



Document No. EPA-RPT-021I

**Kingston Ash Recovery Project  
Non-Time-Critical Removal Action**

**River System Sampling and Analysis Plan  
Task Completion Technical Memorandum  
Aquatic Vegetation and Periphyton Sampling**

**Prepared by:  
Jacobs**

**for the Tennessee Valley Authority**

Revision	Description	Date
00	Issued to TVA for Regulatory Submittal	October 25, 2011

## Table of Contents

1.	PURPOSE.....	1
2.	BACKGROUND .....	1
3.	SAMPLING AND ANALYSIS ACTIVITIES.....	2
4.	ANALYTICAL DATA REVIEW .....	3
5.	DATA QUALITY SUMMARY.....	4
6.	DATA SUMMARY.....	5

## List of Tables

Table 1.	Summary of Aquatic Vegetation Field Activities .....	2
Table 2.	Applicable TVA Documents and Standard Operating Procedures.....	3
Table 3.	Data Review Summary.....	4
Table 4.	Summary of Vegetation Data Quality .....	5
Table 5.	Aquatic Emergent Vegetation at Emory River Mile 1.5 .....	6
Table 6.	Aquatic Emergent Vegetation at Emory River Mile 3.0 .....	7
Table 7.	Aquatic Emergent Vegetation at Emory River Mile 4.5 .....	8
Table 8.	Aquatic Emergent Vegetation at the Emory River Reference Location.....	9
Table 9.	Aquatic Emergent Vegetation at Clinch River Mile 2.5 .....	10
Table 10.	Aquatic Emergent Vegetation at Clinch River Mile 4.0 .....	11
Table 11.	Aquatic Emergent Vegetation at the Clinch River Reference Location.....	12
Table 12.	Aquatic Emergent Vegetation at Tennessee River Mile 567 .....	13
Table 13.	Aquatic Emergent Vegetation at the Tennessee River Reference Location.....	14
Table 14.	Aquatic Shoreline Vegetation at Emory River Mile 1.5 .....	15
Table 15.	Aquatic Shoreline Vegetation at Emory River Mile 3.0 .....	16
Table 16.	Aquatic Shoreline Vegetation at Emory River Mile 4.5 .....	17
Table 17.	Aquatic Shoreline Vegetation at the Emory River Reference Location.....	18
Table 18.	Aquatic Shoreline Vegetation at Clinch River Mile 2.5.....	19
Table 19.	Aquatic Shoreline Vegetation at Clinch River Mile 4.0.....	20
Table 20.	Aquatic Shoreline Vegetation at the Clinch River Reference Location.....	21
Table 21.	Aquatic Shoreline Vegetation at Tennessee River Mile 567.....	22
Table 22.	Aquatic Shoreline Vegetation at the Tennessee River Reference Location .....	23
Table 23.	Periphyton at Emory River Mile 1.0 .....	24
Table 24.	Periphyton at Emory River Mile 2.5 .....	25
Table 25.	Periphyton at Emory River Mile 4.0 .....	26
Table 26.	Periphyton at the Emory River Reference Location.....	27
Table 27.	Periphyton at Clinch River Mile 1.5.....	28
Table 28.	Periphyton at Clinch River Mile 3.5.....	29
Table 29.	Periphyton at the Clinch River Reference Location.....	30

## List of Figures (Attached)

- Figure 1. Aquatic Vegetation and Periphyton Sampling Locations - 2011
- Figure 2. Field Sampling Site for Emergent and Shoreline Vegetation
- Figure 3. Field Crew Sampling Aquatic Vegetation
- Figure 4. Field Crew Sampling Periphyton
- Figure 5. Field Crew Sampling Periphyton

## Appendices

Appendix A: Aquatic Vegetation and Periphyton Sample Summaries

Appendix B: Summary of Aquatic Vegetation and Periphyton Shipments

## List of Acronyms

°C	degree Celsius
COC	chain-of-custody
CRM	Clinch River Mile
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	Engineering Evaluation/Cost Analysis
ERM	Emory River Mile
KIF	Kingston Fossil Plant
MDL	method detection limit
mg/kg	milligram per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ND	not detected
Pace	Pace Analytical Services, Inc.
QA	quality assurance
QC	quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TM	Technical Memorandum
TVA	Tennessee Valley Authority
WP	Work Package

## 1. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the completion of the 2011 aquatic vegetation and periphyton sampling as described in the approved *Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan (SAP)*, Rev. 3, May 24, 2010, Document No. EPA-AO-021. This TM is one of a series being prepared to summarize the field work and data collection activities as SAP tasks are completed. The TM series is intended to provide interim presentations of data that will become the basis for the nature and extent of contamination section of the River System Engineering Evaluation/Cost Analysis (EE/CA) Report. No data evaluation or conclusions are presented.

## 2. BACKGROUND

The data quality objective (DQO) problem statement for aquatic vegetation and periphyton sampling is:

Naturally-occurring metals (e.g., arsenic, selenium) and radionuclides (e.g., radium-226, thorium-228) in ash may accumulate in vegetation in direct contact with sediment and surface water in the river system to concentrations that pose unacceptable risks to ecological receptors who regularly consume them.

Section 2.2.10 of the SAP discusses the design of the aquatic vegetation and periphyton field studies. Aquatic plants refer to plants that live in direct contact with sediment and/or surface water at least part of the year. These aquatic plants include macrophytes, algae, and periphyton. Macrophytes are vascular aquatic plants that may be emergent (e.g., cattails, rushes, and sedges), submerged (e.g., elodea and milfoil), or floating (e.g., duckweed). Algae are non-vascular plants that may be single celled, multi-cellular, or filamentous. Periphyton refers to the complex of algae, bacteria, and detritus attached to submerged surfaces. For the purpose of this TM, aquatic vegetation refers to those plants growing along the shoreline and emerging from the summer pool. Concentrations of ash-related constituents may bioaccumulate in aquatic vegetation and periphyton over time. In addition, because they are at the base of the food chain, aquatic vegetation and periphyton are consumed by other ecological receptors such as benthic invertebrates, fish, birds, and mammals. To estimate the potential ingestion of ash-related constituents in those ecological receptors, the concentrations of ash-related constituents in aquatic vegetation and periphyton must be determined. In order to evaluate the potential effects of exposure, the effects levels from literature will be used when available. Metal concentrations in aquatic vegetation and periphyton will be compared among sites, and significantly elevated concentrations at impacted sites, when compared with the reference sites, may indicate environmental stress. Elevated concentrations may also indicate potential risk to aquatic vegetation and periphyton as well as to their consumers.

Aquatic vegetation and periphyton sampling efforts began in 2011. Emergent summer-pool vegetation, shoreline vegetation, and periphyton were collected for analysis of metals and metalloids. Aquatic vegetation sampling sites were selected based on availability of emergent vegetation. A total of three locations for emergent summer-pool and shoreline vegetation were collected per river reach. When possible, periphyton sampling locations were collocated with 2010 snail sampling locations. One composite periphyton sample of sufficient mass was collected per river reach. Locations on the Emory, Clinch, and Tennessee Rivers (emergent and shoreline vegetation only) represented measurements of both aquatic vegetation and periphyton found living in impacted areas and in upstream locations near the Kingston Fossil Plant (KIF) not impacted by ash.

### 3. SAMPLING AND ANALYSIS ACTIVITIES

Field activities occurred in the summer of 2011 in accordance with Standard Operating Procedure (SOP) TVA-KIF-SOP-62 *Aquatic Vegetation Sampling* (issued September 2010) and TVA-KIF-SOP-59 *Periphyton Sampling* (originally issued September 2010; Revision 1 issued April 2011; Revision 2 issued July 2011).

Emergent and shoreline vegetation was collected June 21 through 24, 2011. Field crews collected emergent vegetation and shoreline vegetation by cutting plants above the water level or roots. In order to account for spatial variability, emergent and shoreline vegetation samples were collected from three distinct areas within each river reach. All vegetation samples were placed in two gallon resealable plastic bags, labeled, double-bagged, custody sealed, and frozen. Samples were then shipped to the lab on dry ice for chemical analysis. There were two sets of quality assurance/quality control (QA/QC) samples serving as a duplicate, matrix spike/matrix spike duplicate (MS/MSD) sample, and two equipment blanks for both shoreline and emergent vegetation. Field collection activities for 2011 are summarized in Table 1.

**Table 1. Summary of Aquatic Vegetation Field Activities**

Summary	Emergent Vegetation	Shoreline Vegetation	Periphyton
Field collection period	June 2011	June 2011	June-August 2011
Number of samples <sup>1,2</sup>	29	29	11
Number of duplicate samples	2	2	1
Number of MS/MSD samples	2	2	0
Number of equipment blanks	2	2	2

**Notes:**

<sup>1</sup>See Appendix A for collection details.

<sup>2</sup>Sample counts include duplicate samples.

Periphyton sampling was conducted from May 31 through June 24, 2011. Periphyton samplers, or *periphytometers*, were comprised of four ceramic tiles attached to a nylon rope line, suspended by a float, and anchored and placed along the shoreline. A total of three periphytometers were deployed in each reach of the Emory and Clinch Rivers on May 31, 2011. Three weeks following deployment, all of the periphytometers were pulled out of the water, and periphyton was scraped off the tiles and composited to produce one sample per reach. Upon retrieval, two periphytometers were missing from the Clinch River Mile 1.5 location and three periphytometers (one full composite set) were missing from the Emory River Mile (ERM) 4.0 location. Periphytometers in these locations and an additional set in each of the reference locations were redeployed on July 8, 2011 and retrieved on August 5, 2011.

All periphyton samples were collected in 4 ounce plastic containers, labeled, individually bagged, and custody sealed and frozen. Samples were then shipped to the lab frozen and on dry ice for chemical analysis. QA/QC samples included an additional set of periphytometers that were collocated with a set of periphytometers at ERM 2.5 to serve as a field duplicate and two equipment blanks were also collected. Field collection activities for 2011 are summarized in Table 1.

Sampling and analysis were performed in accordance with the *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (hereinafter referred to as the TVA-KIF-QAPP), the listed SOPs, field guides, and Work Package (WP) WP-1094. Table 2 identifies the applicable TVA documents and SOPs associated with this aquatic vegetation sampling.

All field samples were shipped to Pace Analytical Services, Inc., Green Bay, WI (Pace) for analysis. Vegetation was analyzed for a suite of 26 metals and percent moisture.

**Table 2. Applicable TVA Documents and Standard Operating Procedures**

Document	Document Number
TVA KIF Ash Recovery Project Quality Assurance Project Plan	TVA-KIF-QAPP
TVA-KIF Work Package: Periphyton and Aquatic Vegetation Sampling	WP-1094
<b>STANDARD OPERATION PROCEDURES:</b>	
Periphyton Sampling	TVA-KIF-SOP-59
Aquatic Vegetation Sampling	TVA-KIF-SOP-62
Field Documentation	TVA-KIF-SOP-06
Sample Labeling, Packing, and Shipping	TVA-KIF-SOP-07
Decontamination of Equipment	TVA-KIF-SOP-08
Field Quality Control Sampling	TVA-KIF-SOP-11
Management and Implementation of EQuIS™-Based Chain-of-Custody	TVA-KIF-SOP-18
Photo Documentation	TVA-KIF-SOP-26

#### **4. ANALYTICAL DATA REVIEW**

TVA's contracted laboratories were required to submit three types of deliverables: a limited (Level 1) data package containing sample results and batch QC sample results; a fully-documented (Level 4) data package including raw data for all analyses; and electronic data deliverables (EDDs) for storage in TVA's EarthSoft EQuIS® database.

EDDs were subjected to completeness and correctness testing during loading to TVA's EQuIS database; once loaded to the EQuIS database, the data were subjected to verification. As defined in the TVA-KIF-QAPP, data verification involved comparison of the data loaded in the EQuIS database to the results reported in the Level 1 data package. In addition, data verification included review of the batch QC summary forms for compliance with the applicable methods and for data usability with respect to the project DQOs and the TVA-KIF-QAPP.

Following receipt of the Level 4 data package, data were subjected to validation. As defined in the TVA-KIF-QAPP, data validation included review of raw data and associated QC summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. As stated in the QAPP: "Initially, 100% of the chemical analysis data will be reported in full documentation data packages for independent data validation. Depending on the nature and frequency of issues identified during data validation, the percentage of data undergoing full data validation may be reduced to a lesser percentage (such as 20%) or data verification may be substituted. The reduction in full data validation may be matrix specific, laboratory specific, or analyte specific. If after the percentage of full data validation has decreased, a trend in frequency of reporting issues, method non-compliances, or data usability issues is identified, data validation will be conducted for specific data points or the percentage of full data validation percentage may be increased until the issues have been minimized to their initial frequency." Data validation expands upon the completeness, correctness, and usability assessment performed during verification to include evaluation of instrumental QC analyses, review of sample preparation information, and recalculation of reported results from raw data. A summary of the data review effort is presented in Table 3.

**Table 3. Data Review Summary**

No. COCs	Matrix	No. Samples	No. Equipment Blank Samples	No. Analytical Results	Percentage Validated
4	Emergent Vegetation	29	2	835	100%
	Shoreline Vegetation	29	2	835	
	Periphyton	11	2	349	
<b>Total</b>	--	<b>69</b>	<b>6</b>	<b>2,019</b>	--

**Notes:**

In addition to equipment rinsate blanks, a Kimwipe used during sample processing was submitted as a material blank (not included in table). For definitions, see the Acronyms section.

## 5. DATA QUALITY SUMMARY

Data validation was performed based on the sample results, summary QC data, and raw data provided by the laboratory. Data validation includes a review of the following QC measures (where applicable):

- Sample condition upon laboratory receipt;
- Initial calibration linearity;
- Blank analysis results greater than the method detection limit (MDL);
- Sample preparation and holding times;
- Initial calibration verification/continuing calibration verification standard recoveries;
- Inductively coupled plasma interference check standard results;
- MDLs and linear ranges;
- Internal standard recoveries;
- Percent moisture;
- MS/MSD;
- Laboratory and field duplicate precision;
- Quantitation of positive results;
- Laboratory control sample/laboratory control sample duplicate recoveries and precision;
- Analytical sequence;
- Reporting limit standard recoveries;
- MDL verification standards; and
- Standard reference material recoveries.

The data met the DQOs defined for this task and are acceptable for use. Table 4 summarizes the data quality based on the review performed and as compared to the data quality measures identified in the TVA-KIF-QAPP. The text of the data validation reports for the samples included in this TM will be included in the EE/CA Report.

**Table 4. Summary of Vegetation Data Quality**

<b>Matrix</b>	<b>Analytical Results (Total Count)</b>	<b>Acceptable (No Qualification)<sup>a</sup></b>		<b>Acceptable (Estimated)<sup>b</sup></b>		<b>Blank Qualified<sup>c</sup></b>		<b>Rejected<sup>d</sup></b>	
Emergent Vegetation	835	624	75%	211	25%	0	0%	0	0%
Shoreline Vegetation	835	589	71%	230	28%	16	2%	0	0%
Periphyton	349	241	69%	90	26%	18	5%	0	0%

**Notes:**

<sup>a</sup>Acceptable, No Qualification – Qualification of data was not warranted based on a review of the applicable QC measures.

<sup>b</sup>Acceptable, Estimated – Quantitation or detection limit is approximate due to limitations or bias identified during a review of the applicable QC measures.

<sup>c</sup>Blank Qualified – Result is considered “not-detected” because it was detected in an associated blank at a similar level.

<sup>d</sup>Rejected – Unreliable result or detection limit; analyte may or may not be present in sample.

## 6. DATA SUMMARY

Summary statistics for periphyton and aquatic vegetation are provided in Tables 5 through 29 for each location collected in 2011.

**Table 5. Aquatic Emergent Vegetation at Emory River Mile 1.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	83.2	83.2	85.5	3 / 3	84.37
Aluminum	mg/kg	--	7.2	7.2	15.1	3 / 3	10.97
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.058	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	4.3	4.3	6.2	3 / 3	5.267
Beryllium	mg/kg	0.028 / 0.031	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	6.3	6.3	8.7	3 / 3	7.533
Cadmium	mg/kg	0.0073 / 0.0079	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	2730	2730	4580	3 / 3	3663
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.015	0.015	0.05	3 / 3	0.02867
Copper	mg/kg	--	1.3	1.3	1.4	3 / 3	1.333
Iron	mg/kg	--	14.4	14.4	18.7	3 / 3	17.17
Lead	mg/kg	0.027 / 0.029	ND	ND	ND	0 / 3	0
Magnesium	mg/kg	--	874	874	1220	3 / 3	1085
Manganese	mg/kg	--	22.7	22.7	48.4	3 / 3	34.17
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.098	0.098	0.2	3 / 3	0.156
Nickel	mg/kg	--	0.14	0.14	0.25	3 / 3	0.1933
Potassium	mg/kg	--	4060	4060	4600	3 / 3	4347
Selenium	mg/kg	0.065 / 0.14	ND	0.077	0.077	1 / 3	0.077
Silver	mg/kg	0.0028 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	46.5 / 50	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	6.2	6.2	10.8	3 / 3	8.567
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.044 / 0.047	ND	ND	ND	0 / 3	0
Zinc	mg/kg	--	4.4	4.4	6.1	3 / 3	5.533

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 6. Aquatic Emergent Vegetation at Emory River Mile 3.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%		68.5	68.5	78.3	3 / 3	72.37
Aluminum	mg/kg		15.3	15.3	49.7	3 / 3	30.1
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg		0.032	0.032	0.32	3 / 3	0.1343
Barium	mg/kg		7.2	7.2	11	3 / 3	9.2
Beryllium	mg/kg	0.028 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg		4.1	4.1	6.2	3 / 3	5
Cadmium	mg/kg		0.014	0.014	0.091	3 / 3	0.04033
Calcium	mg/kg		1090	1090	2460	3 / 3	1797
Chromium	mg/kg	0.12 / 0.13	ND	0.13	0.13	1 / 3	0.13
Cobalt	mg/kg		0.049	0.049	0.12	3 / 3	0.082
Copper	mg/kg		1.1	1.1	1.8	3 / 3	1.333
Iron	mg/kg		28.8	28.8	70	3 / 3	44.47
Lead	mg/kg	0.026 / 0.026	ND	0.045	0.066	2 / 3	0.0555
Magnesium	mg/kg		473	473	667	3 / 3	575
Manganese	mg/kg		97.9	97.9	188	3 / 3	150
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg		0.28	0.28	0.39	3 / 3	0.3267
Nickel	mg/kg		0.21	0.21	0.31	3 / 3	0.26
Potassium	mg/kg		4260	4260	4940	3 / 3	4597
Selenium	mg/kg	0.128 / 0.138	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0027 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	45.8 / 49.1	ND	ND	ND	0 / 3	0
Strontium	mg/kg		3.7	3.7	7.8	3 / 3	5.767
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.043 / 0.047	ND	0.091	0.091	1 / 3	0.091
Zinc	mg/kg		7.7	7.7	15	3 / 3	10.37

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 7. Aquatic Emergent Vegetation at Emory River Mile 4.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	65.6	65.6	82.8	3 / 3	72.87
Aluminum	mg/kg	--	42.3	42.3	75.7	3 / 3	57.77
Antimony	mg/kg	0.013 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.025 / 0.056	ND	0.042	0.042	1 / 3	0.042
Barium	mg/kg	--	6.6	6.6	22.7	3 / 3	12.77
Beryllium	mg/kg	0.026 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	4.5	4.5	8.7	3 / 3	6
Cadmium	mg/kg	0.0068 / 0.0068	ND	0.096	0.11	2 / 3	0.103
Calcium	mg/kg	--	1340	1340	3620	3 / 3	2283
Chromium	mg/kg	0.11 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.089	0.089	0.36	3 / 3	0.183
Copper	mg/kg	--	1.3	1.3	1.6	3 / 3	1.433
Iron	mg/kg	--	68.2	68.2	111	3 / 3	84.97
Lead	mg/kg	--	0.059	0.059	0.099	3 / 3	0.07733
Magnesium	mg/kg	--	511	511	922	3 / 3	760
Manganese	mg/kg	--	105	105	474	3 / 3	238
Mercury	mg/kg	0.01 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.15	0.15	0.34	3 / 3	0.22
Nickel	mg/kg	--	0.3	0.3	0.4	3 / 3	0.3533
Potassium	mg/kg	--	4500	4500	5320	3 / 3	4817
Selenium	mg/kg	0.12 / 0.135	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0026 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	42.8 / 47.6	ND	79.7	79.7	1 / 3	79.7
Strontium	mg/kg	--	4.2	4.2	9.8	3 / 3	7.567
Thallium	mg/kg	0.012 / 0.014	ND	0.017	0.017	1 / 3	0.017
Vanadium	mg/kg	--	0.051	0.051	0.13	3 / 3	0.08633
Zinc	mg/kg	--	6.7	6.7	17	3 / 3	12.07

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 8. Aquatic Emergent Vegetation at the Emory River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	60.1	60.1	87.2	3 / 3	75.77
Aluminum	mg/kg	--	113	113	191	3 / 3	140.3
Antimony	mg/kg	0.013 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	--	0.048	0.048	0.1	3 / 3	0.06833
Barium	mg/kg	--	6.1	6.1	7.7	3 / 3	6.9
Beryllium	mg/kg	0.027 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	2.2	2.2	7.4	3 / 3	4.067
Cadmium	mg/kg	0.0069 / 0.0077	ND	0.032	0.053	2 / 3	0.0425
Calcium	mg/kg	--	1050	1050	3090	3 / 3	1823
Chromium	mg/kg	--	0.17	0.17	0.28	3 / 3	0.2167
Cobalt	mg/kg	--	0.15	0.15	0.28	3 / 3	0.2
Copper	mg/kg	--	1.1	1.1	1.2	3 / 3	1.133
Iron	mg/kg	--	130	130	216	3 / 3	159
Lead	mg/kg	--	0.13	0.13	0.18	3 / 3	0.15
Magnesium	mg/kg	--	426	426	903	3 / 3	594.3
Manganese	mg/kg	--	67.2	67.2	177	3 / 3	117.1
Mercury	mg/kg	0.01 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.12	0.12	0.22	3 / 3	0.1667
Nickel	mg/kg	--	0.4	0.4	0.57	3 / 3	0.4867
Potassium	mg/kg	--	2660	2660	4620	3 / 3	3687
Selenium	mg/kg	0.061 / 0.069	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0026 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	43.5 / 48.9	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	3.1	3.1	7.4	3 / 3	4.733
Thallium	mg/kg	0.012 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	--	0.16	0.16	0.32	3 / 3	0.2167
Zinc	mg/kg	--	6.8	6.8	13.1	3 / 3	10.13

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 9. Aquatic Emergent Vegetation at Clinch River Mile 2.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	75.2	75.2	82.9	3 / 3	79.8
Aluminum	mg/kg	--	6.5	6.5	16.8	3 / 3	12.07
Antimony	mg/kg	0.013 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	--	0.037	0.037	0.19	3 / 3	0.09367
Barium	mg/kg	--	6.4	6.4	8.4	3 / 3	7.233
Beryllium	mg/kg	0.026 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	6.9	6.9	13	3 / 3	9.733
Cadmium	mg/kg	0.0067 / 0.0079	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	2540	2540	4500	3 / 3	3730
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.015	0.015	0.052	3 / 3	0.03133
Copper	mg/kg	--	1.6	1.6	2	3 / 3	1.867
Iron	mg/kg	--	16.2	16.2	20.7	3 / 3	20.6
Lead	mg/kg	0.024 / 0.024	ND	0.031	0.035	3 / 3	0.03233
Magnesium	mg/kg	--	920	920	1560	3 / 3	1243
Manganese	mg/kg	--	34.9	34.9	88.5	3 / 3	74.7
Mercury	mg/kg	0.01 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.23	0.23	0.32	3 / 3	0.3033
Nickel	mg/kg	--	0.13	0.13	0.29	3 / 3	0.2
Potassium	mg/kg	--	4910	4910	5720	3 / 3	5280
Selenium	mg/kg	--	0.088	0.088	0.14	3 / 3	0.113
Silver	mg/kg	0.0025 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	42.2 / 49.7	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	6.1	6.1	10.4	3 / 3	8.733
Thallium	mg/kg	0.012 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.04 / 0.047	ND	ND	ND	0 / 3	0
Zinc	mg/kg	--	8	8	9.2	3 / 3	8.567

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 10. Aquatic Emergent Vegetation at Clinch River Mile 4.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	67.3	67.3	85.3	3 / 3	76.93
Aluminum	mg/kg	--	13	13	33.7	3 / 3	26.77
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.028	ND	0.055	0.055	1 / 3	0.055
Barium	mg/kg	--	3.7	3.7	14	3 / 3	7.167
Beryllium	mg/kg	0.029 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	4.6	4.6	7.4	3 / 3	6.467
Cadmium	mg/kg	0.0074 / 0.0076	ND	0.0084	0.015	2 / 3	0.0117
Calcium	mg/kg	--	2370	2370	2960	3 / 3	2643
Chromium	mg/kg	0.12 / 0.12	ND	0.17	0.17	1 / 3	0.17
Cobalt	mg/kg	--	0.029	0.029	0.088	3 / 3	0.06067
Copper	mg/kg	--	1.5	1.5	2.1	3 / 3	1.733
Iron	mg/kg	--	18	18	36.7	3 / 3	30.03
Lead	mg/kg	0.027 / 0.027	ND	0.06	0.074	2 / 3	0.067
Magnesium	mg/kg	--	633	633	988	3 / 3	812.3
Manganese	mg/kg	--	32.1	32.1	100	3 / 3	73.47
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.15	0.15	0.32	3 / 3	0.21
Nickel	mg/kg	--	0.26	0.26	0.91	3 / 3	0.48
Potassium	mg/kg	--	3810	3810	4230	3 / 3	4013
Selenium	mg/kg	0.065 / 0.068	ND	0.085	0.085	1 / 3	0.085
Silver	mg/kg	0.0028 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	46.6 / 49.8	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	5.5	5.5	8.2	3 / 3	6.433
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.044 / 0.046	ND	0.071	0.071	1 / 3	0.071
Zinc	mg/kg	--	6	6	8.5	3 / 3	6.867

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 11. Aquatic Emergent Vegetation at the Clinch River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	85.8	85.8	88.2	3 / 3	87.3
Aluminum	mg/kg	--	28.8	28.8	59.8	3 / 3	43.93
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.028 / 0.028	ND	0.028	0.065	2 / 3	0.0465
Barium	mg/kg	--	3.8	3.8	4.8	3 / 3	4.333
Beryllium	mg/kg	0.029 / 0.031	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	5.6	5.6	6.6	3 / 3	6.433
Cadmium	mg/kg	0.0075 / 0.0077	ND	0.017	0.017	1 / 3	0.017
Calcium	mg/kg	--	2890	2890	3400	3 / 3	3270
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.028	0.028	0.078	3 / 3	0.05533
Copper	mg/kg	--	1.1	1.1	1.4	3 / 3	1.233
Iron	mg/kg	--	30.5	30.5	57.7	3 / 3	43.1
Lead	mg/kg	--	0.037	0.037	0.093	3 / 3	0.063
Magnesium	mg/kg	--	825	825	1170	3 / 3	994.3
Manganese	mg/kg	--	13.8	13.8	47.3	3 / 3	32.83
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.075	0.075	0.12	3 / 3	0.1017
Nickel	mg/kg	--	0.15	0.15	0.72	3 / 3	0.3733
Potassium	mg/kg	--	2980	2980	4040	3 / 3	3630
Selenium	mg/kg	0.066 / 0.07	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0028 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	47.3 / 50	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	3.8	3.8	7.1	3 / 3	5.767
Thallium	mg/kg	0.014 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	--	0.055	0.055	0.12	3 / 3	0.082
Zinc	mg/kg	--	5.3	5.3	9.9	3 / 3	8.033

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 12. Aquatic Emergent Vegetation at Tennessee River Mile 567**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	76.5	76.5	87.3	3 / 3	82.4
Aluminum	mg/kg	--	15.4	15.4	46	3 / 3	35.33
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.026 / 0.054	ND	0.034	0.058	2 / 3	0.046
Barium	mg/kg	--	4.4	4.4	35	3 / 3	15.13
Beryllium	mg/kg	0.028 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	2.8	2.8	6.6	3 / 3	4.9
Cadmium	mg/kg	0.0071 / 0.0079	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	1980	1980	3250	3 / 3	2523
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.04	0.04	0.1	3 / 3	0.07767
Copper	mg/kg	--	1	1	1.3	3 / 3	1.167
Iron	mg/kg	--	20.4	20.4	53.3	3 / 3	36.73
Lead	mg/kg	0.026 / 0.027	ND	0.04	0.052	2 / 3	0.046
Magnesium	mg/kg	--	605	605	1040	3 / 3	878.7
Manganese	mg/kg	--	45.3	45.3	58.8	3 / 3	51.43
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.091	0.091	0.21	3 / 3	0.147
Nickel	mg/kg	--	0.11	0.11	0.26	3 / 3	0.19
Potassium	mg/kg	--	3160	3160	5180	3 / 3	3950
Selenium	mg/kg	0.127 / 0.139	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0027 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	45.2 / 49.8	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	5.6	5.6	7.4	3 / 3	6.567
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.043 / 0.044	ND	0.073	0.083	2 / 3	0.078
Zinc	mg/kg	--	5.4	5.4	8	3 / 3	6.3

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 13. Aquatic Emergent Vegetation at the Tennessee River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	74.7	74.7	79.5	3 / 3	76.47
Aluminum	mg/kg	--	4.7	4.7	20.9	3 / 3	10.2
Antimony	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.054	ND	0.034	0.034	1 / 3	0.034
Barium	mg/kg	--	0.9	0.9	8.9	3 / 3	5.567
Beryllium	mg/kg	0.027 / 0.028	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	1.2	1.2	4.2	3 / 3	2.833
Cadmium	mg/kg	0.007 / 0.0072	ND	0.014	0.031	2 / 3	0.0225
Calcium	mg/kg	--	501	501	3120	3 / 3	2107
Chromium	mg/kg	0.12 / 0.12	ND	0.27	0.27	1 / 3	0.27
Cobalt	mg/kg	--	0.017	0.017	0.25	3 / 3	0.101
Copper	mg/kg	--	1	1	2.2	3 / 3	1.6
Iron	mg/kg	--	13.8	13.8	49.9	3 / 3	27.37
Lead	mg/kg	0.026 / 0.027	ND	0.028	0.028	1 / 3	0.028
Magnesium	mg/kg	--	326	326	1100	3 / 3	689.3
Manganese	mg/kg	--	60.2	60.2	182	3 / 3	105.2
Mercury	mg/kg	0.011 / 0.011	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.065	0.065	0.31	3 / 3	0.1783
Nickel	mg/kg	0.09 / 0.093	ND	0.094	0.17	2 / 3	0.132
Potassium	mg/kg	--	3140	3140	4600	3 / 3	3907
Selenium	mg/kg	0.125 / 0.129	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0027 / 0.0028	ND	0.0038	0.0038	1 / 3	0.0038
Sodium	mg/kg	44.6 / 46.2	ND	455	455	1 / 3	455
Strontium	mg/kg	--	1.1	1.1	7.7	3 / 3	5.5
Thallium	mg/kg	0.013 / 0.013	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.042 / 0.043	ND	0.053	0.053	1 / 3	0.053
Zinc	mg/kg	--	6.3	6.3	11.7	3 / 3	9.333

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 14. Aquatic Shoreline Vegetation at Emory River Mile 1.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	60.2	60.2	73.4	3 / 3	67.93
Aluminum	mg/kg	--	9.4	9.4	78.7	3 / 3	34.17
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.028 / 0.029	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	7.1	7.1	10.9	3 / 3	9.267
Beryllium	mg/kg	0.029 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	3.3	3.3	6.3	3 / 3	5.033
Cadmium	mg/kg	0.0076 / 0.031	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	2210	2210	3180	3 / 3	3057
Chromium	mg/kg	0.13 / 0.13	ND	0.18	0.18	1 / 3	0.18
Cobalt	mg/kg	--	0.025	0.025	0.22	3 / 3	0.1007
Copper	mg/kg	--	1.9	1.9	2.8	3 / 3	2.467
Iron	mg/kg	--	17.8	17.8	104	3 / 3	48.3
Lead	mg/kg	0.028 / 0.029	ND	0.028	0.048	2 / 3	0.038
Magnesium	mg/kg	--	542	542	740	3 / 3	627.7
Manganese	mg/kg	--	12.9	12.9	60.5	3 / 3	38.1
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	0.035 / 0.036	ND	0.18	0.21	2 / 3	0.195
Nickel	mg/kg	--	0.22	0.22	0.86	3 / 3	0.5333
Potassium	mg/kg	--	3600	3600	5220	3 / 3	4623
Selenium	mg/kg	0.067 / 0.07	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0029 / 0.0069	ND	ND	ND	0 / 3	0
Sodium	mg/kg	47.8 / 49.8	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	7.2	7.2	11.2	3 / 3	9.6
Thallium	mg/kg	0.014 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.045 / 0.047	ND	0.069	0.11	1 / 3	0.11
Zinc	mg/kg	2.1 / 10.2	ND	7.7	9.8	2 / 3	8.8

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 15. Aquatic Shoreline Vegetation at Emory River Mile 3.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	71.9	71.9	74.3	3 / 3	73.47
Aluminum	mg/kg	--	4.9	4.9	7.8	3 / 3	6.233
Antimony	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	--	0.037	0.037	0.088	3 / 3	0.05533
Barium	mg/kg	--	8	8	15.2	3 / 3	11.5
Beryllium	mg/kg	0.027 / 0.029	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	2.3	2.3	2.7	3 / 3	2.467
Cadmium	mg/kg	0.013 / 0.025	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	1210	1210	1630	3 / 3	1430
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.035	0.035	0.086	3 / 3	0.056
Copper	mg/kg	--	1.4	1.4	1.7	3 / 3	1.5
Iron	mg/kg	--	15.3	15.3	19.3	3 / 3	17.67
Lead	mg/kg	0.026 / 0.028	ND	0.028	0.03	2 / 3	0.029
Magnesium	mg/kg	--	532	532	652	3 / 3	601.3
Manganese	mg/kg	--	68.9	68.9	228	3 / 3	129.1
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.17	0.17	0.27	3 / 3	0.23
Nickel	mg/kg	--	0.32	0.32	0.5	3 / 3	0.38
Potassium	mg/kg	--	4150	4150	5150	3 / 3	4557
Selenium	mg/kg	0.062 / 0.067	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0029 / 0.0037	ND	ND	ND	0 / 3	0
Sodium	mg/kg	44.5 / 48	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	4.7	4.7	6.6	3 / 3	5.8
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.042 / 0.045	ND	ND	ND	0 / 3	0
Zinc	mg/kg	2 / 9.1	ND	13.1	15.5	2 / 3	14.3

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 16. Aquatic Shoreline Vegetation at Emory River Mile 4.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	59.1	59.1	70.6	3 / 3	66.3
Aluminum	mg/kg	--	9.8	9.8	40.6	3 / 3	28.4
Antimony	mg/kg	0.014 / 0.014	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.028	ND	0.079	0.079	1 / 3	0.079
Barium	mg/kg	--	10.1	10.1	19.6	3 / 3	13.7
Beryllium	mg/kg	0.028 / 0.029	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	3.1	3.1	4.1	3 / 3	3.633
Cadmium	mg/kg	0.0076 / 0.035	ND	0.061	0.061	1 / 3	0.061
Calcium	mg/kg	--	1510	1510	2120	3 / 3	1793
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.022	0.022	0.11	3 / 3	0.06567
Copper	mg/kg	--	1.7	1.7	2	3 / 3	1.867
Iron	mg/kg	--	17.6	17.6	53	3 / 3	40.03
Lead	mg/kg	--	0.031	0.031	0.056	3 / 3	0.046
Magnesium	mg/kg	--	618	618	824	3 / 3	689.7
Manganese	mg/kg	--	76.1	76.1	189	3 / 3	135
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.087	0.087	0.69	3 / 3	0.299
Nickel	mg/kg	--	0.5	0.5	0.88	3 / 3	0.6833
Potassium	mg/kg	--	2950	2950	4770	3 / 3	4053
Selenium	mg/kg	0.064 / 0.067	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0028 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	45.9 / 48	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	5.4	5.4	6.9	3 / 3	6.3
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.043 / 0.043	ND	0.054	0.062	2 / 3	0.058
Zinc	mg/kg	2.1 / 11.4	ND	13.9	15.5	2 / 3	14.7

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 17. Aquatic Shoreline Vegetation at the Emory River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	74.5	74.5	81.6	3 / 3	77.57
Aluminum	mg/kg	--	9.5	9.5	48.2	3 / 3	29.6
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.029	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	7.7	7.7	28.3	3 / 3	17.4
Beryllium	mg/kg	0.029 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	3.1	3.1	7.2	3 / 3	4.767
Cadmium	mg/kg	--	0.037	0.037	0.089	3 / 3	0.06567
Calcium	mg/kg	--	1700	1700	3540	3 / 3	2340
Chromium	mg/kg	0.12 / 0.13	ND	0.23	0.23	1 / 3	0.23
Cobalt	mg/kg	--	0.05	0.05	0.1	3 / 3	0.073
Copper	mg/kg	--	1.2	1.2	2.2	3 / 3	1.833
Iron	mg/kg	--	18.3	18.3	58.6	3 / 3	41.7
Lead	mg/kg	0.027 / 0.027	ND	0.042	0.057	2 / 3	0.05
Magnesium	mg/kg	--	708	708	1130	3 / 3	877
Manganese	mg/kg	--	52.7	52.7	64.2	3 / 3	57.53
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.045	0.045	0.13	3 / 3	0.078
Nickel	mg/kg	--	0.32	0.32	0.91	3 / 3	0.7267
Potassium	mg/kg	--	2830	2830	4560	3 / 3	3747
Selenium	mg/kg	0.066 / 0.07	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0028 / 0.003	ND	0.012	0.014	1 / 3	0.014
Sodium	mg/kg	47 / 49.8	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	5.6	5.6	11.9	3 / 3	7.867
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.045 / 0.047	ND	0.069	0.069	1 / 3	0.069
Zinc	mg/kg	--	11.5	11.5	14.1	3 / 3	13.2

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 18. Aquatic Shoreline Vegetation at Clinch River Mile 2.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	61.4	61.4	71.7	3 / 3	66.83
Aluminum	mg/kg	--	12.4	12.4	174	3 / 3	66.53
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.028	ND	0.12	0.12	1 / 3	0.12
Barium	mg/kg	--	2.5	2.5	11.1	3 / 3	7.367
Beryllium	mg/kg	0.029 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	2.5	2.5	7.4	3 / 3	5.167
Cadmium	mg/kg	0.0074 / 0.0077	ND	0.01	0.02	2 / 3	0.015
Calcium	mg/kg	--	1920	1920	3620	3 / 3	2577
Chromium	mg/kg	0.12 / 0.13	ND	0.28	0.28	1 / 3	0.28
Cobalt	mg/kg	0.014 / 0.014	ND	0.017	0.17	2 / 3	0.0935
Copper	mg/kg	--	1.5	1.5	2.9	3 / 3	2.3
Iron	mg/kg	--	17.6	17.6	168	3 / 3	68.67
Lead	mg/kg	--	0.029	0.029	0.48	3 / 3	0.1807
Magnesium	mg/kg	--	477	477	1180	3 / 3	765.3
Manganese	mg/kg	--	5.5	5.5	22.1	3 / 3	13.77
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.31	0.31	0.6	3 / 3	0.4467
Nickel	mg/kg	0.095 / 0.095	ND	0.12	0.34	2 / 3	0.23
Potassium	mg/kg	--	3220	3220	7350	3 / 3	5063
Selenium	mg/kg	0.066 / 0.068	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0028 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	46.9 / 48.5	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	4	4	5.9	3 / 3	5
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.044 / 0.046	ND	0.32	0.32	1 / 3	0.32
Zinc	mg/kg	--	8.3	8.3	12.7	3 / 3	10.97

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 19. Aquatic Shoreline Vegetation at Clinch River Mile 4.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	66.5	66.5	75.3	3 / 3	70.57
Aluminum	mg/kg	--	7.8	7.8	31.5	3 / 3	16.47
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.027 / 0.028	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	3.6	3.6	15.4	3 / 3	7.733
Beryllium	mg/kg	0.028 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	2.8	2.8	6.1	3 / 3	4.5
Cadmium	mg/kg	--	0.0081	0.0081	0.017	3 / 3	0.01337
Calcium	mg/kg	--	2260	2260	2350	3 / 3	2293
Chromium	mg/kg	0.12 / 0.12	ND	0.15	0.15	1 / 3	0.15
Cobalt	mg/kg	--	0.026	0.026	0.13	3 / 3	0.06067
Copper	mg/kg	--	2.4	2.4	3.3	3 / 3	2.933
Iron	mg/kg	--	16.6	16.6	25.7	3 / 3	20.37
Lead	mg/kg	--	0.028	0.028	0.054	3 / 3	0.039
Magnesium	mg/kg	--	691	691	755	3 / 3	726.3
Manganese	mg/kg	--	35.7	35.7	71.6	3 / 3	57.77
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.086	0.086	1.3	3 / 3	0.642
Nickel	mg/kg	--	0.18	0.18	0.95	3 / 3	0.4567
Potassium	mg/kg	--	3590	3590	5600	3 / 3	4620
Selenium	mg/kg	0.065 / 0.068	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0028 / 0.0028	ND	0.0043	0.0043	1 / 3	0.0043
Sodium	mg/kg	46.2 / 48.7	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	4.8	4.8	7.9	3 / 3	6.1
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.044 / 0.046	ND	ND	ND	0 / 3	0
Zinc	mg/kg	--	9.5	9.5	11	3 / 3	10

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 20. Aquatic Shoreline Vegetation at the Clinch River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	70.4	70.4	78.8	3 / 3	73.27
Aluminum	mg/kg	--	6.9	6.9	8.9	3 / 3	7.867
Antimony	mg/kg	0.014 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.026 / 0.029	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	3.1	3.1	13.2	3 / 3	7.4
Beryllium	mg/kg	0.028 / 0.031	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	3.7	3.7	5.4	3 / 3	4.433
Cadmium	mg/kg	0.0072 / 0.0079	ND	0.0094	0.0094	1 / 3	0.0094
Calcium	mg/kg	--	2000	2000	2460	3 / 3	2217
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	0.013 / 0.014	ND	0.02	0.035	2 / 3	0.0275
Copper	mg/kg	--	1.7	1.7	2.4	3 / 3	2.133
Iron	mg/kg	--	14.7	14.7	16.5	3 / 3	15.77
Lead	mg/kg	0.026 / 0.029	ND	0.032	0.032	1 / 3	0.032
Magnesium	mg/kg	--	680	680	955	3 / 3	816.3
Manganese	mg/kg	--	14.4	14.4	33.3	3 / 3	24.07
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.082	0.082	0.42	3 / 3	0.254
Nickel	mg/kg	--	0.14	0.14	0.42	3 / 3	0.2433
Potassium	mg/kg	--	3930	3930	4360	3 / 3	4133
Selenium	mg/kg	0.064 / 0.07	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0027 / 0.003	ND	ND	ND	0 / 3	0
Sodium	mg/kg	45.3 / 49.9	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	2.4	2.4	5.9	3 / 3	4.2
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.043 / 0.047	ND	ND	ND	0 / 3	0
Zinc	mg/kg	--	6.5	6.5	12.6	3 / 3	9.4

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 21. Aquatic Shoreline Vegetation at Tennessee River Mile 567**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	65.5	65.5	73.8	3 / 3	70.4
Aluminum	mg/kg	--	5	5	9.5	3 / 3	6.933
Antimony	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.026 / 0.028	ND	0.038	0.046	2 / 3	0.042
Barium	mg/kg	--	7.2	7.2	10	3 / 3	9
Beryllium	mg/kg	0.027 / 0.029	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	1.4	1.4	2.4	3 / 3	1.833
Cadmium	mg/kg	0.0069 / 0.0076	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	1210	1210	1550	3 / 3	1353
Chromium	mg/kg	0.12 / 0.13	ND	ND	ND	0 / 3	0
Cobalt	mg/kg	--	0.02	0.02	0.036	3 / 3	0.02833
Copper	mg/kg	--	1.8	1.8	2.4	3 / 3	2.133
Iron	mg/kg	--	17.7	17.7	19.5	3 / 3	18.73
Lead	mg/kg	0.025 / 0.028	ND	0.041	0.089	2 / 3	0.065
Magnesium	mg/kg	--	487	487	916	3 / 3	728
Manganese	mg/kg	--	57.8	57.8	103	3 / 3	82.83
Mercury	mg/kg	0.011 / 0.011	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.044	0.044	1	3 / 3	0.438
Nickel	mg/kg	--	0.21	0.21	0.39	3 / 3	0.3033
Potassium	mg/kg	--	4150	4150	4440	3 / 3	4263
Selenium	mg/kg	0.062 / 0.067	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0026 / 0.0029	ND	ND	ND	0 / 3	0
Sodium	mg/kg	43.9 / 47.9	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	3.2	3.2	4.4	3 / 3	3.6
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	0.042 / 0.045	ND	ND	ND	0 / 3	0
Zinc	mg/kg	--	16.2	16.2	26.3	3 / 3	21.37

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 22. Aquatic Shoreline Vegetation at the Tennessee River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	69.2	69.2	75.2	3 / 3	72.87
Aluminum	mg/kg	--	43.6	43.6	68.8	3 / 3	53.67
Antimony	mg/kg	0.013 / 0.015	ND	ND	ND	0 / 3	0
Arsenic	mg/kg	0.026 / 0.029	ND	ND	ND	0 / 3	0
Barium	mg/kg	--	1.9	1.9	12.2	3 / 3	6.3
Beryllium	mg/kg	0.027 / 0.03	ND	ND	ND	0 / 3	0
Boron	mg/kg	--	1.3	1.3	3.1	3 / 3	1.933
Cadmium	mg/kg	0.0076 / 0.033	ND	ND	ND	0 / 3	0
Calcium	mg/kg	--	937	937	3060	3 / 3	1842
Chromium	mg/kg	0.12 / 0.13	ND	0.13	0.17	2 / 3	0.15
Cobalt	mg/kg	--	0.03	0.03	0.093	3 / 3	0.054
Copper	mg/kg	--	2.9	2.9	6.8	3 / 3	4.6
Iron	mg/kg	--	51.2	51.2	70.5	3 / 3	58.47
Lead	mg/kg	--	0.061	0.061	0.19	3 / 3	0.1147
Magnesium	mg/kg	--	539	539	1130	3 / 3	798.3
Manganese	mg/kg	--	127	127	188	3 / 3	148
Mercury	mg/kg	0.011 / 0.012	ND	ND	ND	0 / 3	0
Molybdenum	mg/kg	--	0.06	0.06	0.49	3 / 3	0.3
Nickel	mg/kg	--	0.2	0.2	1.3	3 / 3	0.62
Potassium	mg/kg	--	4110	4110	5510	3 / 3	4730
Selenium	mg/kg	0.063 / 0.07	ND	ND	ND	0 / 3	0
Silver	mg/kg	0.0027 / 0.0066	ND	ND	ND	0 / 3	0
Sodium	mg/kg	44.8 / 49.7	ND	ND	ND	0 / 3	0
Strontium	mg/kg	--	2	2	8.5	3 / 3	4.833
Thallium	mg/kg	0.013 / 0.014	ND	ND	ND	0 / 3	0
Vanadium	mg/kg	--	0.069	0.069	0.096	3 / 3	0.07867
Zinc	mg/kg	2 / 11	ND	15	15	1 / 3	15

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 23. Periphyton at Emory River Mile 1.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	82.5	82.5	82.5	1 / 1	82.5
Aluminum	mg/kg	--	2170	2170	2170	1 / 1	2170
Antimony	mg/kg	--	0.049	0.049	0.049	1 / 1	0.049
Arsenic	mg/kg	--	3.4	3.4	3.4	1 / 1	3.4
Barium	mg/kg	--	40.7	40.7	40.7	1 / 1	40.7
Beryllium	mg/kg	--	0.17	0.17	0.17	1 / 1	0.17
Boron	mg/kg	--	2.2	2.2	2.2	1 / 1	2.2
Cadmium	mg/kg	--	0.046	0.046	0.046	1 / 1	0.046
Calcium	mg/kg	--	13800	13800	13800	1 / 1	13800
Chromium	mg/kg	--	2.7	2.7	2.7	1 / 1	2.7
Cobalt	mg/kg	--	1.8	1.8	1.8	1 / 1	1.8
Copper	mg/kg	--	5.6	5.6	5.6	1 / 1	5.6
Iron	mg/kg	--	2160	2160	2160	1 / 1	2160
Lead	mg/kg	--	2.4	2.4	2.4	1 / 1	2.4
Magnesium	mg/kg	--	446	446	446	1 / 1	446
Manganese	mg/kg	--	671	671	671	1 / 1	671
Mercury	mg/kg	--	0.018	0.018	0.018	1 / 1	0.018
Molybdenum	mg/kg	--	0.085	0.085	0.085	1 / 1	0.085
Nickel	mg/kg	--	3.1	3.1	3.1	1 / 1	3.1
Potassium	mg/kg	698 / 698	ND	ND	ND	0 / 1	0
Selenium	mg/kg	--	0.47	0.47	0.47	1 / 1	0.47
Silver	mg/kg	0.0093 / 0.0093	ND	ND	ND	0 / 1	0
Sodium	mg/kg	--	51.9	51.9	51.9	1 / 1	51.9
Strontium	mg/kg	--	15.2	15.2	15.2	1 / 1	15.2
Thallium	mg/kg	0.046 / 0.046	ND	ND	ND	0 / 1	0
Vanadium	mg/kg	--	5.1	5.1	5.1	1 / 1	5.1
Zinc	mg/kg	--	14.6	14.6	14.6	1 / 1	14.6

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 24. Periphyton at Emory River Mile 2.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	78	78	95.1	1 / 1	95.1
Aluminum	mg/kg	--	4040	4040	5680	1 / 1	5680
Antimony	mg/kg	--	0.059	0.059	0.076	1 / 1	0.076
Arsenic	mg/kg	--	5.7	5.7	7.6	1 / 1	7.6
Barium	mg/kg	--	47.2	47.2	62.9	1 / 1	62.9
Beryllium	mg/kg	--	0.3	0.3	0.41	1 / 1	0.41
Boron	mg/kg	--	2.5	2.5	3.2	1 / 1	3.2
Cadmium	mg/kg	--	0.058	0.058	0.077	1 / 1	0.077
Calcium	mg/kg	--	928	928	1170	1 / 1	1170
Chromium	mg/kg	--	4.5	4.5	6.3	1 / 1	6.3
Cobalt	mg/kg	--	3.6	3.6	5	1 / 1	5
Copper	mg/kg	--	5	5	7	1 / 1	7
Iron	mg/kg	--	4300	4300	6130	1 / 1	6130
Lead	mg/kg	--	4	4	5.4	1 / 1	5.4
Magnesium	mg/kg	--	442	442	630	1 / 1	630
Manganese	mg/kg	--	980	980	1300	1 / 1	1300
Mercury	mg/kg	--	0.014	0.014	0.019	1 / 1	0.019
Molybdenum	mg/kg	--	0.19	0.19	0.25	1 / 1	0.25
Nickel	mg/kg	--	6	6	8.4	1 / 1	8.4
Potassium	mg/kg	647 / 3530	ND	733	733	1 / 1	733
Selenium	mg/kg	--	0.61	0.61	0.85	1 / 1	0.85
Silver	mg/kg	0.018 / 0.024	ND	ND	ND	0 / 1	0
Sodium	mg/kg	43.1 / 235	ND	57.6	57.6	1 / 1	57.6
Strontium	mg/kg	--	8	8	10.8	1 / 1	10.8
Thallium	mg/kg	0.071 / 0.099	ND	ND	ND	0 / 1	0
Vanadium	mg/kg	--	8.2	8.2	12.3	1 / 1	12.3
Zinc	mg/kg	--	18.7	18.7	24.1	1 / 1	24.1

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 25. Periphyton at Emory River Mile 4.0**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	90.3	90.3	90.3	1 / 1	90.3
Aluminum	mg/kg	--	7850	7850	7850	1 / 1	7850
Antimony	mg/kg	--	0.063	0.063	0.063	1 / 1	0.063
Arsenic	mg/kg	--	4.9	4.9	4.9	1 / 1	4.9
Barium	mg/kg	--	104	104	104	1 / 1	104
Beryllium	mg/kg	--	0.44	0.44	0.44	1 / 1	0.44
Boron	mg/kg	--	2.3	2.3	2.3	1 / 1	2.3
Cadmium	mg/kg	0.073 / 0.073	ND	ND	ND	0 / 1	0
Calcium	mg/kg	--	1150	1150	1150	1 / 1	1150
Chromium	mg/kg	--	7.9	7.9	7.9	1 / 1	7.9
Cobalt	mg/kg	--	5.9	5.9	5.9	1 / 1	5.9
Copper	mg/kg	--	5	5	5	1 / 1	5
Iron	mg/kg	--	9210	9210	9210	1 / 1	9210
Lead	mg/kg	--	6.9	6.9	6.9	1 / 1	6.9
Magnesium	mg/kg	--	720	720	720	1 / 1	720
Manganese	mg/kg	--	1610	1610	1610	1 / 1	1610
Mercury	mg/kg	--	0.026	0.026	0.026	1 / 1	0.026
Molybdenum	mg/kg	0.34 / 0.34	ND	ND	ND	0 / 1	0
Nickel	mg/kg	--	10.2	10.2	10.2	1 / 1	10.2
Potassium	mg/kg	--	905	905	905	1 / 1	905
Selenium	mg/kg	--	0.93	0.93	0.93	1 / 1	0.93
Silver	mg/kg	--	0.028	0.028	0.028	1 / 1	0.028
Sodium	mg/kg	46.5 / 46.5	ND	ND	ND	0 / 1	0
Strontium	mg/kg	---	9.4	9.4	9.4	1 / 1	9.4
Thallium	mg/kg	0.096 / 0.096	ND	ND	ND	0 / 1	0
Vanadium	mg/kg	--	12.5	12.5	12.5	1 / 1	12.5
Zinc	mg/kg	--	31.2	31.2	31.2	1 / 1	31.2

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 26. Periphyton at the Emory River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	95.8	95.8	97.6	2 / 2	96.7
Aluminum	mg/kg	--	1610	1610	3640	2 / 2	2625
Antimony	mg/kg	--	0.017	0.017	0.03	2 / 2	0.0235
Arsenic	mg/kg	--	0.92	0.92	1.5	2 / 2	1.21
Barium	mg/kg	--	20.4	20.4	44.7	2 / 2	32.55
Beryllium	mg/kg	--	0.089	0.089	0.22	2 / 2	0.1545
Boron	mg/kg	--	0.65	0.65	1.2	2 / 2	0.925
Cadmium	mg/kg	0.0071 / 0.073	ND	0.022	0.022	1 / 2	0.022
Calcium	mg/kg	--	395	395	675	2 / 2	535
Chromium	mg/kg	--	1.7	1.7	3.6	2 / 2	2.65
Cobalt	mg/kg	--	1.6	1.6	3.1	2 / 2	2.35
Copper	mg/kg	--	1.2	1.2	2.4	2 / 2	1.8
Iron	mg/kg	--	1950	1950	4550	2 / 2	3250
Lead	mg/kg	--	1.4	1.4	3.3	2 / 2	2.35
Magnesium	mg/kg	--	176	176	363	2 / 2	269.5
Manganese	mg/kg	--	342	342	606	2 / 2	474
Mercury	mg/kg	0.011 / 0.011	ND	0.011	0.011	1 / 2	0.011
Molybdenum	mg/kg	0.033 / 0.34	ND	0.056	0.056	1 / 2	0.056
Nickel	mg/kg	--	2.5	2.5	5.3	2 / 2	3.9
Potassium	mg/kg	670 / 694	ND	ND	ND	0 / 2	0
Selenium	mg/kg	0.063 / 0.65	ND	0.18	0.18	1 / 2	0.18
Silver	mg/kg	0.0056 / 0.028	ND	ND	ND	0 / 2	0
Sodium	mg/kg	44.6 / 46.3	ND	ND	ND	0 / 2	0
Strontium	mg/kg	--	1.7	1.7	4.4	2 / 2	3.05
Thallium	mg/kg	0.018 / 0.037	ND	ND	ND	0 / 2	0
Vanadium	mg/kg	--	2.7	2.7	5.6	2 / 2	4.15
Zinc	mg/kg	--	8.9	8.9	17.8	2 / 2	13.35

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 27. Periphyton at Clinch River Mile 1.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	75.8	75.8	94.5	2 / 2	85.15
Aluminum	mg/kg	--	3800	3800	7470	2 / 2	5635
Antimony	mg/kg	--	0.079	0.079	0.12	2 / 2	0.0995
Arsenic	mg/kg	--	4.1	4.1	9.6	2 / 2	6.85
Barium	mg/kg	--	42.4	42.4	74.3	2 / 2	58.35
Beryllium	mg/kg	--	0.3	0.3	0.63	2 / 2	0.465
Boron	mg/kg	--	4.3	4.3	5.7	2 / 2	5
Cadmium	mg/kg	--	0.056	0.056	0.14	2 / 2	0.098
Calcium	mg/kg	--	3050	3050	7550	2 / 2	5300
Chromium	mg/kg	--	4.6	4.6	9	2 / 2	6.8
Cobalt	mg/kg	--	2.9	2.9	5.8	2 / 2	4.35
Copper	mg/kg	--	15.3	15.3	35.6	2 / 2	25.45
Iron	mg/kg	--	4000	4000	7300	2 / 2	5650
Lead	mg/kg	--	4.4	4.4	7.9	2 / 2	6.15
Magnesium	mg/kg	--	595	595	920	2 / 2	757.5
Manganese	mg/kg	--	597	597	1270	2 / 2	933.5
Mercury	mg/kg	--	0.052	0.052	0.095	2 / 2	0.0735
Molybdenum	mg/kg	--	0.15	0.15	0.39	2 / 2	0.27
Nickel	mg/kg	--	5.4	5.4	10.7	2 / 2	8.05
Potassium	mg/kg	714 / 6590	ND	ND	ND	0 / 2	0
Selenium	mg/kg	--	0.75	0.75	1.3	2 / 2	1.025
Silver	mg/kg	0.0029 / 0.044	ND	0.016	0.016	1 / 2	0.016
Sodium	mg/kg	47.6 / 439	ND	ND	ND	0 / 2	0
Strontium	mg/kg	--	15.6	15.6	20.6	2 / 2	18.1
Thallium	mg/kg	0.085 / 0.16	ND	ND	ND	0 / 2	0
Vanadium	mg/kg	--	9.2	9.2	20.4	2 / 2	14.8
Zinc	mg/kg	--	26	26	54.9	2 / 2	40.45

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 28. Periphyton at Clinch River Mile 3.5**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	92.8	92.8	92.8	1 / 1	92.8
Aluminum	mg/kg	--	2680	2680	2680	1 / 1	2680
Antimony	mg/kg	--	0.057	0.057	0.057	1 / 1	0.057
Arsenic	mg/kg	--	3.2	3.2	3.2	1 / 1	3.2
Barium	mg/kg	--	33.3	33.3	33.3	1 / 1	33.3
Beryllium	mg/kg	--	0.2	0.2	0.2	1 / 1	0.2
Boron	mg/kg	--	2.9	2.9	2.9	1 / 1	2.9
Cadmium	mg/kg	--	0.049	0.049	0.049	1 / 1	0.049
Calcium	mg/kg	--	13500	13500	13500	1 / 1	13500
Chromium	mg/kg	--	3.4	3.4	3.4	1 / 1	3.4
Cobalt	mg/kg	--	2	2	2	1 / 1	2
Copper	mg/kg	--	10.3	10.3	10.3	1 / 1	10.3
Iron	mg/kg	--	2600	2600	2600	1 / 1	2600
Lead	mg/kg	--	2.9	2.9	2.9	1 / 1	2.9
Magnesium	mg/kg	--	496	496	496	1 / 1	496
Manganese	mg/kg	--	467	467	467	1 / 1	467
Mercury	mg/kg	--	0.044	0.044	0.044	1 / 1	0.044
Molybdenum	mg/kg	--	0.11	0.11	0.11	1 / 1	0.11
Nickel	mg/kg	--	3.7	3.7	3.7	1 / 1	3.7
Potassium	mg/kg	658 / 658	ND	ND	ND	0 / 1	0
Selenium	mg/kg	--	0.5	0.5	0.5	1 / 1	0.5
Silver	mg/kg	0.012 / 0.012	ND	ND	ND	0 / 1	0
Sodium	mg/kg	--	58.4	58.4	58.4	1 / 1	58.4
Strontium	mg/kg	--	16.8	16.8	16.8	1 / 1	16.8
Thallium	mg/kg	0.059 / 0.059	ND	ND	ND	0 / 1	0
Vanadium	mg/kg	--	6.4	6.4	6.4	1 / 1	6.4
Zinc	mg/kg	--	16.4	16.4	16.4	1 / 1	16.4

**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

**Table 29. Periphyton at the Clinch River Reference Location**

Analyte	Units (wet wt. basis)	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
% Moisture	%	--	90.2	90.2	91.2	2 / 2	90.7
Aluminum	mg/kg	--	2560	2560	3840	2 / 2	3200
Antimony	mg/kg	--	0.028	0.028	0.033	2 / 2	0.0305
Arsenic	mg/kg	--	1.9	1.9	2.1	2 / 2	2
Barium	mg/kg	--	23.5	23.5	30.1	2 / 2	26.8
Beryllium	mg/kg	--	0.13	0.13	0.17	2 / 2	0.15
Boron	mg/kg	--	1.9	1.9	3.1	2 / 2	2.5
Cadmium	mg/kg	--	0.047	0.047	0.052	2 / 2	0.0495
Calcium	mg/kg	--	3600	3600	7680	2 / 2	5640
Chromium	mg/kg	--	2.9	2.9	4.1	2 / 2	3.5
Cobalt	mg/kg	--	1.8	1.8	2.4	2 / 2	2.1
Copper	mg/kg	--	4.4	4.4	4.6	2 / 2	4.5
Iron	mg/kg	--	2830	2830	4370	2 / 2	3600
Lead	mg/kg	--	2.8	2.8	4	2 / 2	3.4
Magnesium	mg/kg	--	466	466	564	2 / 2	515
Manganese	mg/kg	--	437	437	555	2 / 2	496
Mercury	mg/kg	--	0.11	0.11	0.14	2 / 2	0.125
Molybdenum	mg/kg	--	0.084	0.084	0.11	2 / 2	0.097
Nickel	mg/kg	--	3.1	3.1	4.1	2 / 2	3.6
Potassium	mg/kg	744 / 750	ND	ND	ND	0 / 2	0
Selenium	mg/kg	--	0.35	0.35	0.53	2 / 2	0.44
Silver	mg/kg	0.003 / 0.018	ND	0.017	0.017	1 / 2	0.017
Sodium	mg/kg	49.6 / 50	ND	ND	ND	0 / 2	0
Strontium	mg/kg	--	5.9	5.9	8.5	2 / 2	7.2
Thallium	mg/kg	0.037 / 0.044	ND	ND	ND	0 / 2	0
Vanadium	mg/kg	--	4.5	4.5	6	2 / 2	5.25
Zinc	mg/kg	--	16.6	16.6	18.4	2 / 2	17.5

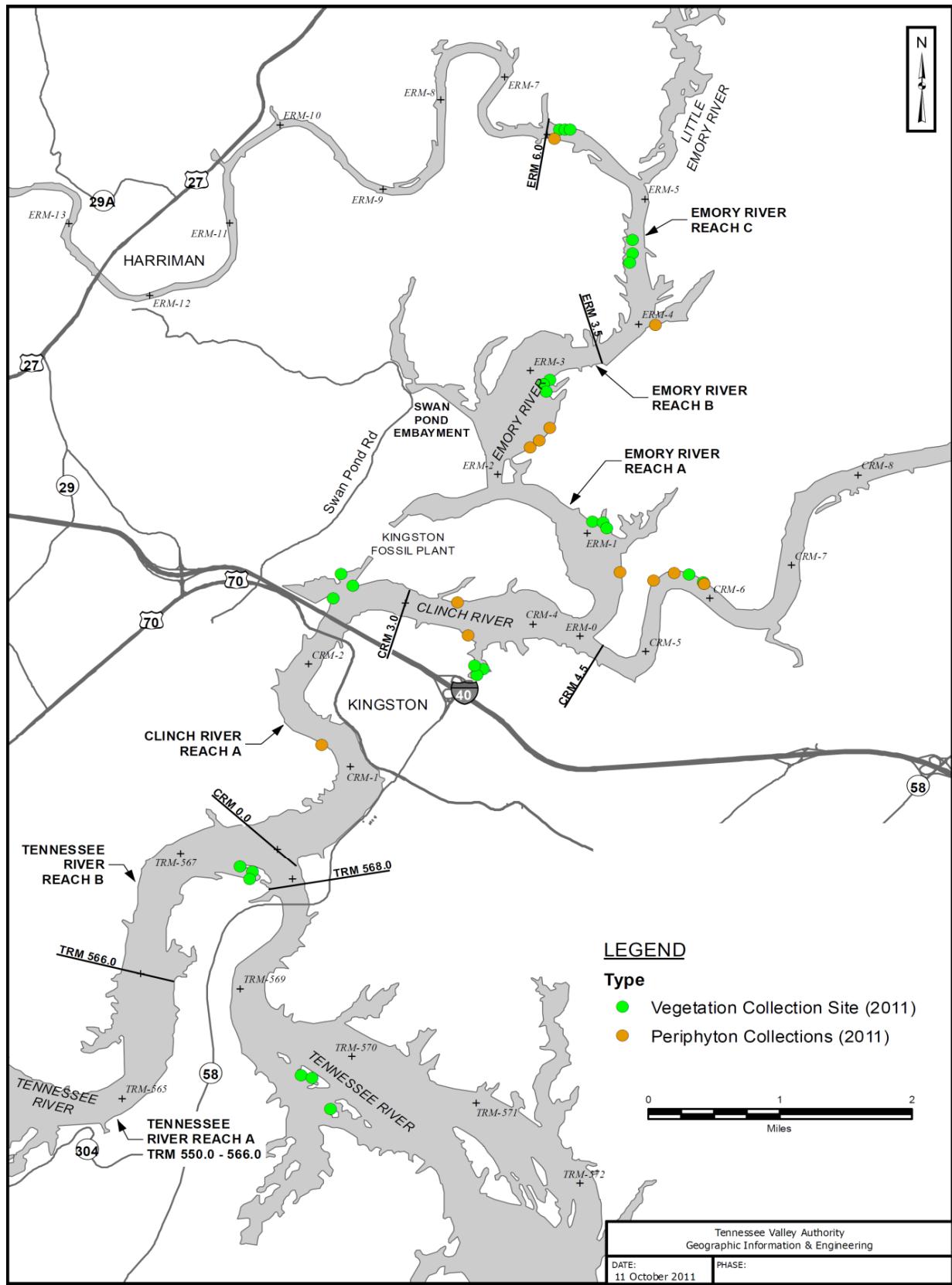
**Notes:**

Grab sample results are presented in wet weight.

For definitions, see the Acronyms section.

## **Figures**

**Figure 1. Aquatic Vegetation and Periphyton Sampling Locations - 2011**



**Figure 2. Field Sampling Site for Emergent and Shoreline Vegetation**



**Figure 3. Field Crew Sampling Aquatic Vegetation**



**Figure 4. Field Crew Sampling Periphyton**



**Figure 5. Field Crew Sampling Periphyton**



**Appendix A**  
**Aquatic Vegetation and Periphyton Sample Summaries**

**Table A-1. Aquatic Vegetation Sample Summary, 2011**

Location		Vegetation Type	
Site Name	Type	Emergent <sup>1</sup>	Shoreline <sup>1</sup>
Upstream Emory River (>6.0)	Reference Sites	3	4
Upstream Clinch River (>4.5)		4	3
Upstream Tennessee River (>568)		3	3
Emory River 1.5	Potentially Affected Sites	3	4
Emory River 3.0		3	3
Emory River 4.5		3	3
Clinch River 2.5		4	3
Clinch River 4.0		3	3
Tennessee River 567		3	3

**Note:** <sup>1</sup>Number of samples include field duplicates; does not include equipment blanks or laboratory duplicates.

**Table A-2. Periphyton Sample Summary, 2011**

Location		Sample Type
Site Name	Type	Periphyton <sup>1</sup>
Upstream Emory River (>6.0)	Reference Sites	2
Upstream Clinch River (>4.5)		2
Emory River 1.0	Potentially Affected Sites	1
Emory River 2.5		3
Emory River 4.0		1
Clinch River 1.5		2
Clinch River 3.5		1

**Note:** <sup>1</sup>Number of samples include field duplicates; does not include equipment blanks.

**Appendix B**  
**Summary of Aquatic Vegetation and Periphyton Shipments**

**Table B-1. Summary of Aquatic Vegetation and Periphyton Shipments to Pace, 2011**

Shipment Date	COCs Shipped	Sample Type			Total Samples per COC	Shipment Sample Total
		Emergent	Shoreline	Periphyton		
21-Jun-11	RSIEV0621Y11A	29			29	58
	RSISV0621Y11A		29		29	
22-Jun-11	RSIPP0622Y11A			7	7	7
05-Aug-11	RSIPP0805Y11A			4	4	4

**Note:** For definitions, see the Acronyms list.