	AIR	4-07-1688-8601	4/15/1986	
Patton Chapel Crew HQ	NPDES	ALG140132	10/1/2012	9/30/2017
	AIR	4-07-1579-8601	4/15/1986	
Trussville Crew Headquarters	NPDES	ALG140131	10/1/2012	9/30/2017

Corporate	Permit Type	Permit Number	Effective Date	Expiration Date
Corporate	AIR	4-07-0456-03	6/14/2016	
Central Utilities Plant	NPDES	ALG250054	4/1/2012	3/31/2017

Eastern Division	Permit Type	Permit Number	Effective Date	Expiration Date
Gadsden Garage	AIR	307-G129-X001	12/18/2008	

Southeast Division	Permit Type	Permit Number	Effective Date	Expiration Date
Eufaula Crew HQ	UIC	ALSI9903437	12/28/2013	12/27/2018
Farley Garage	AIR	607-G127-X001	12/29/2008	
Valley Crew HQ	UIC	ALSI9909429	6/23/2013	6/22/2018

Southern Division	Permit Type	Permit Number	Effective Date	Expiration Date
Selma Crew HQ	NPDES	ALG140244	10/1/2012	9/30/2017

Western Division	Permit Type	Permit Number	Effective Date	Expiration Date
Jasper Garage	AIR	414-GO25-X001	4/28/1995	
Tuscaloosa District Crew HQ & Div. Garage	AIR	413-G005-X001	11/22/1991	

Construction Stormwater	Permit Type	Permit Number	Effective Date	Expiration Date
APC Jasper	NPDES	ALR10BEAI	10/18/2018	3/31/2021
Barry Ash Pond Closure (Barry Bridge)	NPDES	ALR10BDZO	9/25/2018	3/31/2021
Bessemer - Calera	NPDES	ALR10BD36	1/29/2019	3/31/2021
Bessemer-Gorgas 115kV TL	NPDES	ALR10BCAM	5/23/2017	3/31/2021
Butler-Cuba 115kV	NPDES	ALR10BCVH	11/28/2017	3/31/2021
Clay TS	NPDES	ALR10BDY4	9/20/2018	3/31/2021
Clay TS - Rainbow City SS 115kV TL	NPDES	ALR10BB94	9/19/2016	3/31/2021
Cook Springs 115 Tap (2.5 mi) New (2234003)	NPDES	ALR10BBKS	12/8/2016	3/31/2021
County Line Rd-Autauga Creek 115	NPDES	ALR10BCXA	11/30/2017	3/31/2021
Dallas County Borrow Pit	NPDES	ALG890197	3/31/2016	3/31/2021
Dearmanville-Heflin	NPDES	ALR10BEOV	3/15/2019	3/31/2021
Enterprise Tap 115kV	NPDES	ALR10BDEA	3/27/2018	3/31/2021
Fuller Rd-Power South	NPDES	ALR10BCIW	7/17/2017	3/31/2021
Fuller Road-Nostasulga Reconductor (11 mi) (2210134)	NPDES	ALR10BBVO	3/27/2017	3/31/2021
Gaston Ash Pond Closure	NPDES	ALR10BEMT	3/4/2019	3/31/2021
Gaston Co. Line Rd	NPDES	ALR10BCRA	9/28/2017	3/31/2021
Gaston Low Volume Waste Pond	NPDES	ALR10B832	4/1/2016	3/31/2021
Gaston-Co. Line Rd	NPDES	ALR10BCRA	9/28/2017	3/31/2021
Gaston-Fayetteville 230kV	NPDES	ALR10BDVF	8/28/2018	3/31/2021
GE-Burkville-Hunter	NPDES	ALR10BCLS	8/16/2017	3/31/2021
Georgiana-Evergreen 115kV	NPDES	ALR10BEHY	1/19/2019	3/31/2021
Goodsprings TS	NPDES	ALR10BEMV	3/5/2019	3/31/2021
Gorgas - Fairfield 2nd Circuit	NPDES	ALR10BD39	1/16/2018	3/31/2021
Gorgas Ash Pond Closure	NPDES	ALR10BDH3	3/27/2018	3/31/2021
Gorgas Bottom Ash	NPDES	ALR10BELA	2/18/2019	3/31/2021
Gorgas-Fairfield X-Line	NPDES	ALR10BDS3	7/17/2018	3/31/2021

Gorgas-Tuscaloosa AB 115kV	NPDES	ALR10BEO5	3/15/2019	3/31/2021
Greene County Ash Pond Closure	NPDES	ALR10BEMU	2/18/2019	3/31/2021
Greene County Borrow Pit	NPDES	ALR167503	3/31/2016	3/31/2021
Greenville-Georgiana	NPDES	ALR10BEDK	12/5/2018	3/31/2021
GSC Borrow Pit	NPDES	ALG890444	3/31/2016	3/31/2021
GSC Building 9H	NPDES	ALR10BDHJ	4/11/2018	3/31/2021
Haleyville-Wilson Dam	NPDES	ALR10BEJ8	1/17/2019	3/31/2021
Hamilton-Hodges-Bear Creek 46kkV TL	NPDES	ALR10BCJR	8/14/2017	3/31/2021
Holt-South Bessemer	NPDES	ALR10BBHF	10/17/2016	3/31/2021
Jordan Dam-Bouldin Dam	NPDES	ALR10BENP	3/12/2019	3/31/2021
Miller Wasterwater Management Area	NPDES	ALR10BDMA	5/17/2018	3/31/2021
Miller Water Management Area	NPDES	ALR10BCIR	7/19/2017	3/31/2021
Mitchell Dam-North Selma	NPDES	ALR10BDD4	3/13/2018	3/31/2021
Naheola-Butler 115kV Relocation	NPDES	ALR10BDMV	5/17/2018	3/31/2021
Pinckard-Ft. Rucker-Enterprise	NPDES	ALR10BDLE	5/14/2018	3/31/2021
Remlap DS (2254794)	NPDES	ALR10BDSY	7/26/2018	3/31/2021
Ross Bridge Microgrid	NPDES	ALR10BCHD	7/18/2017	3/31/2021
Santuck DS	NPDES	ALR10BEJP	1/24/2019	3/31/2021
Smith Dam-Fulton Springs	NPDES	ALR10BETA	3/30/2019	3/31/2021
South Tuscaloosa-Eutaw 115kV TL	NPDES	ALR10BDQO	6/25/2018	3/31/2021
Theodore SS	NPDES	ALRBCVF	11/30/2017	3/31/2021
Thurlow Dam Laydown Area	NPDES	ALR10BDH4	4/5/2018	3/31/2021
Thweatt TS 115kV Tap	NPDES	ALR10BBUA	3/9/2017	3/31/2021
Troy-Luverne	NPDES	ALR10BCVM	11/30/2017	3/31/2021
Waugh DS 115kV TL	NPDES	ALR10BCY7	12/18/2017	3/31/2021
West Blountsville DS 46kV Tap (2179805) (2179812)	NPDES	ALR10BCJQ	8/14/2017	3/31/2021

Drinking Water Supply	Permit Type	Permit Number	Effective Date	Expiration Date
Greene County Steam Plant	PWS-0642	2017-520	10/1/2016	9/30/2026
Energy Center Water System (PWSID #AL0001815)	PWS	2017-636	9/22/2017	9/30/2027

Pesticide Permit	Permit Type	Permit Number	Effective Date	Expiration Date
APC ServiceTerritory	NPDES	ALG870003	10/31/2016	10/30/2021

Water Quality	Permit Type	Permit Number	Effective Date	Expiration Date
Weiss Waterfowl Project	COE + WQ			

Attachment C

Biocides and Corrosion Inhibitors

Hydrazine

- Quantity stored onsite: 350 gallons
- Frequency of use: As needed for water treatment in the boiler.
- Proposed discharge concentrations: This additive is used based on the demand of the system. Should a minimal amount of product be present in the wastewater, it would be undetectable.

Biomate MBC2881

- Quantity stored onsite: 350 gallons
- Frequency of use: As needed in the water treatment plant.
- Proposed discharge concentrations: This additive is used based on the demand of the system. Should a minimal amount of product be present in the wastewater, it would be undetectable.

Sodium Hypochlorite

- Quantity stored onsite: 17,000 gallons
- Frequency of use: As needed in the water treatment plant and the U6 & 7 cooling towers.
- Proposed discharge concentrations: This additive is used based on the demand of the system. Should a minimal amount of product be present in the wastewater, it would be undetectable.

Nalco 3D Trasar 3DT102

- Quantity stored onsite: 3,000 gallons
- Frequency of use: As needed in the U6 & 7 cooling towers.
- Proposed discharge concentrations: This additive is used based on the demand of the system. Should a minimal amount of product be present in the wastewater, it would be undetectable.

MATERIAL SAFETY DATA SHEET

HydroChem®
INDUSTRIAL SERVICES, INC.

DATE PREPARED: 02/07/2005
MSDS No: M080
Hydrazine, 35%

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Hydrazine, 35%
Product Code: M080
Product Name: Hydrazine, 35%
Molecular Formula: N_2H_4

MANUFACTURER:
HydroChem Industrial Services, Inc.
900 Georgia Ave.
Deer Park, TX 77536
Customer Service: (800) 934-9376

24 HR. EMERGENCY TELEPHONE NUMBERS:

Emergency Contact:	HydroChem ER
Emergency Phone	(800) 569-4889

2. COMPOSITION/INFORMATION ON INGREDIENTS

	wt.%	CAS Registry #
Hydrazine	35	302-01-2
Water	65	7732 -18-5

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200)

	EXPOSURE LIMITS		
	OSHA PEL	ACGIH TLV	Supplier
Hydrazine	1 ppm	0.01 ppm	

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

PHYSICAL APPEARANCE:
Colorless liquid

IMMEDIATE CONCERNS:
May be toxic by
Skin Contact
Ingestion
Inhalation

MEDICAL CONDITIONS AGGRAVATED:

Persons with pre-existing skin disorders, eye problems or impaired liver, kidney or respiratory function may be at increased risk from exposure.

HydroChem® INDUSTRIAL SERVICES, INC.

ROUTES OF ENTRY:
Ingestion, inhalation and eye or skin contact.

4. FIRST AID MEASURES

EYES:
Immediately flush eyes with water for 30 minutes while holding eyelids open. Seek medical attention.

SKIN:
Immediately wash with soap and water for 30 minutes. See a doctor at once. Launder contaminated clothing before reuse. Dispose of contaminated shoes.

INGESTION:
If swallowed, induce vomiting with ipecac (preferred), or by giving water and sticking finger down throat. After vomiting give milk (preferred) or water and consult physician.

INHALATION:
If effects occur, remove to fresh air. See a doctor at once. If breathing has stopped, begin artificial respiration.

5. FIRE FIGHTING MEASURES

Flashpoint and Method: >200°F 93°C SETA Flash CC
Flammable Limits: 4.7% to 100%
Autoignition Temperature: >590°F 310°C

GENERAL HAZARD:
Vapors may travel along the ground and ignite when an ignition source is contacted.

EXTINGUISHING MEDIA:
Use carbon dioxide, or water spray when fighting fires involving this material.

HAZARDOUS COMBUSTION PRODUCTS:
Ammonia and oxides of nitrogen.

EXPLOSION HAZARDS:
Vapors may form explosive mixture with air.

FIRE FIGHTING PROCEDURES:
Use water fog to cool hot containers.

FIRE FIGHTING EQUIPMENT:
As in any fire, wear self-contained breathing apparatus pressure-demand, (MSHA/NIOSH approved or equivalent) and full protective clothing to prevent contact with skin and eyes.

6. ACCIDENTAL RELEASE MEASURES

GENERAL PROCEDURES:
Contain with dikes.
Put in plastic drum.
Soak up residual on inert absorbant (dry sand, vermiculite, earth).
Wash spill site after material pickup is complete.

7. HANDLING AND STORAGE

GENERAL PROCEDURES:
Refer to Section 8.

STORAGE:
Keep container tightly closed.
Isolate from incompatible materials.
Do not store near oxidizing materials.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:
Ventilation - General and local ventilation are required.

PERSONAL PROTECTION
EYES AND FACE:
Chemical goggles with face shield required and an eye wash in work area.

RESPIRATORY:
Use NIOSH approved respirator with hydrazine protection or full-face resipirator with supplies air line. Use SCBA (self-contained breathing apparatus) for emergencies.

PROTECTIVE CLOTHING:
Face shield, boots, protective suit and impervious (neoprene) gloves.

OTHER USE PRECAUTIONS:
Safety shower and eye wash in the work area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Color: Colorless
pH: 10.9
Percent Volatile: 100
Vapor Pressure: Not Determined
Vapor Density: >1 (Air = 1)
Boiling Point: 220°F 104°C
Freezing Point: -87°F -66°C
Solubility in Water: Completely Miscible in All Proportions
Specific Gravity: 1.025

10. STABILITY AND REACTIVITY

STABLE: Yes

HAZARDOUS POLYMERIZATION: No

HAZARDOUS DECOMPOSITION:
Ammonia and oxides of nitrogen.

INCOMPATIBLE MATERIALS:
Highly reactive with oxidizers, acids, some organics, lead, copper and iron oxides.

11. TOXICOLOGICAL INFORMATION

ACUTE
Eyes: Severe irritant. Causes pain and redness. Prolonged or repeated contact may cause mild burn.
Skin: Toxic. Irritant. May cause pain, redness, dermatitis and can cause illness or death.
Ingestion: Toxic. Irritant. Can cause pain, illness or death.
Inhalation: Toxic. Irritant. Can cause illness or death. May cause pain, coughing, or soreness.

TARGET ORGANS:
May cause dizziness, nausea, vomiting, diarrhea, fatigue, muscle tremors. May affect liver, blood, kidneys, lungs. May cause birth defects, genetic changes. May cause tumors.

CARCINOGENICITY:
IARC: Group 2B carcinogen
NTP: Suspect carcinogen
OSHA: Possible suspect carcinogen

COMMENTS:
Only selected Registry of Toxic Effects of Chemical Substances (RTECS) data is presented in this document. See the actual entry in RTECS for complete information.

LD50 (rats) = 60 mg/kg
LC50 (rats) = 570 ppm/4 hr

RTECS Number: MV8050000

12. ECOLOGICAL INFORMATION

GENERAL COMMENTS:
Degradability: Not determined.
Fish Toxicity: Gold orfe LC50 (48 hr) = 0.75 mg/L

13. DISPOSAL CONSIDERATIONS

PRODUCT DISPOSAL:
Ship via permitted waste hauler to permitted hazardous waste disposal facility for incineration (preferred) or chemical deactivation and solidification prior to land filling.

EMPTY CONTAINER:
Leave label on drum and sell drum to an approved drum reconditioner or triple rinse with an appropriate solvent, crush, and ship to sanitary landfill unless prohibited by local regulations.

RCRA/USEPA WASTE INFORMATION:
RCRA Hazardous Waste Number: U133

COMMENTS:
Always follow ALL applicable federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)
Proper Shipping Name: Hydrazine Aqueous Solution
Hazard Class: 6.1
NA/UN Number: UN3293
Packing Group: III
Reportable Quantity (RQ) Under CERCLA: 0.3 gal
Placards: Poison - 6.1
Label: Toxic (or Poison) – 6.1

SPECIAL SHIPPING NOTES:
Material is a HAZARDOUS MATERIAL AND HAZARDOUS SUBSTANCE. Add the letters RQ to the beginning of the shipping description if the RQ amount is met or exceeded in a single container.

15. REGULATORY INFORMATION

DOT Label Symbol and Statement of Hazard

DOT Toxic

UNITED STATES

SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)

Fire: No Pressure Generating: No Reactivity: No Acute: Yes Chronic: Yes

313 Reportable Ingredients: Hydrazine (< 40%)
Title III Notes: This product contains substances which are defined as toxic chemicals under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (40 CFR Part 372).

CERCLA (COMPREHENSIVE RESPONSE, COMPENSATION, AND LIABILITY ACT)
Reportable Spill Quantity: 0.3 gal

EPA
EPA RQ Ingredient: Hydrazine

TSCA (TOXIC SUBSTANCE CONTROL ACT)
TSCA Status: All components of this material are on the TSCA inventory.

STATE REGULATIONS

PROPOSITION 65 STATEMENT:
This product contains chemical(s) known to the state of California to cause cancer and/or reproductive toxicity.

16. OTHER INFORMATION

REASON FOR ISSUE:
Biannual review

Approval date: 02/07/2005

REVISION SUMMARY
Revision #: 4

This MSDS replaces the December 22, 2000 MSDS. No changes in information.

NFPA CODES
Fire: 1 Health: 3 Reactivity: 1

HMIS CODES
Fire: 1 Health: 3 Reactivity: 1

MANUFACTURER DISCLAIMER:
[TM] Indicates a trade or service mark of HydroChem Industrial Services, Inc.

The information herein is believed to be accurate and is presented in good faith; however, no warranties or representations are made by HydroChem Industrial Services, Inc. regarding the accuracy or completeness of the information.

HydroChem Industrial Services, Inc. shall not be held liable for any damage resulting from the handling, or from contact with the above product.

suez

SAFETY DATA SHEET
BIOMATE* MBC2881

1. Identification

Product identifier	**BIOMATE MBC2881**
Other means of identification	None.
Recommended use	Biocide
Recommended restrictions	None known.

Company/undertaking identification

SUEZ WTS USA, Inc.
4636 Somerton Road
Trevose, PA 19053
T 215 355 3300, F 215 953 5524

Emergency telephone

(800) 877 1940

2. Hazard(s) identification

Physical hazards	Corrosive to metals	Category 1
Health hazards	Acute toxicity, oral	Category 4
	Acute toxicity, inhalation	Category 4
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Sensitization, skin	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word Danger

Hazard statement May be corrosive to metals. Harmful if swallowed. Causes severe skin burns and eye damage. May cause an allergic skin reaction. Causes serious eye damage. Harmful if inhaled.

Precautionary statement

Prevention Keep only in original container. Do not breathe mist or vapor. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Contaminated work clothing must not be allowed out of the workplace. Wear eye protection/face protection. Wear protective gloves.

Response If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician. If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse. Absorb spillage to prevent material damage.

Storage Store locked up. Store in corrosive resistant container with a resistant inner liner.

Disposal Dispose of contents/container to an approved facility.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Components	CAS #	Percent
2,2-dibromo-3-nitrilopropionamide	10222-01-2	20 - 40
Sodium bromide	7647-15-6	2.5 - 10

Composition comments Information for specific product ingredients as required by the U.S. OSHA HAZARD COMMUNICATION STANDARD is listed. Refer to additional sections of this SDS for our assessment of the potential hazards of this formulation.

4. First-aid measures

Inhalation If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Call a POISON CENTER or doctor/physician if you feel unwell.

Skin contact Remove contaminated clothing immediately and wash skin with soap and water. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.

Ingestion If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.

Most important symptoms/effects, acute and delayed Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim warm. Keep victim under observation. Symptoms may be delayed.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media Carbon dioxide, dry chemicals, foam, water spray (fog).

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.

Specific methods Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Prevent entry into waterways, sewer, basements or confined areas.

Large Spills: Stop the flow of material, if this is without risk. Absorb spillage to prevent material damage. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Neutralize the spilled material before disposal. Neutralize with approximately 17.2 grams sodium bisulfite or 15.7 grams sodium metabisulfite for every 100 grams biocide product.

Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.

7. Handling and storage

Precautions for safe handling

Do not breathe mist or vapor. Do not taste or swallow. Do not mix with alkaline material. Use only outdoors or in a well-ventilated area. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. When using, do not eat, drink or smoke. Wash hands thoroughly after handling. Do not get in eyes, on skin, or on clothing. Avoid prolonged exposure. Use care in handling/storage.

Conditions for safe storage, including any incompatibilities

Store locked up. Store in a cool, dry place out of direct sunlight. Store in corrosive resistant container with a resistant inner liner. Keep only in the original container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS). Store in accordance with local/regional/national/international regulation.

8. Exposure controls/personal protection

Occupational exposure limits

US. Workplace Environmental Exposure Level (WEEL) Guides

Components	Type	Value	Form
Poly(oxy-1,2-ethanediyl),α-hydro-ω-hydroxy- Ethane-1,2-diol, ethoxylated (CAS 25322-68-3)	TWA	10 mg/m3	Particulate.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls

Eye wash facilities and emergency shower must be available when handling this product. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection

USERS OF A PESTICIDAL PRODUCT SHOULD REFER TO THE PRODUCT LABEL FOR PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS.
Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier. Glove selection must take into account any solvents and other hazards present.

Other

Wear appropriate chemical resistant clothing. Wash off after each use. Replace as necessary.

Respiratory protection

A RESPIRATORY PROTECTION PROGRAM THAT MEETS OSHA'S 29 CFR 1910.134 AND ANSI Z88.2 REQUIREMENTS MUST BE FOLLOWED WHENEVER WORKPLACE CONDITIONS WARRANT A RESPIRATOR'S USE.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Contaminated work clothing should not be allowed out of the workplace.

9. Physical and chemical properties

Appearance

Color Yellow to amber

Physical state Liquid

Odor Slight

Odor threshold	Not available.
pH (concentrated product)	1.9 Neat
pH in aqueous solution	3.3 (5% Solution)
Melting point/freezing point	-0.04 °F (-18 °C)
nitial boiling point and boiling range	Not available.
Flash point	Not applicable.
Evaporation rate	Slower than Ether
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	< 0.1 mmHg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	> 1
Relative density	1.27
Relative density temperature	70 °F (21 °C)
Solubility(ies)	
Solubility (water)	100 %
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	64 mPa.s
Viscosity temperature	70 °F (21 °C)
Other information	
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Pour point	5 °F (-15 °C)
Specific gravity	1.269
VOC	0 % CALCULATED

10. Stability and reactivity

Reactivity	May be corrosive to metals.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Keep away from heat. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Metals. Contact with strong bases may cause a violent reaction releasing heat.
Hazardous decomposition products	Carbon dioxide, bromine, cyanogen bromide, dibromoacetonitrile

11. Toxicological information

Information on likely routes of exposure

Inhalation	Harmful if inhaled.
Skin contact	Causes severe skin burns. May cause an allergic skin reaction.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns. Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics: Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.

Information on toxicological effects

Acute toxicity: Harmful if swallowed. May cause an allergic skin reaction.

Product	Species	Test Results
BIOMATE MBC2881 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg, (Calculated according to GHS additivity formula)
Inhalation		
LC50	Rat	1.3 mg/l, 4 hours, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	510 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
2,2-dibromo-3-nitrilopropionamide (CAS 10222-01-2)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Inhalation		
LC50	Rat	0.32 mg/l, 4 Hour
Oral		
LD50	Rat	206 mg/kg
Sodium bromide (CAS 7647-15-6)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Oral		
LD50	Rat	4200 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation: Causes skin burns.

Serious eye damage/eye irritation: Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization: Not available.

Skin sensitization: May cause an allergic skin reaction.

Germ cell mutagenicity: No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity: Carcinogenic effects are not expected as a result of occupational exposure.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity: This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure: Not classified.

Specific target organ toxicity - repeated exposure: Not classified.

Aspiration hazard Based on available data, the classification criteria are not met. May be harmful if swallowed and enters airways.

Chronic effects Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity

Product		Species	Test Results
BIOMATE MBC2881 (CAS Mixture)			
Aquatic			
Algae	ErC50	Algae	1.5 mg/l, Growth Inhibition, 72 hours
Crustacea	EC50	Daphnia magna	2.5 mg/l, Static Acute Bioassay, 48 hours
Fish	LC50	Rainbow Trout	3.6 mg/l, Static Acute Bioassay, 96 hours

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)
2,2-dibromo-3-nitrilopropionamide 0.79

Bioconcentration factor (BCF)
2,2-dibromo-3-nitrilopropionamide 13 Estimated
Species: Fish

Mobility in soil No data available.

Other adverse effects Nutrients: N= 53,2 mg/g

Persistence and degradability

78 % degradation in 28 days
CO_2 Evolution (Modified Sturm Test) (OECD 301B)
(Refers to active component: 2,2-dibromo-3-nitrilopropionamide)

- COD (mgO2/g)	959
- BOD 5 (mgO2/g)	0 (calculated data)
- BOD 28 (mgO2/g)	0 (calculated data)
- Closed Bottle Test (% Degradation in 28 days)	0
- Zahn-Wellens Test (% Degradation in 28 days)	0
- TOC (mg C/g)	732
- CO2 evolution (modified Sturm test)	78

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of in approved pesticide facility or according to label instructions. Incinerate the material under controlled conditions in an approved incinerator.

Hazardous waste code D002: Waste Corrosive material [pH <=2 or =>12.5, or corrosive to steel]
The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number	UN3265
UN proper shipping name	Corrosive liquid, acidic, organic, n.o.s. (DBNPA (2,2-DIBROMO-3-NITRILOPROPIONAMIDE))
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	III
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

ERG number	153

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

'ATA

UN number	UN3265
UN proper shipping name	Corrosive liquid, acidic, organic, n.o.s. (DBNPA (2,2-DIBROMO-3-NITRILOPROPIONAMIDE))
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	153
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN3265
UN proper shipping name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (DBNPA (2,2-DIBROMO-3-NITRILOPROPIONAMIDE))
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-B
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

DOT

IATA; IMDG

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
This is an EPA registered biocide and is exempt from TSCA inventory requirements. See FIFRA registry number.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)	Hazardous substance
Safe Drinking Water Act (SDWA)	Not regulated.

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

FIFRA registration number	3876-95
TSCA	This is an EPA registered biocide and is exempt from TSCA inventory requirements.
FIFRA hazard statement	This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label: DANGER Corrosive Causes irreversible eye damage Harmful if inhaled, swallowed, or absorbed through the skin Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals This pesticide is toxic to fish and aquatic organisms
Food and drug administration	The ingredients in this product are approved by FDA under 21 CFR 176.300.

US state regulations

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Developmental toxin

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

No ingredient listed.

US - Massachusetts RTK - Substance List

Not regulated.

US - Pennsylvania RTK - Hazardous Substances

Not regulated.

US - Rhode Island RTK

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

2,2-dibromo-3-nitrilopropionamide (CAS 10222-01-2) Listed.

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

16. Other information, including date of preparation or last revision

Issue date	Oct-17-2014
Revision date	Apr-09-2018
Version #	2.1
List of abbreviations	CAS: Chemical Abstract Service Registration Number TWA: Time Weighted Average STEL: Short Term Exposure Limit LD50: Lethal Dose, 50% LC50: Lethal Concentration, 50% EC50: Effect Concentration, 50% NOEL: No Observed Effect Level COD: Chemical Oxygen Demand BOD: Biochemical Oxygen Demand TOC: Total Organic Carbon IATA: International Air Transport Association IMDG: International Maritime Dangerous Goods Code ACGIH: American Conference of Governmental Industrial Hygienists TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.
References:	No data available
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
Revision information	Product and Company Identification: Alternate Name/Document Information Hazard(s) identification: Response First-aid measures: Indication of immediate medical attention and special treatment needed Exposure controls/personal protection: General hygiene considerations Toxicological information: Specific target organ toxicity - single exposure Other information, including date of preparation or last revision: Disclaimer HazReg Data: Europe - EU GHS: Classification
Prepared by	This SDS has been prepared by SUEZ Regulatory Department (1-215-355-3300).

* Trademark of SUEZ. May be registered in one or more countries.

BCS

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

BASIC CHEMICAL SOLUTIONS

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED): **BCS SODIUM HYPOCHLORITE SOLUTION (5 - 12.5%)**

CHEMICAL NAME/CLASS: Hypochlorous acid salt

PRODUCT USE: Bleach, disinfectant, cooling tower, waste water treatment additive.

SUPPLIER/MANUFACTURER'S NAME: **BASIC CHEMICAL SOLUTIONS**

ADDRESS: **Corporate Office**
525 Seaport Blvd.
Redwood City, CA 94063

BUSINESS PHONE: 800-411-4227

EMERGENCY PHONE: **CHEMTREC**: 800-424-9300

DATE OF PREPARATION: November 13, 2003

DATE OF REVISION: March 5, 2009

Si usted no entiende las Hojas de Informacion de Seguridad sobre Materials, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the Material Safety Data Sheet, find someone to explain it to you in detail.)

s

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		NIOSH	
			TWA mg/m³	STEL mg/m³	PEL mg/m³	STEL mg/m³	IDLH mg/m³	OTHER mg/m³
Sodium Hypochlorite Solution	7681-52-9	5-15	0.5 ppm as Cl_2	1 ppm as Cl_2	0.5 ppm as Cl_2	1 ppm as Cl_2	10 ppm as Cl_2	NE
Water and other ingredients. The other ingredients are each present in less than 1 percent concentration in this product.		Balance	The components present in the balance of this product do not contribute any significant, additional hazards. All hazard information pertinent to this product has been presented in the remaining sections of this Material Safety Data Sheet, per the requirements of Federal Occupational Safety and Health Hazard Communication Standard (29 CFR 1910.1200).					

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is light-yellow to green solution with a strong chlorine-like smell. This solution is corrosive to skin. Causes burns to skin, eyes, respiratory tract and mucous membranes. Harmful or fatal if swallowed. In the event of fire or spill, adequate precautions must be taken. This product will react with acids to release toxic chlorine gas. If involved in a fire, this product may decompose to produce a variety of compounds (i.e. chlorine, sodium oxide, oxygen). Emergency responders must wear the proper personal protective equipment suitable for the situation to which they are responding.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH (BLUE	3
FLAMMABILITY (RED)	0
REACTIVITY (YELLOW	1
PROTECTIVE	D

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		

For routine industrial applications

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of occupational overexposure are inhalation and contact with skin and eyes. The symptoms of overexposure to this product are as follows:

INHALATION: If mists or sprays of this solution are inhaled, this product may cause pulmonary irritation, irritation of the mucus membranes, coughing, and a sore throat. Inhalation of this product may cause damage to the tissues of the respiratory system producing potentially fatal lung disorders (chemical pneumonitis and pulmonary edema). If mixed with acids, hypochlorite solutions release large amounts of chlorine gas. This gas can cause severe irritation of the nose and throat. Exposure to high levels of chlorine gas may result in severe lung damage.

CONTACT WITH SKIN or EYES: Severe irritation and/or burns can occur following eye exposure. Contact may cause impairment of vision and corneal damage possibly blindness. Sodium hypochlorite mist and solutions can cause skin irritation. In severe cases, chemical burns may result. This product is a skin sensitizer; prolonged or repeated over-exposures can result in allergic contact dermatitis.

SKIN ABSORPTION: Skin absorption is not anticipated to be a significant route of over-exposure to any component of this product.

INGESTION: Though ingestion is not anticipated to be a significant route of over-exposure to this product. If ingestion does occur, hypochlorite solutions release hypochlorous acid on contact with gastric juices, and ingestion causes irritation and corrosion of mucous membranes, pain, vomiting, and edema of the pharynx and larynx; reduced blood pressure, delirium and coma may occur. Ingestion of large quantities may be fatal.

INJECTION: Though injection is not anticipated to be a significant route of over-exposure to this product, if it occurs, local reddening, tissue swelling, and discomfort may result.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**.

ACUTE: This solution is corrosive, and can burn and damage eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and breathing difficulty. Though unlikely to occur during occupational use, ingestion or inhalation of large quantities may be fatal.

CHRONIC: Repeated skin contact with this product may result in dermatitis (inflammation and reddening of the skin). Sodium Hypochlorite, a component of this product, is a skin sensitizer; prolonged or repeated over-exposures can result in allergic contact dermatitis.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

SKIN EXPOSURE: If the product contaminates the skin, Rinse skin immediately with plenty of water for 15-20 minutes. Take off contaminated clothing, taking care not to contaminate eyes. Washing with large amounts of clean water should continue until affected skin surface no longer feels slippery. Victim must seek medical attention.
Call a poison control center or doctor for treatment advice.

4. FIRST-AID MEASURES (Continued)

EYE EXPOSURE: If this product enters the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Do not attempt to neutralize. Oils or ointments should not be used at this time. Call a poison control center or doctor for treatment advice. Victim must seek immediate medical attention.
INHALATION: If vapors, mists, or sprays of this product are inhaled, remove victim to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Remove or cover gross contamination to avoid exposure to rescuers. Do not give anything by mouth to an unconscious person.

INGESTION: If this product is swallowed, call a poison control center or doctor immediately for treatment advice. Do not induce vomiting unless told to do so by a poison control center or doctor. Have person sip a glass of water if able to swallow. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and MSDS to health professional with victim.

Note to Physicians: Symptomatic. Treatment and supportive therapy as indicated. Do NOT give acidic antidotes such as juice, soft drink, vinegar, etc. This product contains materials that may cause severe pneumonitis if aspirated. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy if respiration is depressed. Following exposure the patient should be kept under medical review for at least 48 hours as delayed pneumonitis may occur. Pulmonary edema is likely and may be delayed. Steroid therapy, if given early, may be effective in preventing or alleviating edema.

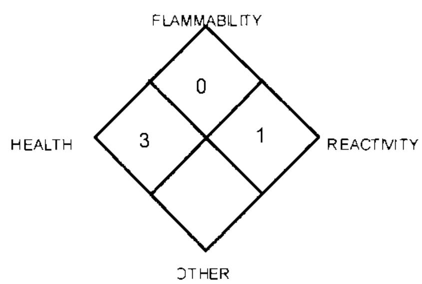
5. FIRE-FIGHTING MEASURES

FLASH POINT, °C (method): Not flammable.
AUTOIGNITION TEMPERATURE, °C: Not flammable.
FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES
Foam: YES
Halon: YES
Carbon Dioxide: YES
Dry Chemical: YES
Other: Any "ABC" Class.

NFPA RATING



UNUSUAL FIRE AND EXPLOSION HAZARDS: Sodium hypochlorite is a strong chemical oxidant, but solutions do not support combustion. Not considered flammable or combustible. Reaction with nitrogen compounds, chloroorganic compounds, or easily oxidizable compounds (reducing agents) may be explosive. This material is non-flammable but is decomposed by heat and light, causing a pressure build-up, which could result in an explosion. When heated, it may release chlorine gas. Vigorous reaction with oxidizable or organic materials may result in fire. Contact with aluminum, tin or zinc will result in the generation of heat and release of hydrogen gas. Run-off from fire control may cause pollution. Keep fire-exposed containers cool with water spray to prevent rupture due to excessive heat. High pressure water hose may spread product from broken containers increasing contamination. If involved in a fire, this product may decompose to produce a variety of compounds (i.e. chlorine, sodium oxide, oxygen). Emergency responders must wear the proper personal protective equipment suitable for the situation to which they are responding. Products of combustion are irritating to the respiratory tract and may cause breathing difficulty. Symptoms may be delayed several hours or longer depending upon the extent of exposure

Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move fire-exposed containers, if it can be done without risk to firefighters. If possible, prevent run-off water from entering storm drains, bodies of water, or other environmentally sensitive areas. If necessary, discard or decontaminate fire response equipment using water and sodium bicarbonate before returning such equipment to service.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

The proper personal protective equipment for incidental releases (e.g.-1 L of the product released in a well-ventilated area) use impermeable gloves, specific for the material handled, goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard-hat. Self Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, Select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.
Absorb spilled liquid with polypads or other suitable absorbent materials. Neutralize residue with sodium bicarbonate and water rinse. Decontaminate the area thoroughly. Test area with litmus paper to confirm neutralization. Place all spill residue in a suitable container. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

Deactivation For Small Spills: Hypochlorite can be broken down by covering it with a reducing agent such as sodium sulfite or sodium thiosulfate.

PART III *How can I prevent hazardous situations from occurring*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash hands after handling this product. Do not eat or drink while handling this material. Remove contaminated clothing immediately. Discard contaminated clothing items, or launder before re-use. Inform anyone handling such contaminated laundry of the hazards associated with this product. Use ventilation and other engineering controls to minimize potential exposure to this product.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing mists or sprays generated by this product. Use in a well-ventilated location.

For Non-Bulk Containers: Open containers slowly, on a stable surface. Containers of this product must be properly labeled. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Wash thoroughly after using this material. Storage areas should be made of fire-resistant materials. If appropriate, post warning signs in storage and use areas. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Empty containers may contain residual liquid, therefore, empty containers should be handled with care.

Bulk Containers: All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

Tank Car Shipments: Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tank (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be clean and free of incompatible chemicals, prior to connection to the tank car or vessel. Valves and hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment before maintenance begins by a triple-rinse with water followed, if necessary, by using sodium bicarbonate and an additional rinse. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: If required use a corrosion-resistant ventilation system separate from other exhaust ventilation systems to ensure that there is no potential for overexposure to sprays, or mists of this product and that exposures are below those in section 2 (Composition and Information on Ingredients). Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, or applicable State regulations. If adequate ventilation is not available or if there is potential for airborne exposure above the exposure limits (listed in Section 2) a respirator may be worn up to respirator exposure limitations, check with respirator equipment manufactures recommendations/limitations. For a higher level of protection use positive pressure supplied air respiration protection or Self Contained Breathing Apparatus or if oxygen levels are below 19.5% or are unknown.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS:
Positive pressure, full-facepiece Self Contained Breathing Apparatus; or positive pressure, full-facepiece Self Contained Breathing Apparatus with an auxiliary positive pressure Self Contained Breathing Apparatus.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields are recommended when the operation can generate splashes, sprays or mists.

HAND PROTECTION: Wear appropriate gloves for routine industrial use. Use appropriate gloves for spill response, as stated in Section 6 of this MSDS (Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. Cover-all, rubber aprons, or chemical protective clothing made from natural rubber are generally acceptable, depending upon the task.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): Not available.
SPECIFIC GRAVITY (water = 1): 1.198
SOLUBILITY IN WATER: Completely soluble.
VAPOR PRESSURE, mm Hg @ 21 °C: 12 mmHg.
ODOR THRESHOLD: 0.06 ppm (detection), for Chlorine.
LOG WATER/OIL DISTRIBUTION COEFFICIENT: Not available.
EVAPORATION RATE (n-BuAc=1): Similar to water.
MELTING/FREEZING POINT: -13.6°C (7.5°F).
BOILING POINT: Decomposes above 40°C (104°F).
pH: 11-13

APPEARANCE AND COLOR: This product is light-yellow to green solution with a strong chlorine-like smell.
HOW TO DETECT THIS SUBSTANCE (warning properties): Litmus paper will turn blue-purple upon contact with this solution.

10. STABILITY and REACTIVITY

STABILITY: Stable at room temperature.

DECOMPOSITION PRODUCTS: Thermal decomposition products of this solution can include: Chlorine, sodium oxide, oxygen, oxides of chlorine, sodium chlorate, and hydrogen.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: This product reacts with strong acids producing heat and chlorine gas, which is toxic. Other incompatibles include organic material, cellulose, oxidizable materials, ammonia, urea, ammonium salts, ethyleneimine, cyanides, nitrogen compounds, alcohols, metals, and metal oxides. Reacts with metals to produce flammable hydrogen gas. Metal and metal oxide catalysts decompose hypochlorites, evolving oxygen and often causing explosions. May react explosively with nitrogen containing compounds or form chloroamines, which are explosive. Alkaline hypochlorite solutions may react explosively with some chloroorganic compounds.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposure or contact to extreme temperatures and incompatible chemicals.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Additional toxicology information for components greater than 1 percent in concentration is provided below.

SODIUM HYPOCHLORITE:
Eye effects-Rabbit, adult 10 mg Moderate irritation effects
Microsomal Mutageniticity Assay-*Salmonella typhimurium* 1 mg/plate
Cytogenetic Analysis-Human: lymphocyte, 100 ppm/24 hours
Oral-Woman TDLo: 1 g/kg: Central nervous system effects, Blood pressure effects,
Intravenous-Man TDLo: 45 mg/kg: Pulmonary system effects
Oral-Mouse LD_{50}: 5800 mg/kg
Oral-Rat LD_{50}: 8910 mg/kg

SUSPECTED CANCER AGENT: The major components of this product are not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA; and are therefore not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: This product is severely irritating and corrosive to contaminated tissue.

SENSITIZATION TO THE PRODUCT: Sodium Hypochlorite, a component of this product, is a sensitizer. Prolonged or repeated skin contact can result in the development of rashes, welts, and other allergy-like symptoms.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: This product is not reported to produce mutagenic effects in humans. Sodium hypochlorite caused mutations in several short-term studies using bacteria and cultured mammalian cells. The significance of these tests is unclear. It was not mutagenic in tests (chromosome aberration and micronucleus) on live animals.

Embryotoxicity: This product is not reported to produce embryotoxic effects in humans.
Teratogenicity: This product is not reported to cause teratogenic effects in humans.
Reproductive Toxicity: This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES: Currently there are no Biological Exposure Indices (BEIs) associated with the components of this product.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE Skin disorders can be aggravated by over-exposure to this product. Inhalation of this products mists may aggravate respiratory conditions.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure to this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: The components of this product are relatively stable in the environment; they may degrade, after time, into other organic and inorganic constituents. Additional environmental data are available as follows:

SODIUM HYPOCHLORITE: Water solubility = 29.4 g/ 100 mL (25EC).

EFFECT OF MATERIAL ON PLANTS or ANIMALS: This product is harmful or fatal to plant and animal life if this product is released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.
Invertebrate and Microbial Toxicity: LOEC Oncorhynchus kisutch 0.02 mg/ l.

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE: This product can substantially raise the pH of an aquatic environment and can be extremely toxic to fish and aquatic plants. As with all chemicals, work practices should be aimed at eliminating environmental releases.

Fish Toxicity: LC50 (48 hr) rainbow trout 0.07 mg/ l.
LC50 (96 hr) fathead minnow 5.9 mg/l.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

EPA WASTE NUMBER: D002 (Characteristic, Corrosivity), applicable to wastes consisting only of this solution.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Hypochlorite solution
HAZARD CLASS NUMBER and DESCRIPTION:	8 (Corrosive Material)
UN IDENTIFICATION NUMBER:	UN 1791
PACKING GROUP:	II
DOT LABEL(S) REQUIRED:	Corrosive

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 154

MARINE POLLUTANT: This product does not contain any components which are designated by the Department of Transportation to be Marine Pollutants. (49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

Note: The latest DOT information is provided, please verify all DOT information as it is subject to change without notice.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: The components of this product subject to the reporting requirements of Section 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act are as follows.

COMPONENT	SARA 302	SARA 304	SARA 313
Sodium Hypochlorite	No	Yes	No

SARA Threshold Planning Quantity: Not applicable.

TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Sodium Hypochlorite = 100 lbs.

OTHER FEDERAL REGULATIONS: Not applicable.

STATE REGULATORY INFORMATION: Components of this product are covered under specific State regulations, as denoted below:

Illinois - Toxic Substance List: Sodium Hypochlorite.
New Jersey - Right to Know Hazardous Substance List: Sodium Hypochlorite
North Dakota - List of Hazardous Chemicals, Reportable Quantities: Sodium Hypochlorite.

CALIFORNIA PROPOSITION 65 No component of this product is on the California Proposition 65 lists.

15. REGULATORY INFORMATION (Continued)

If this product is used for the purpose of a pesticide it would be a violation of federal law to use this product in a manner inconsistent with its labeling. Call BCS to see if your required use is covered by our label. The following labeling section is taken from our pesticide label but has no directions for use. It does not constitute a pesticide label. It is for information only.

LABELING (Precautionary Statements): KEEP OUT OF REACH OF CHILDREN - DANGER - PELIGRO

HAZARDS TO HUMANS AND DOMESTIC ANIMALS: DANGER: Corrosive, may cause severe skin or chemical bums to broken skin. Causes eye damage. May be fatal if swallowed. Avoid breathing vapors. Do not get in eyes, on skin, or on clothing. Wear goggles or face shield and rubber gloves when handling this product. Wash hands after handling. Vacate poorly ventilated areas as soon as possible. Do not return until odors have dissipated.

ENVIRONMENTAL HAZARDS: This product is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NDPES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

PHYSICAL OR CHEMICAL HAZARDS: STRONG OXIDIZIING AGENT: Mix only with water according to label directions. Mixing this product with chemicals (e.g. ammonia. acids, detergents, etc.) or organic matter (e.g. urine, feces, etc.) will release chlorine gas which is irritating to eyes, lungs and mucous membranes.

STORAGE AND DISPOSAL: Store this product in a cool dry area, away from direct sunlight and heat to avoid deterioration. In case of spill, flood areas with large quantities of water. Product or rinsates that cannot be used should be diluted with water before disposal in sanitary sewer (see Environmental Hazards). Do not contaminate food or feed by storage, disposal or cleaning of equipment.

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice. Call a poison control center or doctor for further treatment advice.

If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

If swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor.

If inhaled: If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Do not give anything by mouth to an unconscious person.

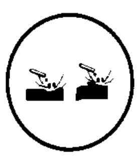
Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage.

In case of fire: Use dry chemical, CO_2 , or alcohol foam. In case of spill: Neutralize residue with sodium bicarbonate and rinse area. Place in suitable container. Refer to MSDS for additional information.

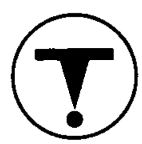
TARGET ORGANS: Skin, eyes and respiratory system.

WHMIS SYMBOLS:

E- Corrosive Material



D2B- Poisonous and Infectious Materials/Other Effects I



16. OTHER INFORMATION

INFORMATION SOURCE: CHEMICAL SAFETY ASSOCIATES, Inc.

PREPARED BY: BASIC CHEMICAL SOLUTIONS

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:
ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.
TLV - **Threshold Limit Value** - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour **Time Weighted Average (TWA)**, the 15-minute **Short Term Exposure Limit**, and the instantaneous **Ceiling Level**. Skin adsorption effects must also be considered.
OSHA - U.S. Occupational Safety and Health Administration.
PEL - **Permissible Exposure Limit** - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.
IDLH - **Immediately Dangerous to Life and Health** - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **R**ecommended **E**xposure **L**evels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:
HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime over-exposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime over-exposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:
Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoigntion Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:
Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause death. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

REGULATORY INFORMATION:
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Other acronyms used are: **Superfund Amendments and Reauthorization Act (SARA)**; the **Toxic Substance Control Act (TSCA)**; Marine Pollutant status according to the **DOT**; California's Safe Drinking Water Act (**Proposition 65**); the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)**; and various state regulations. This section also includes information on the precautionary warnings which appear on the materials package label.

SAFETY DATA SHEET

3D TRASAR® 3DT102

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	3D TRASAR® 3DT102
Other means of identification	:	Not applicable.
Recommended use	:	COOLING WATER TREATMENT
Restrictions on use	:	Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
Company	:	Nalco Company 1601 W. Diehl Road Naperville, Illinois 60563-1198 USA TEL: (630)305-1000
Emergency telephone number	:	(800) 424-9300 (24 Hours) CHEMTREC
Issuing date	:	04/15/2015

Section: 2. HAZARDS IDENTIFICATION

GHS Classification

Not a hazardous substance or mixture.

GHS Label element

Precautionary Statements : **Prevention:**
Wash hands thoroughly after handling.
Response:
Specific measures: consult SDS Section 4.
Storage:
Store in accordance with local regulations.

Other hazards : None known.

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

No hazardous ingredients

Section: 4. FIRST AID MEASURES

Protection of first-aiders	:	In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders.Use personal protective equipment as required.
Most important symptoms and effects, both acute and delayed	:	See Section 11 for more detailed information on health effects and symptoms.

Section: 5. FIREFIGHTING MEASURES

Hazardous combustion products	:	Carbon oxides

Section: 6. ACCIDENTAL RELEASE MEASURES

Section: 7. HANDLING AND STORAGE

Suitable material	:	The following compatibility data is suggested based on similar product data and/or industry experience: PVC, Buna-N, EPDM, Fibre glass, Neoprene, Plasite 6000, Plasite 4005, Plasite 7122, Polypropylene, Polyethylene, Polyurethane, Vinyl, PTFE, Chlorosulfonated polyethylene rubber, Fluoroelastomer
Unsuitable material	:	The following compatibility data is suggested based on similar product data and/or industry experience: Aluminum, Brass, Carbon steel, Nickel, Stainless Steel 304, Stainless Steel 316**

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Personal protective equipment

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Viscous liquid
Colour	:	orange
Odour	:	not significant
Flash point	:	> 93.3 °C Method: ASTM D 93, Pensky-Martens closed cup
pH	:	5.0, 100 %
Odour Threshold	:	no data available
Melting point/freezing point	:	FREEZING POINT: -10.5 °C
Initial boiling point and boiling range	:	no data available
Evaporation rate	:	no data available
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	no data available
Relative vapour density	:	no data available

Relative density	:	1.28 (15.6 °C)
Density	:	10.55 lb/gal
Water solubility	:	completely soluble
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition temperature	:	no data available
Viscosity, dynamic	:	no data available
Viscosity, kinematic	:	570 mm2/s (21.7 °C)
VOC	:	0.7 % Calculation method

Section: 10. STABILITY AND REACTIVITY

Incompatible materials	:	None known
Hazardous decomposition products	:	Oxides of carbon

Section: 11. TOXICOLOGICAL INFORMATION

Potential Health Effects

Experience with human exposure

Skin contact	:	No symptoms known or expected.
Ingestion	:	No symptoms known or expected.
Inhalation	:	No symptoms known or expected.

Toxicity

<u>Product</u>

Acute oral toxicity	:	LD50 rat > 5,000 mg/kg Test substance Similar Product
Acute inhalation toxicity	:	no data available
Acute dermal toxicity	:	no data available
Skin corrosion/irritation	:	Result: 0.0 Method: Draize Test Test substance:Similar Product
Serious eye damage/eye irritation	:	Result: 4.7 Method: Draize Test Test substance: Similar Product

Respiratory or skin sensitization	:	no data available
Carcinogenicity	:	no data available
Reproductive effects	:	no data available
Germ cell mutagenicity	:	no data available
Teratogenicity	:	no data available
STOT - single exposure	:	no data available
STOT - repeated exposure	:	no data available
Aspiration toxicity	:	no data available

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product

Toxicity to fish : LC50 Pimephales promelas (fathead minnow): 948 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Oncorhynchus mykiss (rainbow trout): 4,884 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Inland Silverside: > 5,000 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Pimephales promelas (fathead minnow): 625 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Oncorhynchus mykiss (rainbow trout): 2,500 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Inland Silverside: 5,000 mg/l
Exposure time: 96 hrs
Test substance: Product

Toxicity to daphnia and other aquatic invertebrates : LC50 Mysid Shrimp (Mysidopsis bahia): 3,750 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Ceriodaphnia dubia: 750 mg/l
Exposure time: 48 hrs
Test substance: Product

EC50 Daphnia magna (Water flea): 938 mg/l
Exposure time: 48 hrs

Test substance: Product

NOEC Daphnia magna (Water flea): 625 mg/l
Exposure time: 48 hrs
Test substance: Product

NOEC Mysid Shrimp (Mysidopsis bahia): 2,500 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Ceriodaphnia dubia: 500 mg/l
Exposure time: 48 hrs
Test substance: Product

Persistence and degradability

The organic portion of this preparation is expected to be poorly biodegradable.

Total Organic Carbon (TOC) : 150,000 mg/l

Chemical Oxygen Demand (COD): 460,000 mg/l

Biochemical Oxygen Demand (BOD):

Incubation Period	Value	Test Descriptor
5 d	36,900 mg/l	Product

Mobility

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	: <5%
Water	: 10 - 30%
Soil	: 70 - 90%

The portion in water is expected to be soluble or dispersible.

Bioaccumulative potential

This preparation or material is not expected to bioaccumulate.

Other information

no data available

Section: 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

Section: 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport (DOT)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Air transport (IATA)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Sea transport (IMDG/IMO)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Section: 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 302 : The following components are subject to reporting levels established by SARA Title III, Section 302:

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop 65

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)

The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)

The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA

All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

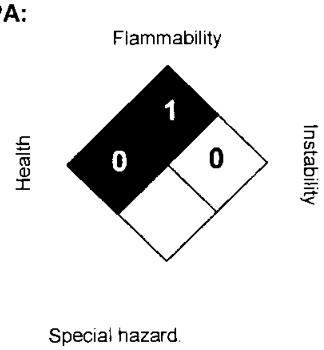
KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

Section: 16. OTHER INFORMATION

NFPA:



HMIS III:

HEALTH	0
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Revision Date	:	04/15/2015
Version Number	:	1.1
Prepared By	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
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