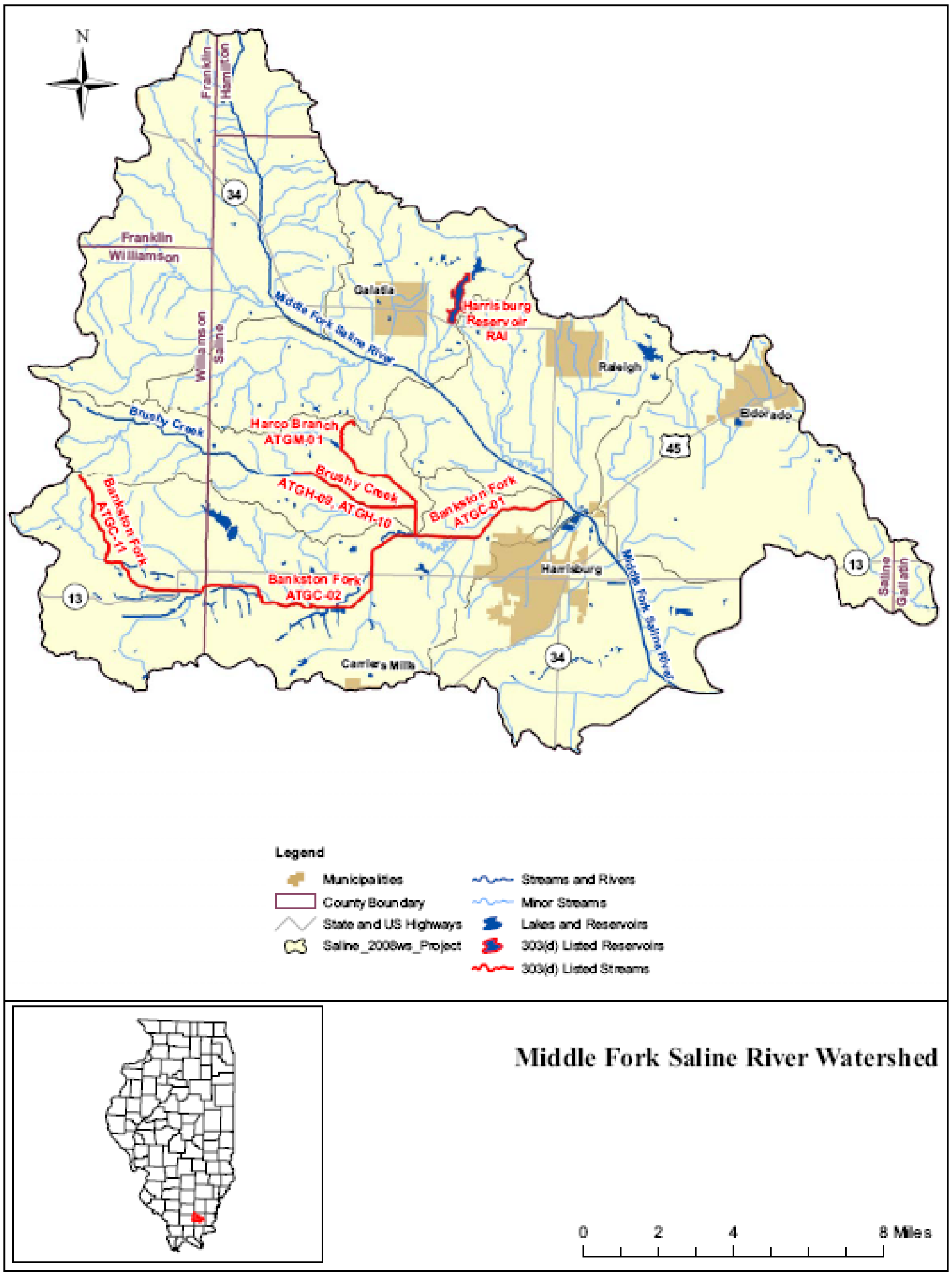
Middle Saline River Watershed TMDL Report

IEPA/BOW/11-003 November 2011



Illinois Environmental Protection Agency

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Acronyms

°F	degrees Fahrenheit
ALMP	Ambient Lake Monitoring Program
BMP	best management practice
BOD	biochemical oxygen demand
$CBOD_5$	5-day carbonaceous biochemical oxygen demand
cfs	cubic feet per second
CRP	Conservation Reserve Program
CWA	Clean Water Act
DEM	Digital Elevation Model
DMR	Discharge Monitoring Reports
DO	dissolved oxygen
DP	dissolved phosphorus
ft	foot
GIS	geographic information system
GWLF	generalized watershed loading function
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
ICLP	Illinois Clean Lakes Program
IDA	Illinois Department of Agriculture
IDNR	Illinois Department of Natural Resources
ILLCP	Illinois Interagency Landscape Classification Project
Illinois EPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
ISWS	Illinois State Water Survey
LA	load allocation
LC	loading capacity
MBI	Macroinvertebrate Biotic Index
mg/L	milligrams per liter
MOS	margin of safety
NASS	National Agricultural Statistics Service
NCDC	National Climatic Data Center
NRCS	National Resource Conservation Service
PO_4	phosphate
SSURGO	Soil Survey Geographic Database

STATSGO	State Soil Geographic
STORET	Storage and Retrieval
TMDL	total maximum daily load
TP	total phosphorus
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WLA	waste load allocation

Section 1
Goals and Objectives for Middle Fork Saline River Watershed

1.1 Total Maximum Daily Load (TMDL) Overview

A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs are a requirement of Section 303(d) of the Clean Water Act (CWA). To meet this requirement, the Illinois Environmental Protection Agency (Illinois EPA) must identify water bodies not meeting water quality standards and then establish TMDLs for restoration of water quality. Illinois EPA develops a list known as the "303(d) list" of water bodies not meeting water quality standards every two years, and it is included in the Integrated Water Quality Report. Water bodies on the 303(d) list are then targeted for TMDL development. The Illinois EPA's most recent Integrated Water Quality Report was issued in March 2008. In accordance with USEPA's guidance, the report assigns all waters of the state to one of five categories. Category 5 includes water bodies in which data have indicated that a TMDL is needed. Therefore, all waters that appear on the 303(d) list are included in Category 5 of the Integrated Water Quality Report and vice versa.

In general, a TMDL is a quantitative assessment of water quality impairments, contributing sources, and pollutant reductions needed to attain water quality standards. The TMDL specifies the amount of pollutant or other stressor that needs to be reduced to meet water quality standards, allocates pollutant control or management responsibilities among sources in a watershed, and provides a scientific and policy basis for taking actions needed to restore a water body.

Water quality standards are laws or regulations that states authorize to enhance water quality and protect public health and welfare. Water quality standards provide the foundation for accomplishing two of the principal goals of the CWA. These goals are:

- Restore and maintain the chemical, physical, and biological integrity of the nation's waters

- Where attainable, to achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water

Water quality standards consist of three elements:

- The designated beneficial use or uses of a water body or segment of a water body

- The water quality criteria necessary to protect the use or uses of that particular water body

- An antidegradation policy

Examples of designated uses are primary contact (swimming), protection of aquatic life, and public and food processing water supply. Water quality criteria describe the quality of water that will support a designated use. Water quality criteria can be expressed as numeric limits or as a narrative statement. Antidegradation policies are adopted so that water quality improvements are conserved, maintained, and protected.

1.2 TMDL Goals and Objectives for Middle Fork Saline River Watershed

The Illinois EPA has a three-stage approach to TMDL development. The stages are:

- Stage 1 – Watershed Characterization, Data Analysis, Methodology Selection
- Stage 2 – Data Collection (optional)
- Stage 3 – Model Calibration, TMDL Scenarios, Implementation Plan

This report addresses Stage 1 and Stage 3 of TMDL development for the Middle Fork Saline River watershed. Additional data were collected for some of the impaired segments during the development of this report by Illinois EPA staff. The additional data have been incorporated throughout the document and were used in the development of the TMDLs during Stage 3 of the process. Following are the impaired water body segments in the Middle Fork Saline watershed for which TMDLs were developed:

- Bankston Fork (ATGC-01)
- Bankston Fork (ATGC-02)
- Bankston Fork (ATGC-11)
- Brushy Creek (ATGH-09)
- Brushy Creek (ATGH-10)
- Harco Branch (ATGM-01)
- Harrisburg Reservoir (RAI)

These impaired water body segments are shown on Figure 1-1. There are seven impaired water body segments within the Middle Fork Saline River watershed. Table 1-1 lists the water body segment, water body size, and potential causes of impairment for the water body.

Table 1-1 Impaired Water Bodies in Middle Fork Saline River Watershed

Water Body Segment ID	Water Body Name	Size	Impaired Use	Cause of Impairment*	Potential Sources
ATGC-01	Bankston Fork	4.32 miles	Aquatic Life	**Manganese, Silver, Sulfates**	Impacts from Abandoned Mine Lands, Acid Mine Drainage, Surface Mining
				Sedimentation/Siltation, Total Suspended Solids	Acid Mine Drainage, Impacts from Abandoned Mine Lands, Surface Mining, Crop Production
			Primary Contact Recreation	**Fecal Coliform**	Unknown
ATGC-02	Bankston Fork	4.7 miles	Aquatic Life	**Manganese, Silver, Sulfates**	Surface Mining, Acid Mine Drainage, Impacts from Abandoned Mine Lands
ATGC-11	Bankston Fork	8.49 miles	Aquatic Life	**Manganese, Sulfates**	Surface Mining
ATGH-09	Brushy Creek	1.44 miles	Aquatic Life	**Manganese, Sulfates**	Surface Mining, Acid Mine Drainage, Mine Tailings
ATGH-10	Brushy Creek	3.5 miles	Aquatic Life	**Silver, Sulfates**	Surface Mining
ATGM-01	Harco Br.	3.09 miles	Aquatic Life	**Copper, Manganese, Nickel, pH, Silver, Sulfates, Zinc**	Acid Mine Drainage, Surface Mining
RAI	Harrisburg Reservoir	208.9 acres	Aesthetic Quality	**Phosphorus (Total)**	Crop Production, Runoff from Forest/Grassland/Parkland, Urban Runoff/Storm Sewers
				Total Suspended Solids	Runoff from Forest/Grassland/Parkland, Littoral/shore Area Modifications

* **Bold Causes of Impairment do have numeric water quality standard and TMDLs were be developed.** *Italicized Causes of Impairment do not have numeric water quality standard.*

Illinois EPA is currently only developing TMDLs for parameters that have numeric water quality standards. Therefore, the remaining sections of this report will focus on the pH, total fecal coliform, manganese, silver, copper, nickel, sulfates, zinc, and total phosphorus (numeric standard) impairments in the Middle Fork Saline River watershed.

Total suspended solids and sedimentation/siltation are causes of impairments that do not have numeric water quality standards, so TMDLs for these causes were not developed for this report. However, in the implementation plans completed during Stage 3 of the TMDL these potential causes are discussed and would likely be addressed and mitigated through implementation of the recommended controls for the pollutants that do have numeric water quality standards. The recommended controls for each impaired segment include measures for reducing erosion and sediment loading which would address the impairments caused by total suspended solids and sedimentation/siltation.

The TMDL for the segments listed above specify the following elements:

- Loading Capacity (LC) or the maximum amount of pollutant loading a water body can receive without violating water quality standards
- Waste Load Allocation (WLA) or the portion of the TMDL allocated to existing or future point sources
- Load Allocation (LA) or the portion of the TMDL allocated to existing or future nonpoint sources and natural background
- Margin of Safety (MOS) or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality

These elements are combined into the following equation:

$$\mathbf{TMDL = LC = \Sigma WLA + \Sigma LA + MOS}$$

The TMDL developed must also take into account the seasonal variability of pollutant loads so that water quality standards are met during all seasons of the year. Also, reasonable assurance that the TMDL will be achieved is described in the implementation plan. The implementation plan for the Middle Fork Saline River watershed (see Section 9) describes how water quality standards will be attained. This implementation plan includes recommendations for implementing best management practices (BMPs), cost estimates, institutional needs to implement BMPs and controls throughout the watershed, and a timeframe for completion of implementation activities.

1.3 Report Overview

The remaining sections of this report contain:

- **Section 2 Middle Fork Saline River Watershed Characteristics** provides a description of the watershed's location, topography, geology, land use, soils, population, and hydrology
- **Section 3 Public Participation and Involvement** discusses public participation activities that occurred throughout the TMDL development
- **Section 4 Middle Fork Saline River Watershed Water Quality Standards** defines the water quality standards for the impaired water bodies

- **Section 5 Middle Fork Saline River Watershed Characterization** presents the available water quality data needed to develop TMDLs, discusses the characteristics of the impaired reservoirs in the watershed, and also describes the point and non-point sources with potential to contribute to the watershed load

- **Section 6 Approach to Developing TMDL and Identification of Data Needs** makes recommendations for the models and analysis that are needed for TMDL development and also suggests segments for Stage 2 data collection

- **Section 7 Methodology Development for the Middle Fork Saline River Watershed** details the development of the TMDLs for each impaired segment or water body

- **Section 8 Total Maximum Daily Loads for the Middle Fork Saline River Watershed** provides the results of the TMDL analysis for each impaired stream segment or water body

- **Section 9 Implementation Plan for the Middle Fork Saline River Watershed** makes recommendations for implementation actions, point source controls, management measures, and BMPs that can be used to address water quality issues in the watershed

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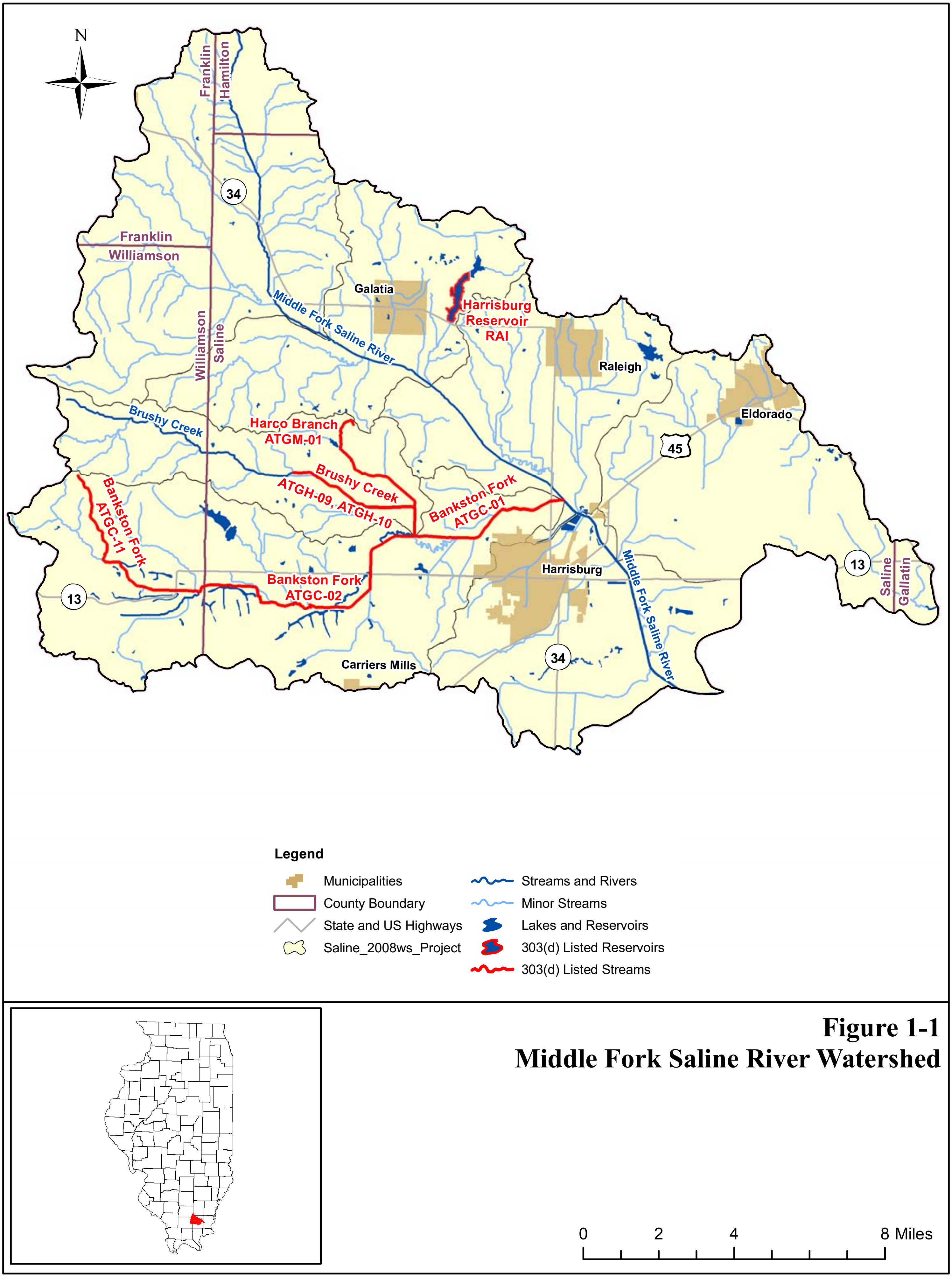

Figure 1-1
Middle Fork Saline River Watershed

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Section 2
Middle Fork Saline River Watershed Description

2.1 Middle Fork Saline River Watershed Location

The Middle Fork Saline River watershed (Figure 1-1), located in southern Illinois, flows in a southeasterly direction and drains approximately 160,562 acres. Approximately 119,182 acres lie in Saline County, 28,929 acres lie in eastern Williamson County, 7,586 acres lie in southeastern corner of Franklin County, 3,567 acres lie in southwestern corner of Hamilton County, and 1,298 acres lie in the southeastern corner of Gallatin County.

2.2 Topography

Topography is an important factor in watershed management because stream types, precipitation, and soil types can vary dramatically by elevation. National Elevation Dataset (NED) coverages containing 30-meter grid resolution elevation data are available from the U.S. Geological Survey (USGS) for each 1:24,000-topographic quadrangle in the United States. Elevation data for the Middle Fork Saline River watershed was obtained by overlaying the NED grid onto the GIS-delineated watershed. Figure 2-1 shows the elevations found within the watershed.

Elevation in the Middle Fork Saline River watershed ranges from 1,068 feet above sea level near the headwaters of Brushy Creek in the western part of the watershed to 275 feet at its most downstream point in the southeastern part of the watershed near the Middle Fork of the Saline River.

2.3 Land Use

Land use data for the Middle Fork Saline River watershed were extracted from the Illinois Gap Analysis Project (IL-GAP) Land Cover data layer. IL-GAP was started at the Illinois Natural History Survey (INHS) in 1996, and the land cover layer was the first component of the project. The IL-GAP Land Cover data layer is a product of the Illinois Interagency Landscape Classification Project (IILCP), an initiative to produce statewide land cover information on a recurring basis cooperatively managed by the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), the Illinois Department of Agriculture (IDA), and the Illinois Department of Natural Resources (IDNR). The land cover data was generated using 30-meter grid resolution satellite imagery taken during 1999 and 2000. The IL-GAP Land Cover data layer contains 23 land cover categories, including detailed classification in the vegetated areas of Illinois. Appendix A contains a complete listing of land cover categories. (Source: IDNR, INHS, IDA, USDA NASS's 1:100,000 Scale Land Cover of Illinois 1999-2000, Raster Digital Data, Version 2.0, September 2003.)

The land use of the Middle Fork Saline River watershed was determined by overlaying the IL-GAP Land Cover data layer onto the GIS-delineated watershed. Table 2-1 contains the land uses contributing to the Middle Fork Saline River watershed, based on the IL-GAP land cover categories, and also includes the area of each land cover category and percentage of the watershed area. Figure 2-2 illustrates the land uses of the watershed.

The land cover data reveal that approximately 113,364 acres, representing about 71 percent of the total watershed area, are devoted to agricultural activities. Soybean and corn farming account for about 22 percent and 19 percent of the watershed area, respectively, and rural grassland accounts for about 25 percent. Upland accounts for about 10 percent and floodplain forest accounts for about 8 percent. Other land cover types each represent less than three percent of the watershed area.

Table 2-1 Land Cover and Land Use in Middle Fork Saline River Watershed

Land Cover Category	Area (Acres)	Percentage
Rural Grassland	40,574	25.3
Soybeans	35,507	22.1
Corn	29,954	18.7
Upland Forest	16,415	10.2
Floodplain Forest	13,201	8.2
Low/Medium Density	3,959	2.5
Surface Water	3,399	2.1
Urban Open Space	3,388	2.1
Winter Wheat	2,709	1.7
Winter Wheat/Soybeans	2,402	1.5
Partial Canopy/Savannah Upland	1,664	1.0
High Density	1,287	0.8
Other Small Grains & Hay	1,221	0.8
Coniferous	1,123	0.7
Other Agriculture	996	0.6
Barren & Exposed Land	834	0.5
Shallow Water	670	0.4
Swamp	480	0.3
Shallow Marsh/Wet Meadow	406	0.3
Deep Marsh	328	0.2
Seasonally/Temporarily Flooded	42	<0.1
Total	**160,562**	**100**

2.4 Soils

Two types of soil data are available for use within the state of Illinois through the Natural Resource Conservation Service (NRCS). General soils data and map unit delineations for the entire state are provided as part of the State Soil Geographic (STATSGO) database. Soil maps for the database are produced by generalizing detailed soil survey data. The mapping scale for STATSGO is 1:250,000. More detailed soils data and spatial coverages are available through the Soil Survey Geographic (SSURGO) database for a limited number of counties. For SSURGO data, field mapping methods using national standards are used to construct the soil maps. Mapping scales generally range from 1:12,000 to 1:63,360 making SSURGO the most detailed level of soil mapping done by the NRCS.

At this time, SSURGO data is available for all the counties within the Middle Fork Saline River. Attributes of the spatial coverage can be linked to the SSURGO databases, which provide information on various chemical and physical soil characteristics for each map unit and soil series. Of particular interest for TMDL development are the hydrologic soil groups as well as the K-factor of the Universal Soil Loss Equation. The following sections describe and summarize the specified soil characteristics for the Middle Fork Saline River watershed.

2.4.1 Middle Fork Saline River Watershed Soil Characteristics

Appendix B contains a table of the SSURGO soil series for the Middle Fork Saline River watershed. Various soil types exist in the watershed, but no single type covers more than 2 percent of the watershed. The table also contains the area, dominant hydrologic soil group, and k-factor range. Each of these characteristics is described in more detail in the following paragraphs.

Figure 2-3 shows the hydrologic soils groups found within the Middle Fork Saline River watershed. Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms. Hydrologic soil groups B, C, D, B/D, and C/D are found within the Middle Fork Saline River watershed. The majority of the watershed falls into group C. Group C soils are defined as having "moderately high runoff potential when thoroughly wet." These soils have a low rate of water transmission (NRCS 2007).

A commonly used soil attribute is the K-factor. The K-factor:

> *Indicates the susceptibility of a soil to sheet and rill erosion by water.* (The K-factor) *is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water (NRCS 2005).*

The distribution of K-factor values in the Middle Fork Saline River watershed range from 0.17 to 0.43.

2.5 Population

The Census 2000 TIGER/Line data from the U.S. Census Bureau were retrieved. Geographic shapefiles of census blocks were downloaded for Franklin, Hamilton, Saline, and Williamson Counties. The census block shapefiles were clipped to each watershed so that only block populations directly associated with the watershed would be counted. City populations were taken from the U.S. Census Bureau. For municipalities located along a watershed border, population was estimated based on the percentage of the municipalities' area within the watershed boundary.

Approximately 19,450 people reside in the Middle Fork Saline River watershed. The major municipalities in the watershed are shown in Figure 1-1. The largest urban development in the watershed is the city of Harrisburg, which is located approximately in the center of the Middle Fork Saline River watershed.

2.6 Climate, Pan Evaporation, and Streamflow

2.6.1 Climate

Southern Illinois has a temperate climate with hot summers and cold, snowy winters. Monthly precipitation data from Harrisburg, Illinois (station id. 3879) in Saline County were extracted from the NCDC database for the years of 1901 through 2006. The data station in Harrisburg, Illinois was chosen to be representative of precipitation throughout the Middle Fork Saline River watershed.

Table 2-2 contains the average monthly precipitation along with average high and low temperatures for the period of record. The average annual precipitation is approximately 38.4 inches.

Table 2-2 Average Monthly Climate Data in Harrisburg, IL

Month	Total Precipitation (inches)	Maximum Temperature (degrees F)	Minimum Temperature (degrees F)
January	2.4	43	24
February	2.1	47	27
March	3.5	58	36
April	3.8	68	45
May	4.2	76	53
June	4.1	86	63
July	3.3	89	65
August	3.3	90	65
September	3.2	82	57
October	3.0	72	46
November	3.1	57	36
December	2.4	45	27
Total	**38.4**	**68**	**45**

2.6.2 Pan Evaporation

Through the ISWS website, pan evaporation data are available from nine locations across Illinois (ISWS 2007). The Dixon Springs station was chosen to be representative of pan evaporation conditions for Harrisburg Lake. The Dixon Springs station is located approximately 30 miles south of the Harrisburg Lake. The station was chosen for its proximity to the 303(d)-listed water bodies and stream segments in southern Illinois and the completeness of the dataset compared to other stations. The average monthly pan evaporation at the Dixon Springs station for the years 1983 to 2002 yields an average annual pan evaporation of 48.1 inches. Actual evaporation is typically less than pan evaporation, so the average annual pan evaporation was multiplied by 0.75 to calculate an average annual evaporation of 36.1 inches (ISWS 2007).

2.6.3 Streamflow

Analysis of the Middle Fork Saline River watershed requires an understanding of flow throughout the drainage area. Three USGS gages within the watershed have historic data available, which are summarized with respective information in Table 2-3.

Table 2-3 Streamflow Gages in the Middle Fork Saline River Watershed

Gage Number	Name	POR
03382160	Bankston Fork near Crab Orchard, IL	1978-1980
03382170	Brushy Creek near Harco, IL	1922-1932
03382200	Middle Fork Saline River Near Harrisburg, IL	1966-1982

Since there are no gages within the watershed that have data for the past 20 years, stage data were estimated using the drainage area ratio method, represented by the following equation.

$$Q_{gaged}\left(\frac{Area_{ungaged}}{Area_{gaged}}\right) = Q_{ungaged}$$

where Q_{gaged} = Streamflow of the gaged basin
$Q_{ungaged}$ = Streamflow of the ungaged basin
$Area_{gaged}$ = Area of the gaged basin
$Area_{ungaged}$ = Area of the ungaged basin

The assumption behind the equation is that the flow per unit area is equivalent in watersheds with similar characteristics. Therefore, the flow per unit area in the gaged watershed multiplied by the area of the ungaged watershed estimates the flow for the ungaged watershed.

USGS gage 05597500 (Crab Orchard Creek near Marion, Illinois) was chosen as an appropriate gage from which to estimate flows for all impaired stream segments in the Middle Fork Saline River watershed. The Crab Orchard Creek watershed is approximately 9 miles west of the nearest sampling site on the impaired segments in the Middle Fork Saline River watershed (ATGC-11) and approximately 19 miles west of the furthest sampling site in the watershed (ATGC-01). The gage drains an area of 31.7 square miles, which is within an order of magnitude in size as the watersheds delineated for the impaired segments in the Middle Fork Saline River watershed. GIS analysis shows that the surrogate gage watershed has similar land use, soils, and topography as the Middle Fork Saline watershed. Data also show that the surrogate gage watershed receives comparable precipitation throughout the year. Surrogate flow data are discussed in further detail in Section 7.

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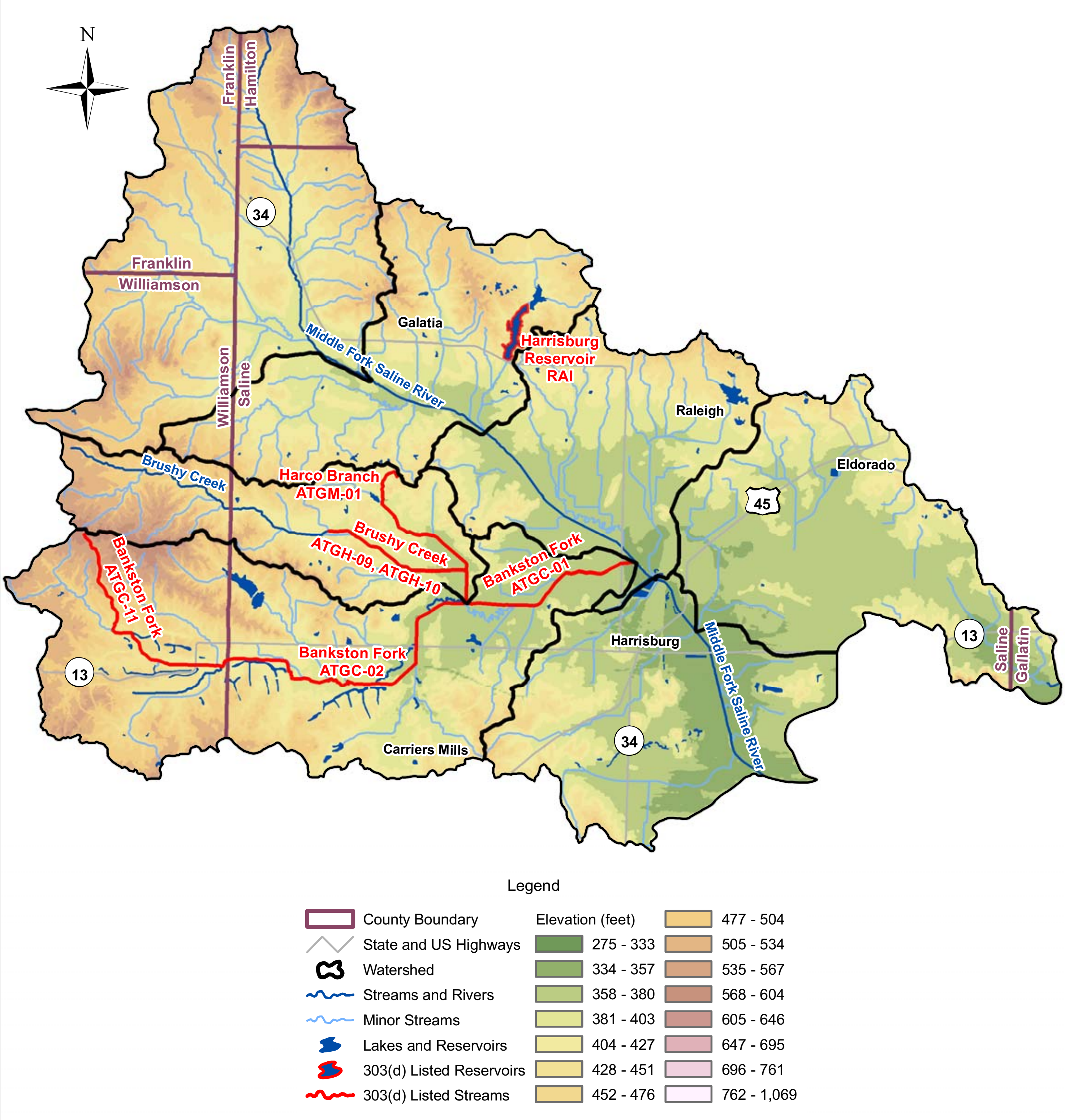


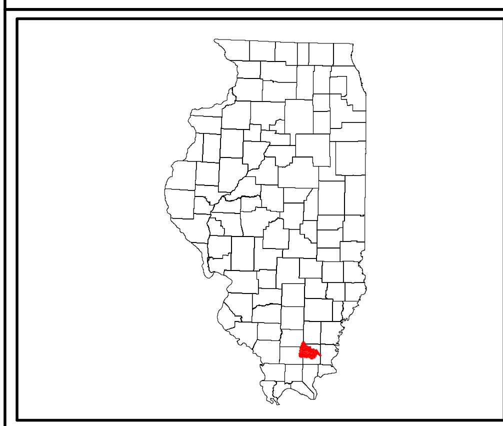
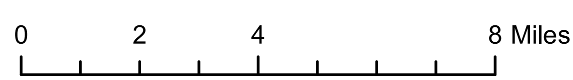


Figure 2-1
Middle Fork Saline River Watershed
Elevation



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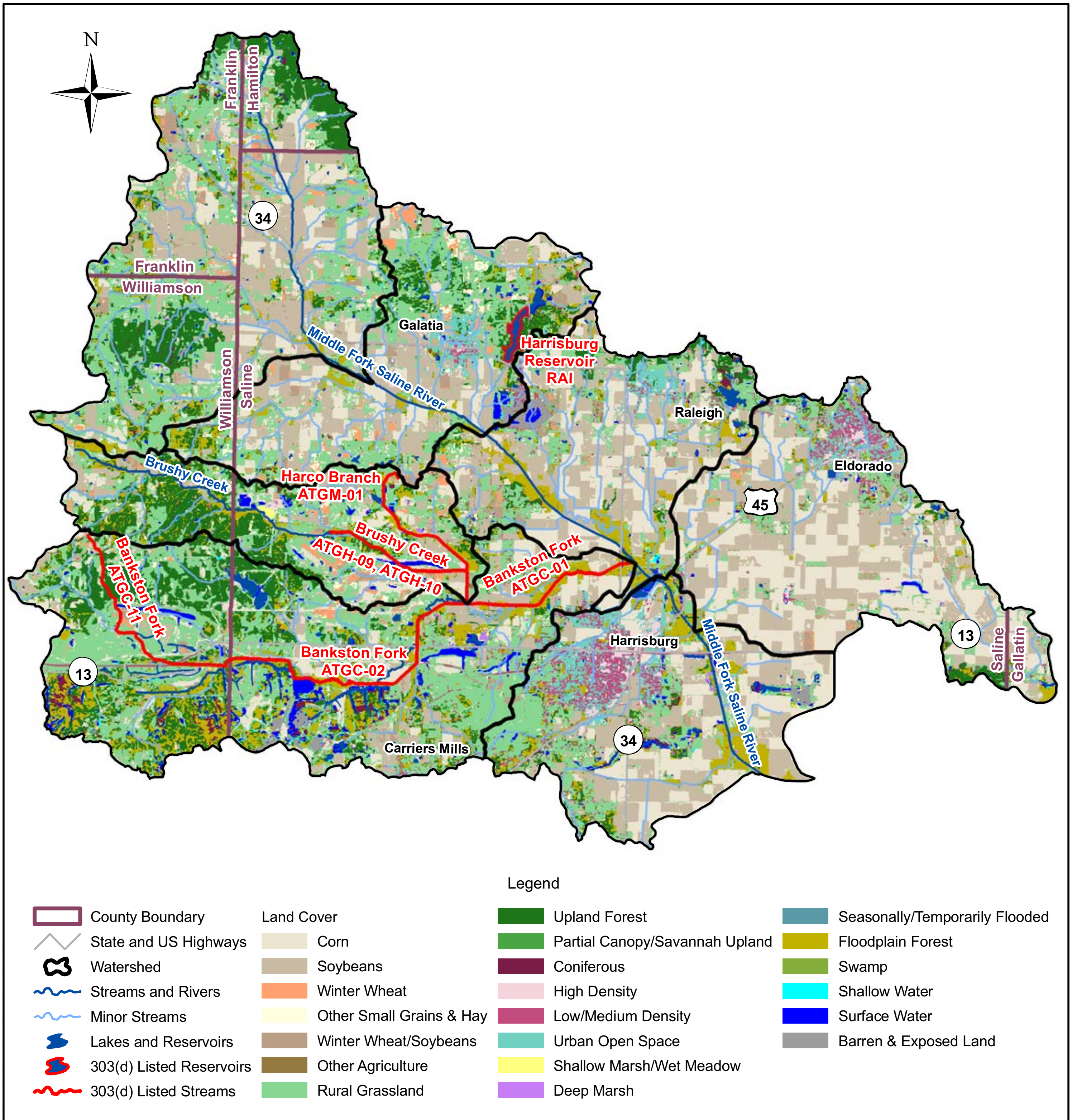

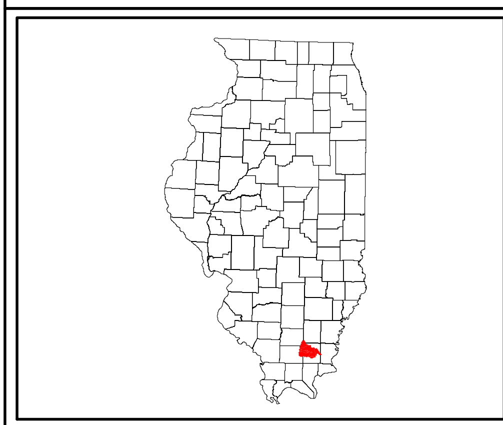

Figure 2-2
Middle Fork Saline River Watershed
Land Use

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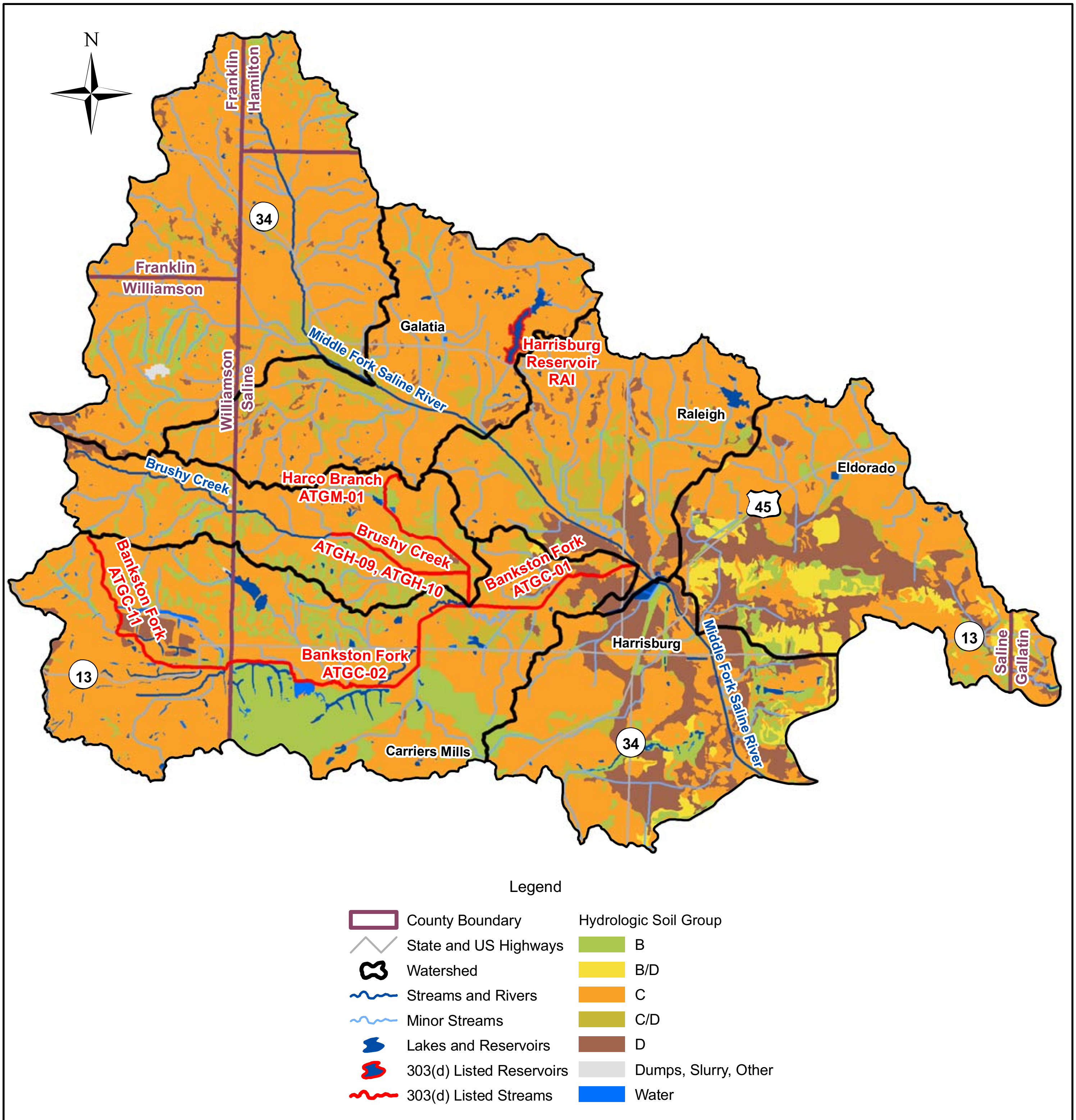

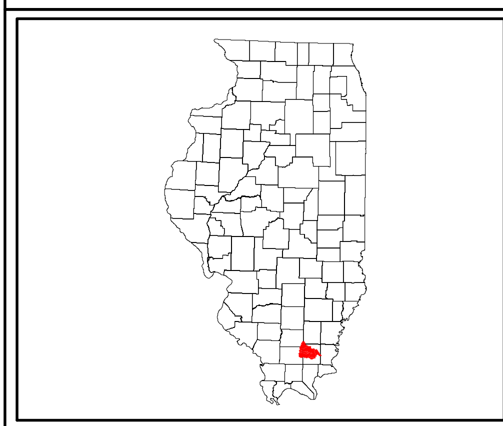

Figure 2-3
Middle Fork Saline River Watershed
Soils

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Section 3
Public Participation and Involvement

3.1 Middle Fork Saline River Watershed Public Participation and Involvement

Public knowledge, acceptance, and follow through are necessary to implement a plan to meet recommended TMDLs. It is important to involve the public as early in the process as possible to achieve maximum cooperation and counter concerns as to the purpose of the process and the regulatory authority to implement any recommendations.

Illinois EPA, along with CDM, held two public meetings within the watershed throughout the course of the TMDL development. Following the completion of Stage 1 of the TMDL process, a public meeting was held in Harrisburg, Illinois on May 12, 2009. No public response comments were received at this meeting. Similarly, a public meeting was held in Harrisburg on August 10, 2010 following the completion of Stage 3 of the TMDL process for the Middle Fork Saline River watershed. Illinois EPA did not receive any comments following this meeting from attendees or other members of the public.

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Section 4
Middle Fork Saline River Watershed Water Quality Standards

4.1 Illinois Water Quality Standards

Water quality standards are developed and enforced by the state to protect the "designated uses" of the state's waterways. In the state of Illinois, setting the water quality standards is the responsibility of the Illinois Pollution Control Board (IPCB). Illinois is required to update water quality standards every three years in accordance with the CWA. The standards requiring modifications are identified and prioritized by Illinois EPA, in conjunction with USEPA. New standards are then developed or revised during the three-year period.

Illinois EPA is also responsible for developing scientifically based water quality criteria and proposing them to the IPCB for adoption into state rules and regulations. The Illinois water quality standards are established in the Illinois Administrative Rules Title 35, Environmental Protection; Subtitle C, Water Pollution; Chapter I, Pollution Control Board; Part 302, Water Quality Standards.

4.2 Designated Uses

The waters of Illinois are classified by designated uses, which include: General Use, Public and Food Processing Water Supplies, Lake Michigan, and Secondary Contact and Indigenous Aquatic Life Use (Illinois EPA 2005). The designated uses applicable to the Middle Fork Saline River watershed are the General Use.

4.2.1 General Use

The General Use classification is defined by IPCB as standards that "will protect the state's water for aquatic life, wildlife, agricultural use, secondary contact use, and most industrial uses and ensure the aesthetic quality of the state's aquatic environment." Primary contact uses are protected for all General Use waters whose physical configuration permits such use.

4.3 Illinois Water Quality Standards

To make 303(d) listing determinations for aquatic life uses, Illinois EPA first collects biological data and if this data suggests that an impairment to aquatic life exists, a comparison of available water quality data with water quality standards will then occur. For public and food processing water supply waters, Illinois EPA compares available data with water quality standards to make impairment determinations. Tables 4-1 and 4-2 present the numeric water quality standards of the potential causes of impairment for both lakes and streams in the Middle Fork Saline River watershed. Only constituents with numeric water quality standards will have TMDLs developed at this time.

Table 4-1 Summary of Water Quality Standards for Potential Causes of Lake Impairments in Harrisburg Reservoir

Parameter	Units	General Use Water Quality Standard	Regulatory Reference
Total Phosphorus	mg/L	0.05[(1)]	302.205

mg/L = milligrams per liter
(1) Standard applies in particular to inland lakes and reservoirs (greater than 20 acres) and in any stream at the point where it enters any such lake or reservoir.

Table 4-2 Summary of Numeric Water Quality Standards for Potential Causes of Stream Impairments in Middle Fork Saline River Watershed

Parameter	Units	General Use Water Quality Standard	Regulatory Reference
Manganese (total)	µg/L	1000	302.208(g)
Total Fecal Coliform	Count/ 100 mL	*May through October* 200[(1)], 400[(2)]	302.209
pH	s.u.	6.5-9	302.204
Silver	µg/L	5	302.208(g)
Sulfates	mg/L	Chloride and Hardness Dependent[(3)]	302.208(g)
Nickel (dissolved)	µg/L	Acute standard[(4)] = (exp[0.5173+0.8460 x ln(H)]) x 0.998* Chronic standard[(5)] = (exp[-2.286+0.8460 x ln(H)]) x 0.997*	302.208(e)
Copper (dissolved)	µg/L	Acute standard[(4)] = (exp[-1.464+0.9422 x ln(H)]) x 0.960* Chronic standard[(5)] = (exp[-1.465+0.8545 x ln(H)]) x 0.960*	302.208(e)
Zinc (dissolved)	µg/L	Acute standard[(4)] = (exp[0.9035+0.8473 x ln(H)]) x 0.978* Chronic standard[(5)] = (exp[-0.8165+0.8473 x ln(H)]) x 0.986*	302.208(e)

µg/L = micrograms per liter
mg/L = milligrams per liter
* = conversion factor multiplier for dissolved metals
(1) Geometric mean based on a minimum of five samples taken over not more than a 30-day period.
(2) Standard shall not be exceeded by more than 10 percent of the samples collected during any 30-day period.
(3) Sulfate standard was updated in 2008 to read:

1. At any point where water is withdrawn or accessed for purposes of livestock watering, the average of sulfate concentrations must not exceed 2,000 mg/L when measured at a representative frequency over a 30 day period.

2. The results of the following equations provide sulfate water quality standards in mg/L for the specified ranges of hardness (in mg/L as $CaCO_3$) and chloride (in mg/L) and must be met at all times:

*a. If the hardness concentration of receiving waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L, and if the chloride concentration of waters is greater than or equal to 25 mg/L but less than or equal to 500 mg/L, then: C = [1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65 where, C = sulfate concentration*

*b. If the hardness concentration of waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L, and if the chloride concentration of waters is greater than or equal to 5 mg/L but less than 25 mg/L, then: C = [-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65 where C = sulfate*

Table 4-2 Summary of Numeric Water Quality Standards for Potential Causes of Stream Impairments in Middle Fork Saline River Watershed

Parameter	Units	General Use Water Quality Standard	Regulatory Reference

concentration

3. The following sulfate standards must be met at all times when hardness (in mg/L as $CaCO_3$) and chloride (in mg/L) concentrations other than specified above are present:

a. If the hardness concentration of waters is less than 100 mg/L or chloride concentration of waters is less than 5 mg/L, the sulfate standard is 500 mg/L.

b. If the hardness concentration of waters is greater than 500 mg/L and the chloride concentration of waters is 5 mg/L or greater, the sulfate standard is 2,000 mg/L.

c. If the combination of hardness and chloride concentrations of existing waters are not reflected in subsections [above]*, the sulfate standard may be determined in a site-specific rulemaking pursuant to section 303(c) of the Federal Water Pollution Control Act of 1972 (Clean Water Act), 33 USC 1313, and Federal Regulations at 40 CFR. 131.10(j)(2).*

(4) Not to be exceeded except as provided in 35 Ill. Adm. Code 302.208(d).

(5) Not to be exceeded by the arithmetic average of at least four consecutive samples collected over any period of at least four days except as provided in 35 Ill. Adm. Code 302.208(d). The samples used to demonstrate attainment or lack of attainment with a chronic standard must be collected in a manner that assures an average representative of the sampling period. To calculate attainment status of chronic metals standards, the concentration of the metal in each sample is divided by the calculated water quality standard for the sample to determine a quotient. The water quality standard is attained if the mean of the sample quotients is less than or equal to one for the duration of the averaging period.

4.4 Potential Pollutant Sources

In order to properly address the conditions within the Middle Fork Saline River watershed, potential pollution sources must be investigated for the pollutants where TMDLs will be developed. The following is a summary of the potential sources associated with the listed potential causes for the 303(d) listed segments in this watershed. Further detail on potential pollutant sources is provided in Section 5.

Table 4-3 Summary of Potential Pollutant Sources in the Middle Fork Saline River Watershed

Segment ID	Segment Name	Potential Causes of Impairment	Potential Sources (as identified by the 2006 303(d) list)
ATGC-01	Bankston Fork	**Manganese**, **Silver**, Sedimentation/Siltation, **Sulfates**, Total Suspended Solids, **Fecal Coliform**	Impacts from Abandoned Mine Lands, Acid Mine Drainage, Surface Mining, Unknown, Crop Production
ATGC-02	Bankston Fork	**Manganese**, **Silver**, **Sulfates**	Surface Mining, Acid Mine Drainage, Impacts from Abandoned Mine Lands
ATGC-11	Bankston Fork	**Manganese**, **Sulfates**	Surface Mining
ATGH-09	Brushy Creek	**Manganese**, **Sulfates**	Surface Mining, Acid Mine Drainage, Mine Tailings
ATGH-10	Brushy Creek	**Silver**, **Sulfates**	Surface Mining
ATGM-01	Harco Branch	**Copper**, **Manganese**, **Nickel**, **pH**, **Silver**, **Sulfates**, **Zinc**	Acid Mine Drainage, Surface Mining
RAI	Harrisburg Reservoir	**Phosphorus (Total)**, Total Suspended Solids	Crop Production, Runoff from Forest/Grassland/Parkland, Urban Runoff/Storm Sewers, Littoral/shore Area Modifications

***Bold Potential Causes of Impairment have numeric water quality standard and TMDLs will be developed.**

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Section 5
Middle Fork Saline River Watershed Characterization

Data were collected and reviewed from many sources in order to further characterize the Middle Fork Saline River watershed. Data have been collected in regards to water quality, reservoirs, and both point and nonpoint sources. This information is presented and discussed in further detail in the remainder of this section.

5.1 Water Quality Data

There are 10 historic water quality stations within the Middle Fork Saline River watershed, including 3 stations found on Harrisburg Reservoir that were used for this report. Figure 5-1 shows the water quality data stations within the watershed that contain data relevant to the impaired segments.

The impaired water body segments in the Middle Fork Saline River watershed were presented in Section 1. Refer to Table 1-1 for impairment information specific to each segment. The following sections address both stream and lake impairments. Data are summarized by impairment and discussed in relation to the relevant Illinois numeric water quality standard. Data analysis is focused on all available data collected since 1990. The information presented in this section is a combination of USEPA Storage and Retrieval (STORET) database and Illinois EPA database data. STORET data are available for stations sampled prior to January 1, 1999, while Illinois EPA data (electronic and hard copy) are available for stations sampled after that date. Illinois EPA collected additional data for a number of segments and parameters in 2008 and 2009. These data have been incorporated into this report. The following sections will first discuss Middle Fork Saline River watershed stream data followed by Middle Fork Saline River watershed lake data.

5.1.1 Stream Water Quality Data

The Middle Fork Saline River watershed has 7 impaired stream segments within its drainage area that are addressed in this report. There is one active water quality station on each of the 7 impaired segments (see Figure 5-1). The data summarized in this section include water quality data for impaired constituents as well as parameters that could be useful in future modeling and analysis efforts. All historic water quality data are available in Appendix C.

5.1.1.1 Fecal Coliform

Bankston Fork segment ATGC-01 is listed for impairment caused by total fecal coliform. Table 5-1 summarizes available historic fecal coliform data on the segment. The general use water quality standard for fecal coliform states that the standard of 200 cfu per 100 mL not be exceeded by the geometric mean of at least five samples, nor can 10 percent of the samples collected exceed 400 cfu per 100 mL in protected waters, except as provided in 35 Ill. Adm. Code 302.209(b). Samples must be collected over a 30-day period or less during the months of May through October. There are no instances since 1990 where at least five samples have been collected during a 30-day period. The summary of data presented in Table 5-1 reflects single samples compared to the standards during the appropriate months. Figure 5-2 shows the total fecal coliform samples collected over time at segment ATGC-01.

Table 5-1 Existing Fecal Coliform Data for Bankston Fork

Sample Location and Parameter	Period of Record and Number of Data Points	Geometric mean of all samples	Maximum	Minimum	Number of samples > 200 [1]	Number of samples > 400 [1]
Bankston Fork Segment ATGC-01; Sample Location ATGC-01						
Total Fecal Coliform (cfu/100 mL)	1990-2005; 64	172.2	28000	3	26	18

[1] Samples collected during the months of May through October

5.1.1.2 pH

Harco Branch segment ATGM-01 is listed for impairment caused by pH. A sample is considered a violation if it falls below 6.5 or above 9.0 standard units at any time. A total of 3 samples have been collected since 1990 from the impaired segment. As shown, all 3 of the samples collected at ATGM-01 during this time period were in violation of the standard.

Table 5-2 Existing pH Data for Harco Branch

Sample Location	Sample Date	Result (s.u.)
ATGM01	6/17/1993	2.34
ATGM01	9/28/1993	2.50
ATGM01	12/13/1993	3.08

5.1.1.3 Sulfates

Harco Branch segment ATGM-01, Bankston Fork segments ATGC-01, ATGC-02, ATGC-11, and Brushy Creek segments ATGH-09 and ATGH-10 are listed for impairment of the aquatic life use by sulfates. The Illinois water quality standard for sulfate was updated in 2008 making the standard variable based on chloride concentrations and hardness conditions in the waterbody. The full details of the standard were presented in Section 4. Table 5-3 summarizes the results of the 146 samples collected from impaired stream segments in this watershed between 1990 and 2008. Figure 5-3 shows the sulfate sample results graphically.

Table 5-3 Existing Sulfates Data for Middle Fork Saline River Watershed Impaired Stream Segments

Sample Location and Parameter	Illinois WQ Standard (mg/L)	Period of Record and Number of Data Points	Mean	Maximum	Minimum	Number of Violations(1)
Harco Branch Segment ATGM-01; Sample Location ATGM-01						
Sulfates	Hardness & Chloride Dependent	1993, 2008; 6	672	1580	74.9	0
Bankston Fork Segment ATGC-01; Sample Location ATGC-01						
Sulfates	Hardness & Chloride Dependent	1990-2005; 116	1287	3040	12	22
Bankston Fork Segment ATGC-02; Sample Location ATGC-02						
Sulfates	Hardness & Chloride Dependent	1993, 2008; 6	1170	2070	150	0
Bankston Fork Segment ATGC-11; Sample Location ATGC-11						
Sulfates	Hardness & Chloride Dependent	1993, 2008; 6	1198	2542	27	3
Brushy Creek Segment ATGH-09; Sample Location ATGH-09						
Sulfates	Hardness & Chloride Dependent	1993, 2008; 6	1217	3220	150	1
Brushy Creek Segment ATGH-10; Sample Location ATGH-10						
Sulfates	Hardness & Chloride Dependent	1993, 2008; 6	739	2410	150	1

(1) Violations of new chloride and hardness dependent sulfate standard implemented in Illinois in 2008.

5.1.1.4 Metals

The following segments are listed for aquatic life use impairments caused by metals:

- Bankston Fork segment ATGC-01: Manganese and Silver
- Bankston Fork segment ATGC-02: Manganese and Silver
- Bankston Fork segment ATGC-11: Manganese
- Harco Branch segment ATGM-01: Copper, Manganese, Nickel, Silver, and Zinc
- Brushy Creek segment ATGH-09: Manganese
- Brushy Creek segment ATGH-10: Silver

Table 5-4 contains a summary of metal data collected on impaired segments. The standards for copper, nickel, and zinc are dependent on hardness. Hardness data have been collected in conjunction with these parameters. The number of violations presented in Table 5-4 for these hardness-dependent parameters represent violations of the general use chronic standard. Figure 5-4 shows manganese concentration overtime on Bankston Fork segment ATGC-01. Figure 5-5 shows silver concentrations overtime on the same stream segment. Charts were not developed for the other impaired stream segments in this watershed due to low data availability. All water quality data are available for review in Appendix C.

Table 5-4 Existing Metals Data for Middle Fork Saline River Watershed Impaired Stream Segments

Sample Location and Parameter	Illinois WQ Standard (µg/L)	Period of Record and Number of Data Points	Mean	Maximum	Minimum	Number of Violations
Bankston Fork segment ATGC-01; Sample Location ATGC-01						
Manganese (total)	1000	1990-2005; 137	9766.7	12000	7700	3
Silver (total)	5	1990-2005; 137	3.62	17	0.38(1)	13
Bankston Fork segment ATGC-02; Sample Location ATGC-02						
Manganese (total)	1000	1993, 2008; 6	562	2100	77.4	1
Silver (total)	5	1993, 2008; 6	4.35	13	0.38(1)	2
Bankston Fork segment ATGC-11; Sample Location ATGC-11						
Manganese (total)	1000	1993, 2008; 6	888	2300	69.2	2
Harco Branch segment ATGM-01; Sample Location ATGM-01						
Copper (dissolved)	hardness dependent	1993, 2008; 6	68	190	2.6	2 (2)
Manganese (total)	1000	1993, 2008; 6	5119	12000	253	3
Nickel (dissolved)	hardness dependent	1993, 2008; 6	209	440	3.8	3(2)
Silver (total)	5	1993, 2008; 6	3.9	10	0.38(1)	2
Zinc (dissolved)	hardness dependent	1993, 2008; 6	3654	7400	2.58	3(2)
Brushy Creek segment ATGH-09; Sample Location ATGH-09						
Manganese (total)	1000	1993, 2008; 6	620	1500	162	1
Brushy Creek segment ATGH-10; Sample Location ATGH-10						
Silver (total)	5	1993, 2008; 6	4.1	14	0.38(1)	1

(1) Laboratory minimum detection limit substituted for non-detect samples

(2) Both the chronic and acute standards were exceeded

5.1.2 Lake Water Quality Data

The Middle Fork Saline River watershed has one impaired lake within its drainage area that is addressed in this report. The data summarized in this section include water quality data for the impaired constituents as well as parameters that could be useful in future modeling and analysis efforts. All historic water quality data are available in Appendix C.

5.1.2.1 Harrisburg Reservoir

Harrisburg Reservoir is listed for impairment caused by total phosphorous. There are three active stations on Harrisburg Reservoir (see Figure 5-1). An inventory of all available data associated with the impairment at all depths is presented in Table 5-5.

Table 5-5 Harrisburg Reservoir Data Inventory for Impairments

Harrisburg Reservoir Segment RAI; Sample Locations RAI-1, RAI-2, and RAI-3		
RAI-1	**Period of Record**	**Number of Samples**
Dissolved Phosphorus	1995 - 2002	21
Total Phosphorus	1993-1995 - 2002	2
RAI-2		
Dissolved Phosphorus	1995 - 2002	10
Total Phosphorus	1995 - 2002	10
RAI-3		
Dissolved Phosphorus	1995 - 2002	10
Total Phosphorus	1995 - 2002	11

Table 5-6 contains information on data availability for other parameters that may be useful in data needs analysis and future modeling efforts for phosphorus and nitrogen as nitrate. The inventory presented in Table 5-6 represents data collected at varying depths.

Table 5-6 Harrisburg Lake Data Availability for Data Needs Analysis and Future Modeling Efforts

Harrisburg Lake Segment RAI; Sample Locations RAI-1, RAI-2, and RAI-3		
RAI-1	**Period of Record**	**Number of Samples**
Chlorophyll-a Corrected	1995 - 2002	5
Chlorophyll-a Uncorrected	1995 - 2002	6
Dissolved Oxygen	1995 - 2002	92
Water Temperature	1995 - 2002	92
Depth	1995 - 2002	17
RAI-2		
Chlorophyll-a Corrected	1995 - 2002	5
Chlorophyll-a Uncorrected	1995 - 2002	5
Dissolved Oxygen	1995 - 2002	41
Water Temperature	1995 - 2002	41
Depth	1995 - 2002	10
RAI-3		
Chlorophyll-a Corrected	1995 - 2002	5
Chlorophyll-a Uncorrected	1995 - 2002	5
Dissolved Oxygen	1995 - 2002	27
Water Temperature	1995 - 2002	26
Depth	1995 - 2002	12

5.1.2.1.1 Total Phosphorus

The water quality standard for total phosphorus is a concentration less than or equal to 0.05 mg/L. Compliance with the total phosphorus standard is assessed using samples collected at a one-foot depth from the lake surface. The average total phosphorus concentrations at a one-foot depth for each year of available data at each monitoring site in Harrisburg Reservoir are presented in Table 5-7.

Table 5-7 Average Total Phosphorus Concentrations (mg/L) in Harrisburg Reservoir at one-foot depth

Year	RAI-1		RAI-2		RAI-3		Lake Average	
	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average
1993	1; 0	0.014	0; NA	NA	0; NA	NA	1; 0	0.014
1995	6; 5	0.076	5; 4	0.085	5; 5	0.088	6; 5	0.076
2002	1; 1	0.078	1; 1	0.089	1; 1	0.110	1; 1	0.078

As shown in the table, the majority of samples from 1993-2002 exceeded the total phosphorous water quality standard of 0.05 mg/L. Figure 5-6 shows the total phosphorous concentrations in Harrisburg Reservoir.

5.2 Reservoir Characteristics

5.2.1 Harrisburg Reservoir

Harrisburg Reservoir is located approximately one mile east of Galatia and has a surface area of 209 acres. The lake has a maximum depth of 30 feet and an average depth of 10 feet. Depth values were available with associated water quality sampling and average depths by year are presented below.

Table 5-8 Average Depths (ft) for Harrisburg Reservoir Segment RAI (Illinois EPA 2002 and USEPA 2002a)

Year	RAI-1	RAI-2	RAI-3
1993	27		
1995	26	16	8
2002	24	14	7
Average	26	15	7.5

5.3 Point Sources in the Middle Fork Saline River Watershed

5.3.1 Permitted Mining Operations

There are two mining operations in the Middle fork Saline River watershed that have active NPDES point source discharge permits and are upgradient of impaired streams segments. Table 5-9 contains permit information for these point sources while Figure 5-7 shows the locations of the outfalls for each facility.

Table 5-9 Permitted Facilities Discharging to or Upstream of Impaired Segments in the Middle Fork Saline River Watershed

Facility ID	Facility Name
IL0059749	Western Fuels-Illinois, Inc (Former Brushy Creek Coal Company)
IL0060402	Delta Mine Holding Company

The Delta Mine Holding Company is a reclaimed surface coal mine site that is permitted to discharge stormwater from multiple outfalls to Bankston Fork and Brushy Creek. The permit requires monitoring for pH and settlable solids only and has no flow information. Additionally, Western Fuels-Illinois, Inc operates the Liberty mine under NPDES Permit No. IL0059749. The facility is currently in the process of permit renewal for acid mine drainage from outfalls 002 and 005. These outfalls discharge to

Brushy Creek ATGH-04 which is upstream of segments ATGH-10 and ATGH-09. It should be noted that segment ATGH-04 is not listed for impairment on the 303(d) list.

5.4 Nonpoint Sources

There are many potential nonpoint sources of pollutant loading to the impaired segments in the Middle Fork Saline River watershed. This section will discuss site-specific cropping practices, animal operations, historic mining operations and area septic systems. Cropping practices may be contributing nutrients to Harrisburg Reservoir while animal operations and septic systems may be a potential source of fecal coliform. A discussion of historic mining operations is included as they may be sources of metals, sulfates and low pH within area waterbodies. Data were collected through communication with the local NRCS, Soil and Water Conservation District (SWCD), public health departments, and county tax department officials.

5.4.1 Crop Information

The significant portion of the land found within the Middle Fork Saline River watershed is devoted to crops. Corn and soybean farming account for approximately 31 percent and 25 percent of the watershed, respectively. Tillage practices can be categorized as conventional till, reduced till, mulch-till, and no-till. The percentage of each tillage practice for corn, soybeans, and small grains by county are generated by the Illinois Department of Agriculture from County Transect Surveys. The most recent survey was conducted in 2006. Data specific to the Middle Fork Saline River watershed were not available; however, Franklin, Hamilton, Saline, and Williamson county practices were available and are shown in the following tables.

Table 5-10 Tillage Practices in Franklin County

Tillage System	Corn	Soybean	Small Grain
Conventional	79%	25%	17%
Reduced - Till	1%	2%	54%
Mulch - Till	4%	9%	8%
No - Till	17%	64%	21%

Table 5-11 Tillage Practices in Hamilton County

Tillage System	Corn	Soybean	Small Grain
Conventional	37%	21%	4%
Reduced - Till	12%	9%	19%
Mulch - Till	0%	6%	28%
No - Till	51%	64%	49%

Table 5-12 Tillage Practices in Saline County

Tillage System	Corn	Soybean	Small Grain
Conventional	45%	15%	0%
Reduced - Till	12%	15%	0%
Mulch - Till	4%	4%	0%
No - Till	39%	66%	100%

Table 5-13 Tillage Practices in Williamson County

Tillage System	Corn	Soybean	Small Grain
Conventional	10%	26%	0%
Reduced - Till	35%	12%	100%
Mulch - Till	12%	12%	0%
No - Till	43%	50%	0%

Estimates on tile drainage were provided by the Williamson and Saline county NRCS offices. According to NRCS officials in Williamson County, land in the Middle Fork Saline River watershed consists mainly of rolling hills. As a result, little farming is done in this portion of the watershed and less than 5 percent of farms use field tiles. In Saline County, the topography is more suitable for farming; however, much of the land is unusable due to oil brine damage. On existing farms, field tiles are used on approximately 40 percent of the fields. Information on tile drainage was not available from other county offices in the watershed.

5.4.2 Animal Operations

Animal populations are available from the national Agricultural Statistics Service. Data specific to the Middle Fork Saline River watershed were not available; however, the Franklin, Hamilton, Saline, and Williamson County animal populations were reviewed and are presented in the following tables

Table 5-14 Franklin County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	8,052	7,746	-4%
Beef	3,112	3,135	1%
Dairy	623	599	-4%
Hogs and Pigs	18,007	30,011	67%
Poultry	672	422	-37%
Sheep and Lambs	149	67	-55%
Horses and Ponies	NA	634	NA

Table 5-15 Hamilton County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	4,077	4,320	6%
Beef	NA	NA	NA
Dairy	NA	NA	NA
Hogs and Pigs	12,777	24,167	89%
Poultry	86	129	50%
Sheep and Lambs	NA	207	NA
Horses and Ponies	NA	443	NA

Table 5-16 Saline County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	6,783	6,667	-2%
Beef	3,391	3,442	2%
Dairy	130	108	-17%
Hogs and Pigs	29,516	19,520	-34%
Poultry	NA	NA	NA
Sheep and Lambs	NA	NA	NA
Horses and Ponies	NA	557	NA

Table 5-17 Williamson County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	9,362	9,774	4%
Beef	4,836	5,104	6%
Dairy	58	14	-76%
Hogs and Pigs	6,475	8,221	27%
Poultry	567	298	-47%
Sheep and Lambs	103	111	8%
Horses and Ponies	NA	814	NA

Communications with local NRCS officials have provided more watershed-specific animal information. Williamson County NRCS officials stated that a few small cattle operations exist within the Middle Fork Saline River watershed, but there are no hog operations within the watershed. Saline County reported a few small cattle operations as well, and a few chicken and hog CAFOs, but no definite numbers of operations were available. Information on animal operations was not available from other county offices in the watershed.

5.4.3 Septic Systems

Many households in rural areas of Illinois that are not connected to municipal sewers make use of onsite sewage disposal systems, or septic systems. There are many types of septic systems, but the most common septic system is composed of a septic tank draining to a septic field, where nutrient removal occurs. However, the degree of nutrient removal is limited by soils and system upkeep and maintenance.

Across the U.S., septic systems have been found to be a significant source of phosphorous pollution. Failing or leaking septic systems contribute to fecal coliform pollution, although animal waste, urban runoff and permitted point sources can also contribute. Information on septic systems within the Middle Fork Saline River watershed was obtained, specifically for the areas surrounding Bankston Fork segment ATGC-01, which is impaired for fecal coliform and Harrisburg Reservoir, which is impaired for total phosphorus. The information on the extent of sewered and nonsewered municipalities was obtained from Egyptian Health Department, which serves Saline County. Health department officials stated that Harrisburg, Eldorado, Galatia, Raleigh, and Carriers Mills are served by city sewer systems. There is also a small town northeast of Harrisburg called Muddy that is sewered. Any homes beyond the limits of these cities and towns are served by septic systems. Health department officials stated, however, that there are very few houses outside of the city limits of each of these towns.

According to county plat maps, there are no homes located along Bankston Fork segment ATGC-01. Maps of this area show plats of 100 acres and larger, which are most likely used exclusively for agricultural purposes. Land to the west of Harrisburg is primarily composed of the "Tuttle Bottoms" land. This area is bottomland with some agriculture and large amounts of mining. Health department officials estimated that there are no more than ten homes in this area, all of which would be served by septic systems. Although the conditions of these septic systems are unknown, officials state that any problems with a septic system would be reported to their department and would be inspected and immediately brought to code.

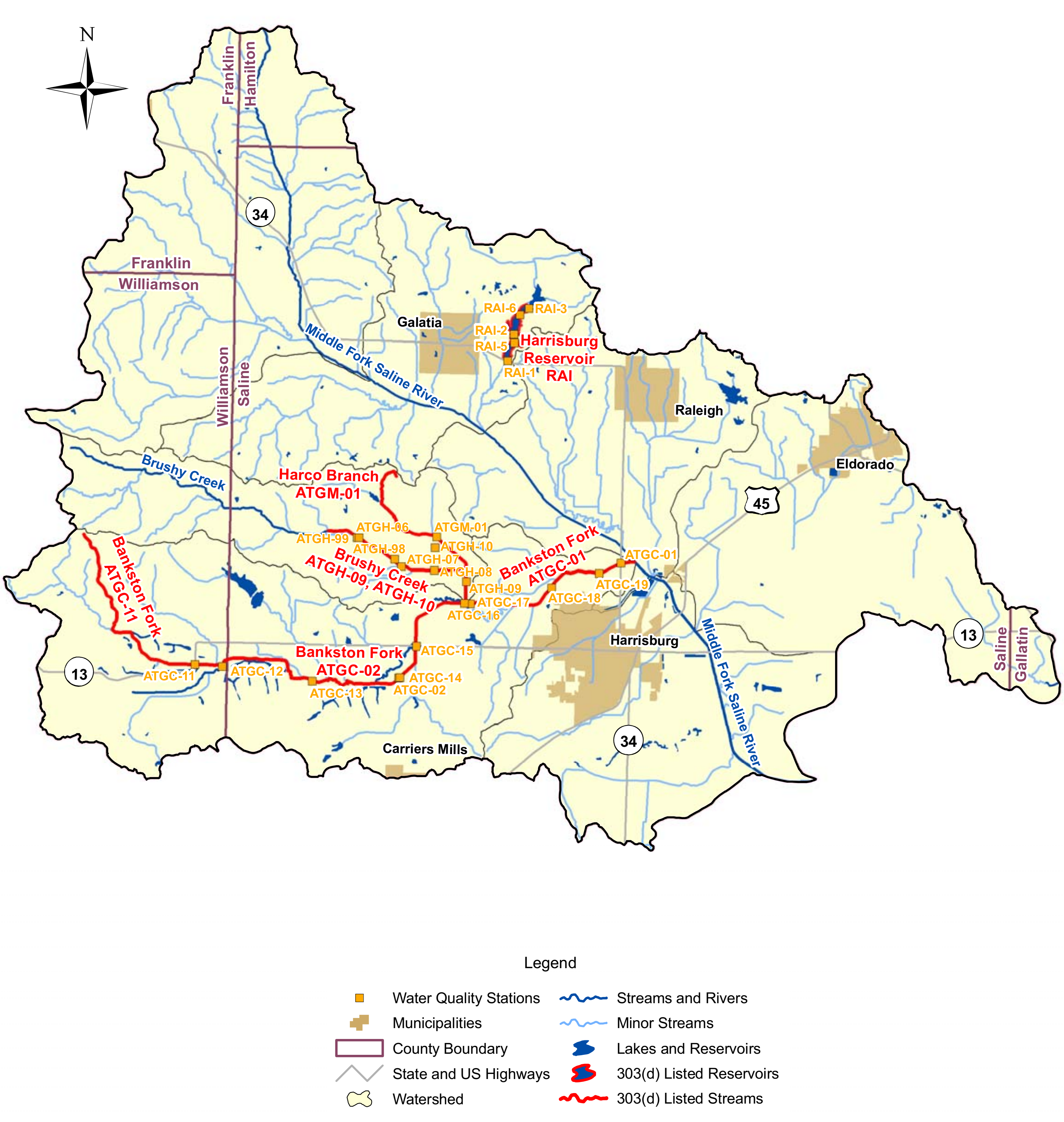
Health department officials stated that Saline County is the largest coal producing county in Illinois, and the majority of water body impairments in this region are likely the result of mining practices (refer to Section 5.3 for a brief discussion of mining in the watershed). One health department official stated that there are large populations of geese along segment ATGC-01 of Bankston Fork and suggested that geese feces could be contributing to the fecal coliform impairment.

Saline County Health Department officials were also able to provide information on the area surrounding Harrisburg Reservoir. As mentioned previously, the nearby towns of Galatia and Raleigh are both served by sewer systems. The municipality surrounding the reservoir, however, is served by septic systems. Health department officials stated that the houses surrounding the lake are primarily vacation homes and cabins occupied only during the summer months of the year. The department has received a few calls in the past dealing with failing septic systems in this area, but each of these systems was inspected and brought back to code.

5.4.4 Historic Mining Operations

In addition to the point source contributions from active mines, overland runoff from current and former mining operations can contribute to pollutant loads in the waterways. Runoff from surface mines and from mine spoils and waste can contain elevated concentrations of metals and sulfates and may have low pH levels which can further facilitate the suspension of dissolved metals into the water column.

Data from the Illinois State Geological Survey (ISGS) indicate that there are a large number of active and abandoned mines in the Middle Fork Saline River watershed, as shown in Figure 5-8. Both surface mining and underground mining operations exist in the watershed targeting the Springfield, Herrin, Dekoven/Davis, and Womac coal seams. Over 200 mining locations (past and present) are reported by the ISGS within the watershed. Permitted facilities were discussed in Section 5.3.1. Additional information on the mining operations within the Middle Fork Saline River Watershed and throughout Illinois can be found at the ISGS Coal Section website at: http://www.isgs.illinois.edu/maps-data-pub/coal-maps/coalshapefiles.shtml.



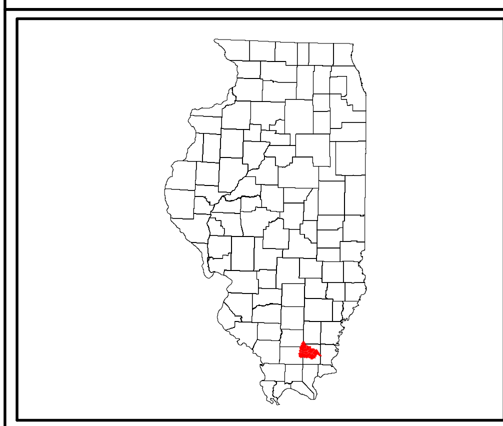


Figure 5-1
Middle Fork Saline River Watershed
Water Quality Stations

0 1.25 2.5 5 Miles

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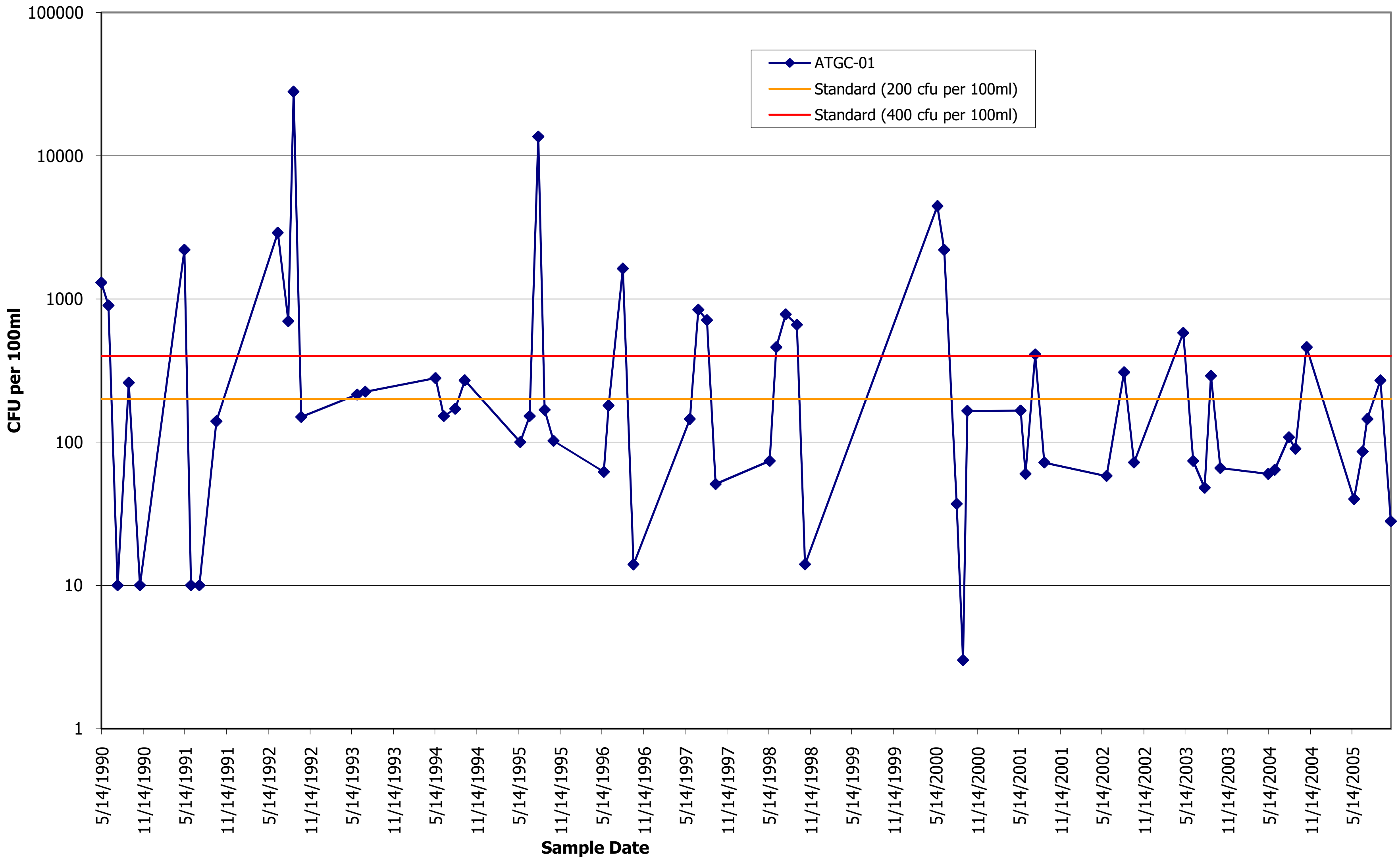

Figure 5-2:
Fecal Coliform Data
Bankston Fork Segment ATGC-01

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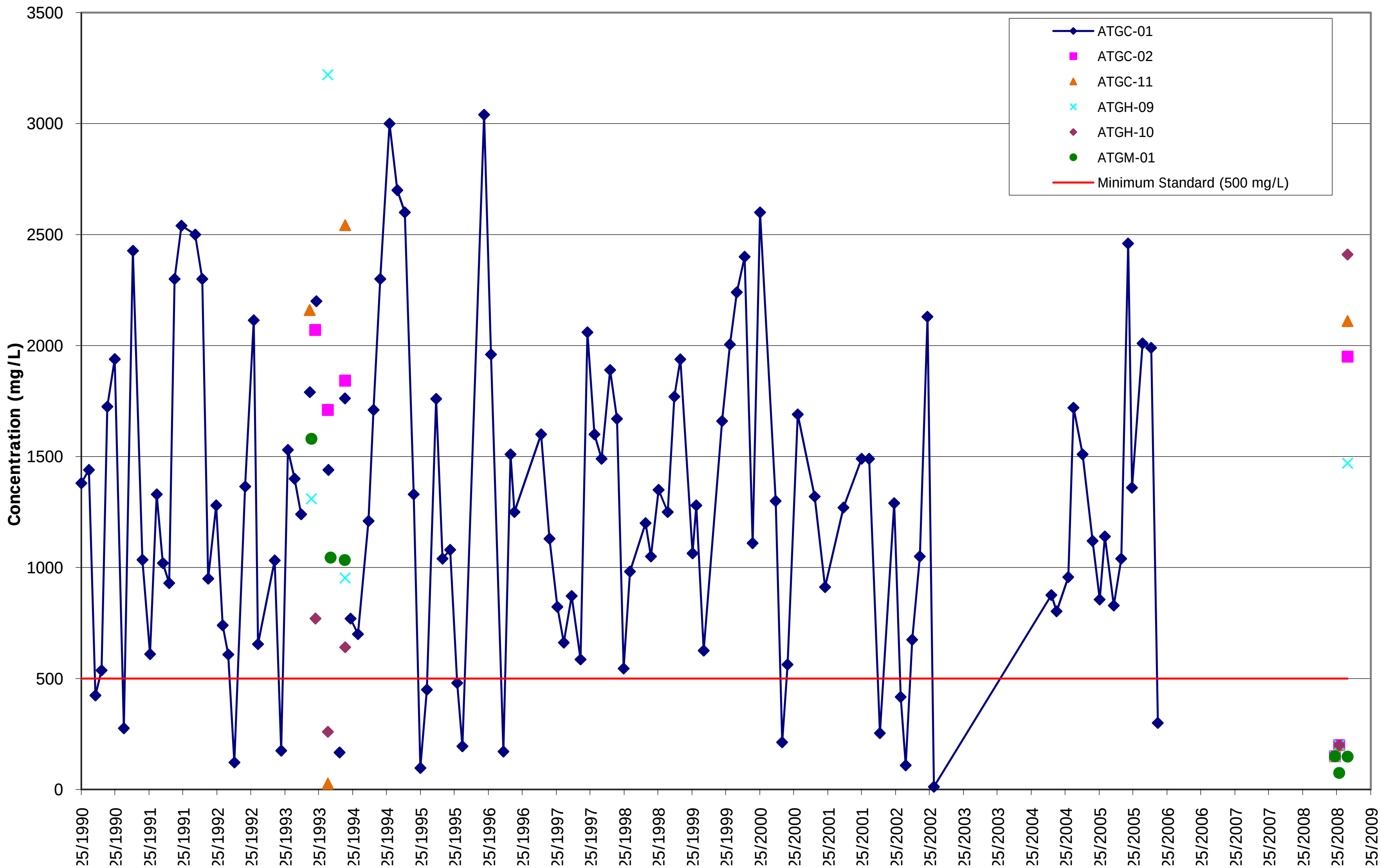

Figure 5-3:
Sulfate Concentrations
Impaired Stream Segments
Middle Fork Saline River Watershed

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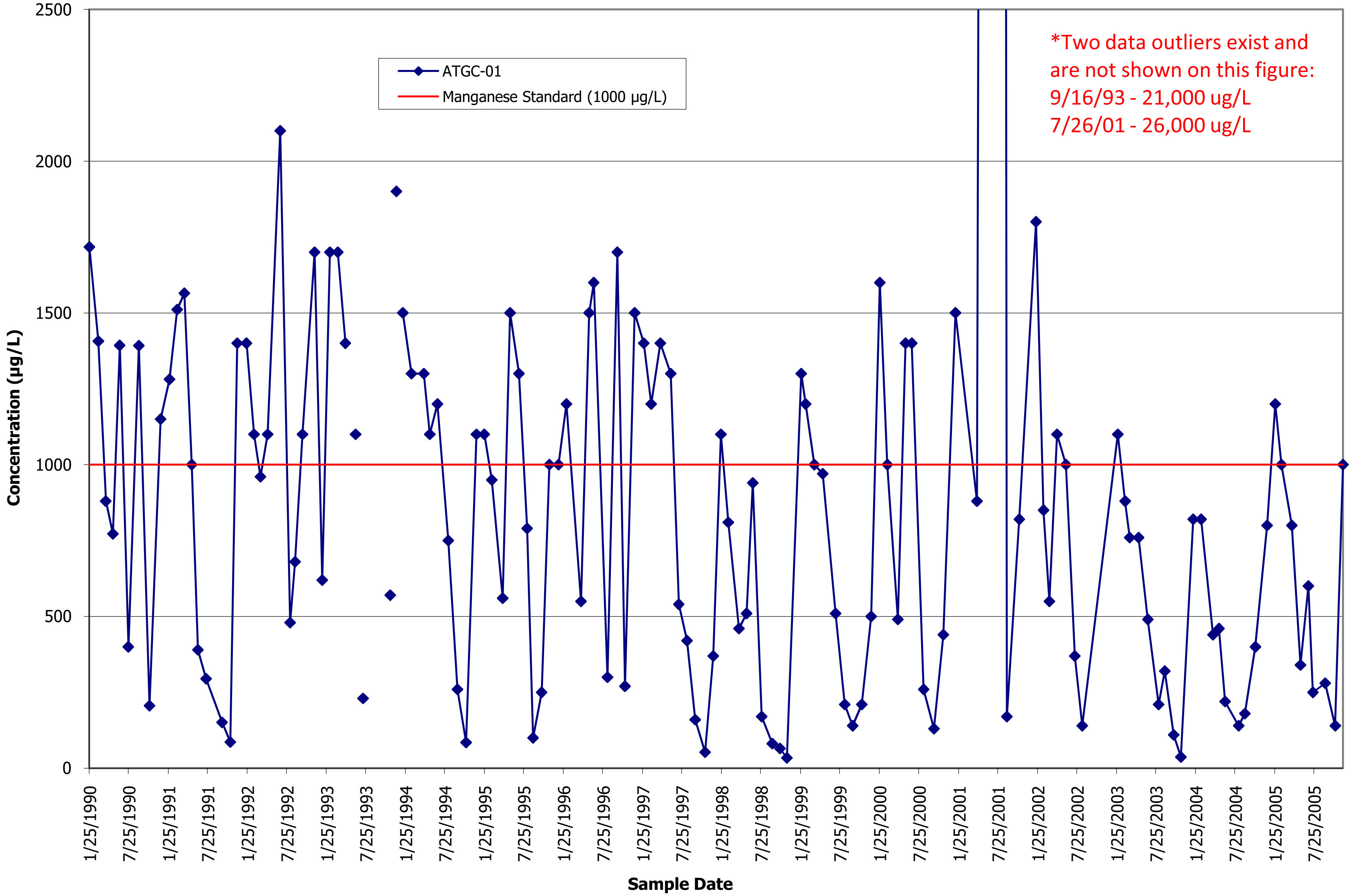

Figure 5-4:
Total Manganese Concentrations
Bankston Fork Segment ATCG-01

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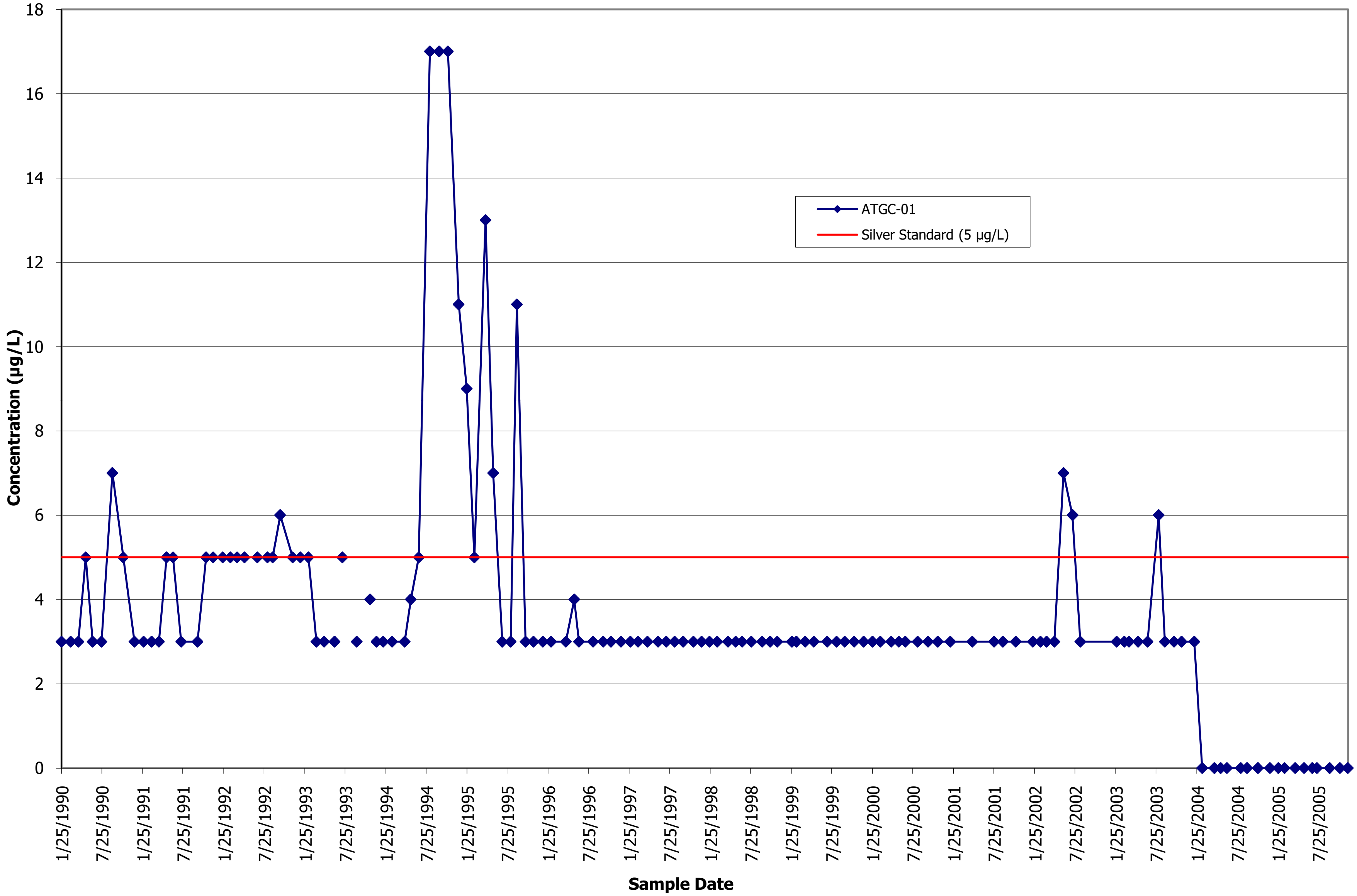

Figure 5-5:
Silver Concentrations
Bankston Fork Segment ATGC-01

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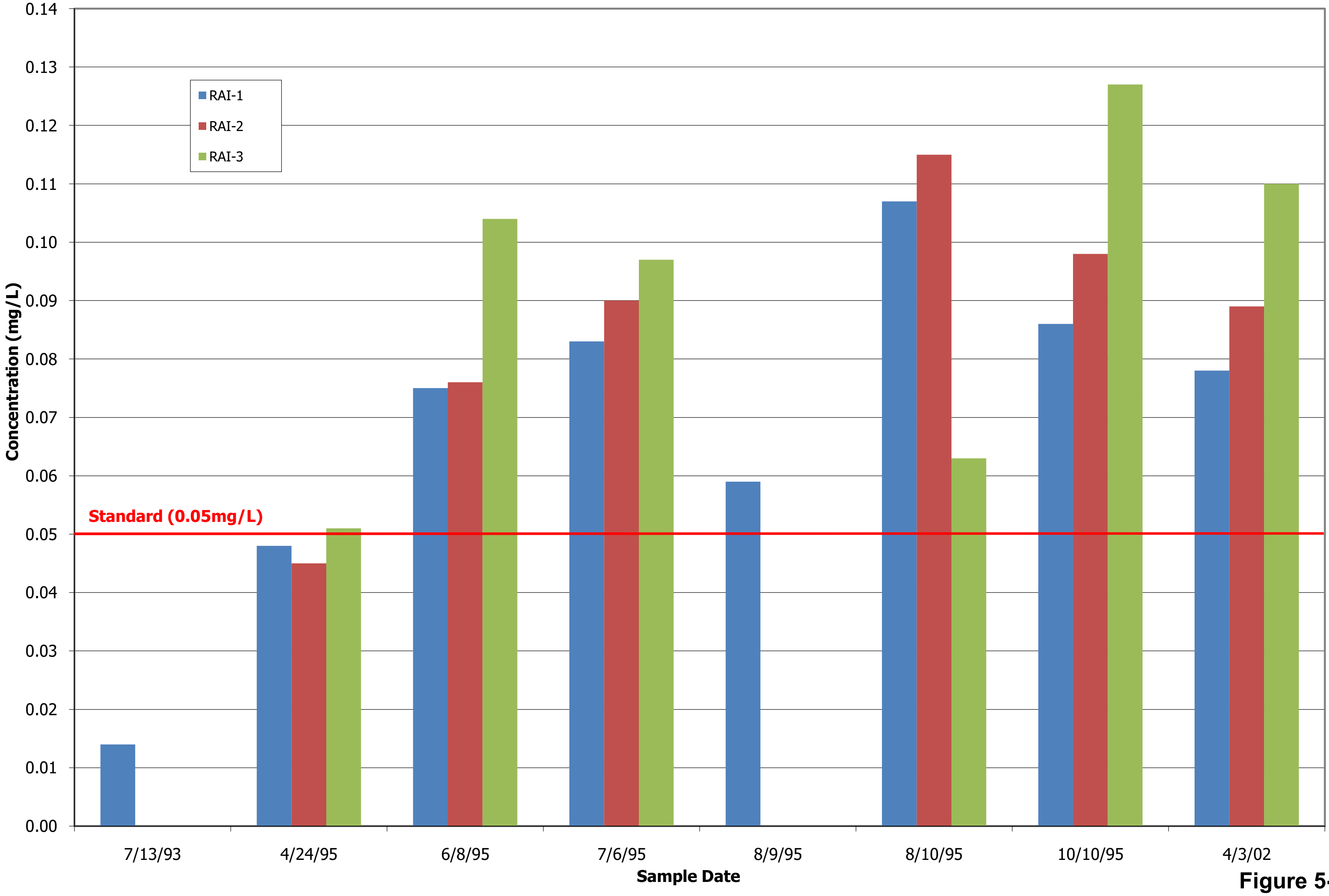

Figure 5-6:
Total Phosphorus Concentrations at 1-foot Depth Harrisburg Reservoir

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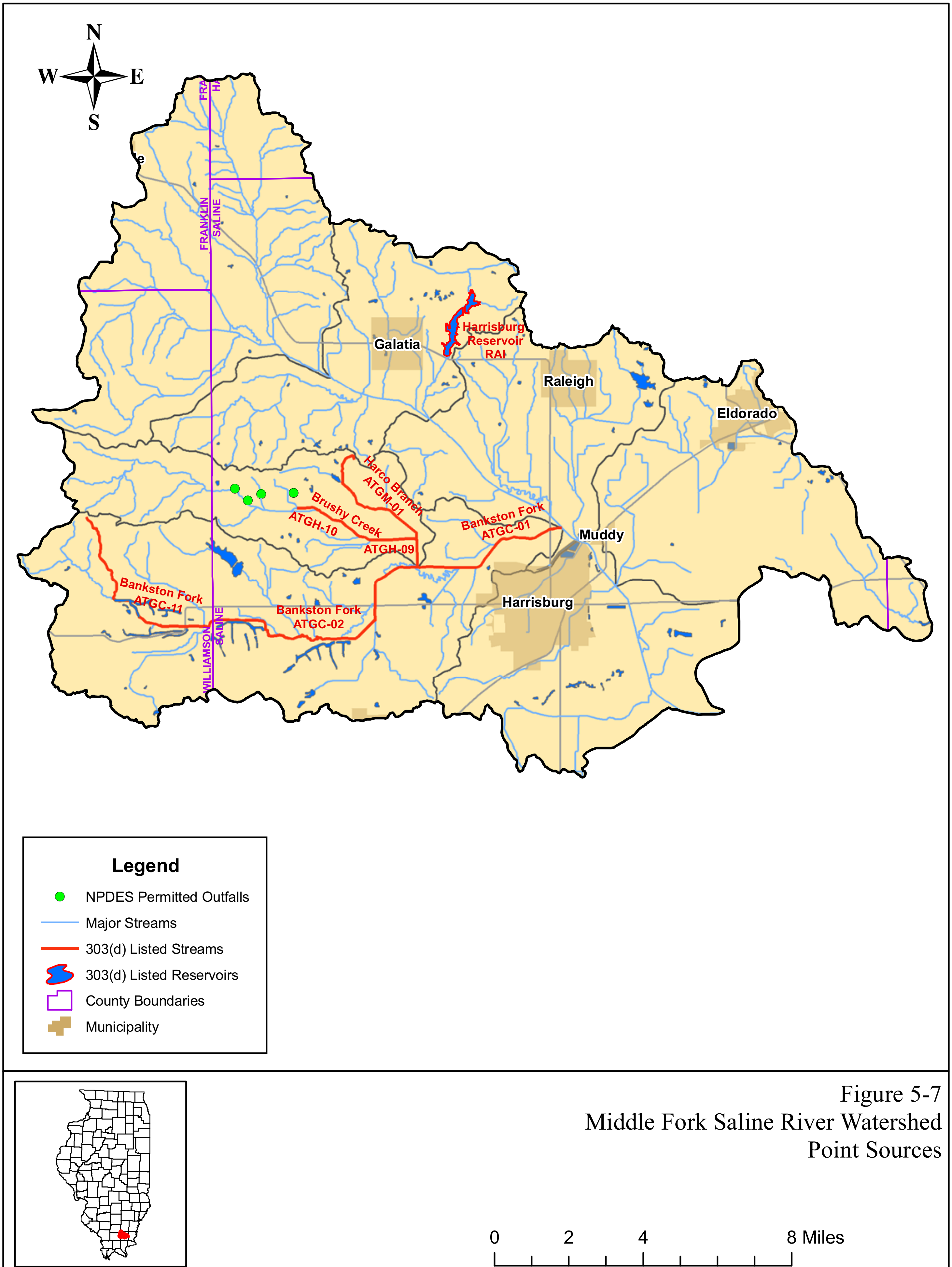

Figure 5-7
Middle Fork Saline River Watershed
Point Sources

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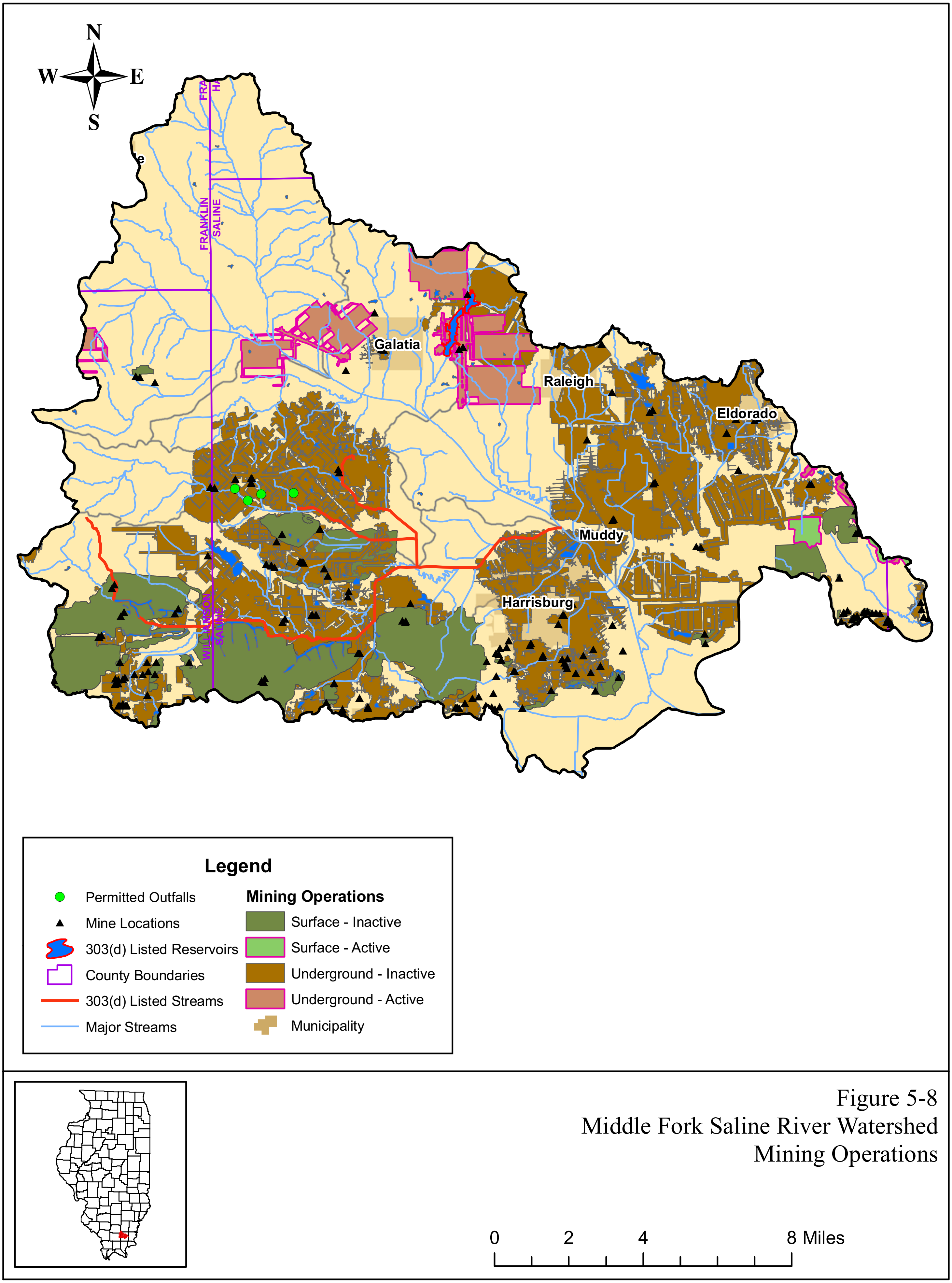

Figure 5-8
Middle Fork Saline River Watershed
Mining Operations

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Section 6
Approach to Developing TMDL and Identification of Data Needs

Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. Of the pollutants causing impairment to stream segments in the Middle Fork Saline River watershed; manganese, silver, sulfates, fecal coliform, copper, nickel, pH, and zinc are all of the parameters with numeric water quality standards. For the impaired reservoir in the watershed, total phosphorus is the only parameter with numeric water quality standards. Refer to Table 1-1 for a full list of potential causes of impairment. Illinois EPA believes that addressing the parameters with numeric standards should lead to an overall improvement in water quality due to the interrelated nature of the other listed pollutants. Recommended technical approaches for developing TMDLs for streams and lakes are presented in this section. Additional data needs are also discussed.

6.1 Simple and Detailed Approaches for Developing TMDLs

The range of analyses used for developing TMDLs varies from simple to complex. Examples of a simple approach include mass-balance, load-duration, and simple watershed and receiving water models. Detailed approaches incorporate the use of complex watershed and receiving water models. Simple approaches typically require less data than detailed approaches and therefore these are the analyses recommended for the Middle Fork Saline River watershed. Establishing a link between pollutant loads and resulting water quality is one of the most important steps in developing a TMDL. As discussed above, this link can be established through a variety of techniques. The objective of the remainder of this section is to recommend approaches for establishing these links for the constituents of concern in the Middle Fork Saline River watershed.

6.2 Approaches for Developing TMDLs for Stream Segments in Middle Fork Saline River Watershed

6.2.1 Recommended Approach for Metals, Sulfates, and Fecal Coliform TMDLs for Stream Segments

Table 6-1 contains information regarding the pollutant and available data for the impaired stream segments in the Middle Fork Saline River watershed.

Table 6-1: Stream Impairment Data Availability Middle Fork Saline River Watershed

Stream Name	Segment ID	Cause of Impairment	Data Count	Period of Record
Bankston Fork	ATGC-01	Fecal Coliform	64	1990-2005
		Sulfates	116	1990-2005
		Manganese	137	1990-2005
		Silver	137	1990-2005
	ATGC-02	Sulfates	3	1993
		Manganese	3	1993
		Silver	3	1993
	ATGC-11	Sulfates	3	1993
		Manganese	3	1993
Harco Branch	ATGM-01	Sulfates	3	1993
		Copper	3	1993
		Manganese	3	1993
		Nickel	3	1993
		Silver	3	1993
		Zinc	3	1993
Brushy Creek	ATGH-09	Sulfates	3	1993
		Manganese	3	1993
	ATGH-10	Sulfates	3	1993
		Silver	3	1993

The recommended approach for developing TMDLs for these segments and parameters is the load-duration curve method. The load-duration methodology uses the cumulative frequency distribution of streamflow and pollutant concentration data to estimate the allowable loads for a waterbody. Further data collection was suggested for all segments except Bankston Fork segment ATGC-01 because the remaining segments had only 3 available samples each, all of which were collected in 1993. An additional 3 samples were collected by Illinois EPA at each segment in 2008-2009 and the data were incorporated into TMDL.

6.2.2 Recommended Approach for pH TMDL in Harco Branch Segment ATGM-01

Segment ATGM-01 of Harco Branch is listed for pH impairments. The segment had only three samples available for review and each violated the pH standard by falling below 6.5. The available samples were from 1993 meaning no data are available within the last 15 years. Potential approaches to developing the pH TMDL for this segment include a spreadsheet approach that would take into account natural conditions in the watershed. A more detailed procedure to develop the pH TMDL could be based on an analytical procedure developed by the Kentucky Department of Environmental Protection (2001). The procedure calculates a maximum allowable hydrogen ion loading in the water column to maintain pH standards. Due to the limited nature of the pH dataset and the fact that pH is a measure of acidity and/or alkalinity in the stream and not associated with a pollutant load but rather the amount of H^+ ion in the solution, a TMDL was not calculated for pH. However, it is anticipated that pH issues will be addressed by implementing load reduction strategies for the TMDL pollutants associated with the segment, as outlined in Section 9 of this document.

6.3 Approaches for Developing TMDLs for Harrisburg Reservoir

Harrisburg Reservoir is listed for impairment caused by total phosphorus. The BATHTUB model is recommended for TMDL development. The BATHTUB model performs steady-state water and nutrient balance calculations in a spatially segmented hydraulic network that account for advective and diffusive transport, and nutrient sedimentation. The model relies on empirical relationships to predict lake trophic conditions and subsequent DO conditions as functions of total phosphorus and nitrogen loads, residence time, and mean depth (USEPA 1997). Oxygen conditions in the model are simulated as meta and hypolimnetic depletion rates, rather than explicit concentrations. Watershed loadings to the lakes were estimated using event mean concentration data, precipitation data and estimated flows within the watershed and therefore, no additional data collection was required.

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Section 7
Methodology Development for the Middle Fork Saline River Watershed

7.1 Methodology Overview

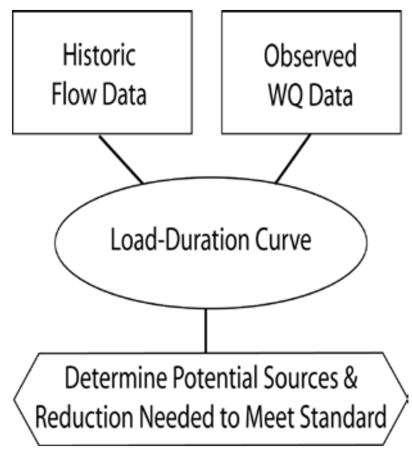
Table 7-1 contains information on the methodologies selected and used to develop TMDLs for impaired segments within the Middle Fork Saline River watershed.

Table 7-1 Methodologies Used to Develop TMDLs in the Middle Fork Saline River Watershed

Segment Name/ID	Causes of Impairment	Methodology
Bankston Fork - ATGC-01	Manganese, Silver, Sulfates, Fecal coliform	Load Duration Curves
Bankston Fork - ATGC-02	Manganese, Silver, Sulfates	Load Duration Curves
Bankston Fork - ATGC-11	Manganese, Sulfates	Load Duration Curves
Brushy Creek - ATGH-09	Manganese, Sulfates	Load Duration Curves
Brushy Creek - ATGH-10	Silver, Sulfates	Load Duration Curves
Harco Branch - ATGM-01	Copper, Manganese, Nickel, pH, Silver, Sulfates, Zinc	Load Duration Curves
Harrisburg Reservoir - RAI	Total Phosphorus	BATHTUB

7.1.1 Load-Duration Curve Overview

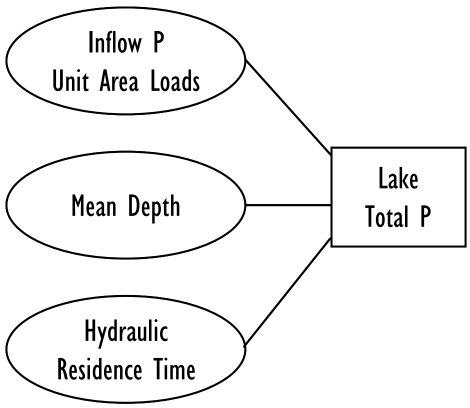
Loading capacity analyses were performed for each of the impaired stream segments in this watershed (ATGC-01, ATGC-02, ATGC-11, ATCH-09, ATGH-10, and ATGM-10). A load-duration curve is a graphical representation of the maximum load of a pollutant that a stream segment can assimilate over a range of flow scenarios while still meeting the instream water quality standard. The load-duration curve approach utilizes historic flow data and observed water quality data to provide useful information regarding the magnitude and frequency of exceedences as well as the flow scenarios when exceedences occur most often (see Schematic 1). In the Middle Fork Saline River watershed, load duration curves were constructed for a number of contaminants including; copper, manganese, nickel, silver, zinc, sulfates, and fecal coliform.



Schematic 1

7.1.2 BATHTUB Overview

TMDL analysis for total phosphorus in Harrisburg Reservoir involved the use of observed data coupled with the rational method as inputs to the BATHTUB model. This method required inputs from several sources including online databases and GIS-compatible data.



Schematic 2

Schematic 2 shows the data inputs for the BATHTUB model that was used to calculate the TMDL. Subbasin flows were estimated using the area ratio method and phosphorus loadings to the reservoir from the surrounding watersheds were estimated using the unit area load method, also known as the "export coefficient" method (USEPA 2001). This method is based on the assumption that, on an annual basis and normalized to area, a roughly constant runoff pollutant loading can be expected for a given land use type. This method also requires that unit area loads are not applied to watersheds that differ greatly in climate, hydrology, soils, or ecology from those from which the parameters were derived (USGS 1997).

Once the subbasin flows and concentrations were estimated, they were used as input for the BATHTUB model. The BATHTUB model uses empirical relationships between mean reservoir depth, total phosphorus inputted to the lake, and the hydraulic residence time to determine in-reservoir concentrations (see Schematic 2).

7.2 Methodology Development

The following sections further discuss and describe the methodologies utilized to examine copper, manganese, nickel, silver, zinc, sulfates, fecal coliform, and total phosphorus levels in the impaired waterbodies in the Middle Fork Saline River watershed.

7.2.1 pH

Harco Branch segment ATGM-01 is listed for impairment caused by pH. pH is a measure of acidity and/or alkalinity in the stream and not associated with a pollutant load but rather the amount of H^+ ion in the solution. Changes in pH can impact the concentrations of certain metal ions found in the water by altering the solubility of those metals in water. Acidic waters ($pH<7.0$) are associated with increased capacity to contain dissolved metals and therefore, pH levels and metal concentrations in waters are often closely interrelated. It is anticipated that pH issues will be addressed by implementing load reduction strategies for the TMDL pollutants associated with the segment, as outlined in Section 9 of this document. Therefore, a specific TMDL calculation for pH on Harco Branch segment ATGM-01 was not developed.

7.2.2 Load Duration Curve Development

Load duration curves are used to gain understanding of the range of loads allowable throughout the flow regime of a stream. This approach was used to characterize the current loading of contaminants to impaired segments of Bankston Fork (ATGC-01, ATGC-02, and ATGC-11), Brushy Creek (ATGH-09 and ATGH-10), and Harco Branch (ATGM-01).

7.2.2.1 Watershed Delineation and Flow Estimation

Watersheds for the areas contributing directly to the impaired stream segments at the Illinois EPA data collection stations were delineated with GIS analyses through use of the NED as discussed in Section 2.2 of this report. The delineation determined that Bankston Fork segments ATGC-01, ATGC-02, and ATGC-11 capture flows from directly contributing watersheds of approximately 76.3, 39.2, and 10.1 square miles, respectively. Brushy Creek segment ATGH-09 captures flows from a directly contributing watershed of 21.8 square miles and the watershed for Brushy Creek segment ATGH-10 is 16.6 square miles. Stream segment ATGM-01 on Harco Branch is somewhat smaller with a watershed area of approximately 4.0 square miles. Figure 7-1 shows the location of the water quality stations on each segment as well as the boundary of the GIS-delineated watersheds.

In order to create a load duration curve, it is necessary to obtain flow data corresponding to each water quality sample. As discussed in Section 2.6.3 of this report, there are no USGS stream gages within the watersheds that have current, or even recent, streamflow data. Therefore, the drainage area ratio method, represented by the following equation, was used to estimate flows.

$$Q_{gaged}\left(\frac{Area_{ungaged}}{Area_{gaged}}\right) = Q_{ungaged}$$

where Q_{gaged} = Streamflow of the gaged basin
$Q_{ungaged}$ = Streamflow of the ungaged basin
$Area_{gaged}$ = Area of the gaged basin
$Area_{ungaged}$ = Area of the ungaged basin

The assumption behind the equation is that the flow per unit area is equivalent in watersheds with similar characteristics. Therefore, the flow per unit area in the gaged watershed multiplied by the area of the ungaged watershed estimates the flow for the ungaged watershed.

USGS gage 05597500 (Crab Orchard Creek near Marion, Illinois) was chosen as an appropriate gage from which to estimate flows for all impaired stream segments in the Middle Fork Saline River watershed. The Crab Orchard Creek watershed is approximately 9 miles west of the nearest sampling site on the impaired segments in the Middle Fork Saline River watershed (ATGC-11) and approximately 19 miles west of the furthest sampling site in the watershed (ATGC-01). The gage drains an area of 31.7 square miles, which is within an order of magnitude in size as the watersheds delineated for the impaired segments in the Middle Fork Saline River watershed. GIS analysis shows that the surrogate gage watershed has similar land use, soils, and topography as the Middle Fork Saline watershed. Data also show that the surrogate gage watershed receives comparable precipitation throughout the year.

Data were downloaded through the USGS for the Crab Orchard Creek gage and multiplied by the area ratio method discussed above to estimate flows for each watershed. Only one of the four NPDES permitted facilities in the Crab Orchard watershed has a measureable permitted flow (Crab Orchard Grade and High School permit number IL0037311). The facility is permitted to discharge 0.003 million gallons per day (mgd). These flows were subtracted from the gage to account for point source influence. The Liberty Mine (NPDES IL 0059749) has two outfalls that discharge upstream of Brushy Creek segment ATGH-10. Stormwater sedimentation ponds discharge from outfalls 005 and 009 at rates of 0.074 mgd and 0.002 mgd, respectively. Additional adjustments were made to account for these flows in Brushy Creek and Bankston Fork segment ATGC-01 which are downstream of these outfalls. Spreadsheets used for the area ratio flow calculations are provided in Appendix D.

7.2.2.2 Manganese: Bankston Fork ATGC-01, ATGC-02, ATGC-11, Brushy Creek ATGH-09, and Harco Branch ATGM-01

Flow duration curves for each impaired segment were generated by ranking the estimated daily flow data generated through the area ratio method discussed above, determining the percent of days these flows were exceeded, and then graphically plotting the results. The flows in the duration curve were then multiplied by the water quality standard for manganese to generate a load duration curve. The general use water quality standard for manganese is 1.0 mg/L (302.208(g)).

Data collected from USEPA STORET and Illinois EPA databases during Stage 1 of TMDL development and data collected by Illinois EPA in 2008 and 2009 were paired with the corresponding flow for the sampling dates and plotted against the load duration curves. Figures 7-2 through 7-6 show the load duration curves as solid lines and the historically observed pollutant loads for manganese as points on each graph. In addition, zones are shown on each figure to provide information on flow regimes. For stream segments that have annual periods of zero-flow, the flow regime categories were shifted from the typical 25^{th}, 50^{th}, and 75^{th} percentile brackets to represent only periods of the year with measurable flow.

Historic data are limited within the watershed with the exception of Bankston Fork segment ATGC-01. The load duration curve for manganese on this segment shows that, out of the 137 total samples collected since 1990, 59 have exceeded the total manganese standard of 1.0 mg/L (or 1,000 ug/L). Eighty percent of the exceedences for manganese on this segment have occurred during mid-range to high flows and there have been zero exceedences in the lowest flow category.

The remaining segments (Bankston Fork ATGC-02 and ATGC-11, Brushy Creek ATGH-09, and Harco Branch ATGM0-01) each have six historic samples available for analysis. The load duration curves for manganese on these segments show that all exceedences occurred under mid-range to high flow conditions. Spreadsheets used for the calculation of manganese load duration curves are provided in Appendix E.

7.2.2.3 Silver: Bankston Fork ATGC-01, ATGC-02, Brushy Creek ATGH-10, and Harco Branch ATGM-01

Flow duration curves for analysis of silver loads to impaired segments were generated by ranking the estimated daily flow data generated through the area ratio method discussed above, determining the percent of days these flows were exceeded, and then graphically plotting the results. The flows in the duration curve were then multiplied by the water quality standard for silver to generate a load duration curve. The general use water quality standard for silver is 5 µg/L (302.208(g)).

Data collected from USEPA STORET and Illinois EPA databases during Stage 1 of TMDL development and data collected by Illinois EPA in 2008 and 2009 were paired with the corresponding flow for the sampling dates and plotted against the load duration curves. Figures 7-7 through 7-10 show the load duration curves as solid lines and the historically observed pollutant loads for silver as points on each graph. In addition, zones are shown on each figure to provide information on flow regimes. For stream segments that have annual periods of zero-flow, the flow regime categories were shifted from the typical 25th, 50th, and 75th percentile brackets to represent only periods of the year with measurable flow.

The load duration curve for silver on Bankston Fork ATGC-01 shows that 29 of the 137 total samples exceeded the water quality criteria since 1990. Exceedences at ATGC-01 are distributed evenly throughout the range of flows with the greatest number of exceedences occurring in the mid-range of flow values. The load duration curve developed for silver at ATGC-02 shows that 2 of 6 samples exceeded the water quality standard. One of the exceedences was in a relatively high flow range and the other was in a relatively low flow range. Analysis of the load duration curve developed for silver at Brushy Creek segment ATGH-10 shows that there has only been 1 exceedence of the silver criteria since 1990. The one exceedence occurred under relatively low flow conditions. Appendix F contains spreadsheets used for the calculation of the load duration curves for silver.

7.2.2.4 Sulfates: Bankston Fork Segment ATGC-01, ATGC-02, ATGC-11, Brushy Creek ATGH-09, ATGH-10, and Harco Branch ATGM-01

Flow duration curves for sulfate analysis were generated by ranking the estimated daily flow data generated through the area ratio method discussed above, determining the percent of days these flows were exceeded, and then graphically plotting the results. The sulfate standard has recently been updated in the State of Illinois (2008). The general use standard was previously 500 mg/L as outlined in Section 302.208(g) of the water quality standards. The recently adopted standard for sulfate states that "the following concentrations for sulfate must not be exceeded except in receiving waters for which mixing is allowed pursuant to Section 302.102:

1. At any point where water is withdrawn or accessed for purposes of livestock watering, the average of sulfate concentrations must not exceed 2,000 mg/L when measured at a representative frequency over a 30 day period.

2. The results of the following equations provide sulfate water quality standards in mg/L for the specified ranges of hardness (in mg/L as $CaCO_3$) and chloride (in mg/L) and must be met at all times:

    a. If the hardness concentration of receiving waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L, and if the chloride concentration of waters is greater than or equal to 25 mg/L but less than or equal to 500 mg/L, then: C = [1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65 where, C = sulfate concentration

    b. If the hardness concentration of waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L, and if the chloride concentration of waters is greater than or equal to 5 mg/L but less than 25 mg/L, then: C = [-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65 where C = sulfate concentration

3. The following sulfate standards must be met at all times when hardness (in mg/L as $CaCO_3$) and chloride (in mg/L) concentrations other than specified in (h)(2) are present:

    a. If the hardness concentration of waters is less than 100 mg/L or chloride concentration of waters is less than 5 mg/L, the sulfate standard is 500 mg/L.

    b. If the hardness concentration of waters is greater than 500 mg/L and the chloride concentration of waters is 5 mg/L or greater, the sulfate standard is 2,000 mg/L.

    c. If the combination of hardness and chloride concentrations of existing waters are not reflected in subsection (h)(3)(A) or (B), the sulfate standard may be determined in a site-specific rulemaking pursuant to section 303(c) of the Federal Water Pollution Control Act of 1972 (Clean Water Act), 33 USC 1313, and Federal Regulations at 40 CFR. 131.10(j)(2).

The calculated standards for sulfate have a minimum value of 500 mg/l and increase with increased hardness and chloride concentrations. TMDLs for sulfates were developed using the lowest calculated standard for sulfate (500 mg/L) in order to provide the most conservative estimate of allowable load. In order to facilitate the visual representation of the load duration curves for sulfate, the flows in the duration curves were multiplied by the most commonly calculated standards for sulfates (500 and 2,000 mg/L) and both concentrations are plotted on the load duration plots (Figures 7-11 through 7-16).

Data collected from USEPA STORET and Illinois EPA databases during Stage 1 of TMDL development were paired with the corresponding flow for the sampling date and plotted against the load duration curve. Data collected by IEPA in 2008were also included in the load duration plots. Figures 7-11 through 7-16 show the load duration curves as two solid lines (sulfate loads at 2,000 mg/L and 500 mg/L) and the observed pollutant loads as points on each graph. Actual exceedences of calculated sulfate criteria are highlighted using an alternate point symbol. In addition, zones are shown on each figure to provide information on flow regimes. For stream segments that have annual periods of zero-flow, the flow regime categories were shifted from the typical 25^{th}, 50^{th}, and 75^{th} percentile brackets to represent only periods of the year with measurable flow. Appendix G contains the spreadsheet used for this analysis.

On Bankston Fork at ATGC-01, a total of 14 of 116 sulfate samples exceeded the calculated standard with a higher concentration of exceedences observed in the lower flow ranges (2 additional exceedences were observed in the zero-flow range, but are not shown on the load duration plot). Using the new calculated standard, data show no violations on segment ATGC-02 of Bankston Fork or on Harco Branch segment ATGM-01. No further TMDL analysis for sulfates will be completed for these segments as loads do not need to be reduced. Load duration analysis for sulfates at Bankston Fork segment ATGC-11 reveals that 3 of 6 samples collected in this segment since 1990 exceed the calculated water quality criteria. The exceedences are found in low, medium, and high flow conditions, suggesting that sulfate exceedences can occur across a broad range of flow conditions. Analysis for sulfates at segment ATGH-09 reveals that 1 of 6 samples collected in this segment since 1990 exceed the calculated water quality criteria. The exceedence occurred under relatively low flow conditions. Load duration analysis for sulfates at segment ATGH-10 reveals that 1 of 6 samples collected in this segment since 1990 exceed the calculated water quality criteria. The exceedence occurred under low flow conditions.

7.2.2.5 Copper, Nickel, and Zinc: Harco Branch ATGM-01

Flow duration curves for Harco Branch ATGM-01 were generated by ranking the estimated daily flow data generated through the area ratio method discussed above, determining the percent of days these flows were exceeded, and then graphically plotting the results. Water quality standards for dissolved copper, dissolved nickel, and dissolved zinc can be found in Section 302.208(e) of the Illinois water quality standards. Standards for these metals are expressed as acute and chronic calculations that are dependent on instream hardness values. The load duration curves for each parameter were developed by multiplying the flow duration values by the acute standards calculated for the lowest observed hardness value on the segment (100 mg/L). Actual exceedences of the standards are based on acute standards calculated for each sample using total hardness data collected at the time of sampling and are also shown on Figures 7-17 through 7-19. The flow regime categories shown on these figures were shifted from the typical 25^{th}, 50^{th}, and 75^{th} percentile brackets to represent only periods of the year with measurable flow.

The load duration curve developed for copper shows 2 exceedences of the calculated acute standard for the 6 dissolved copper samples reported since 1990. Both exceedences occurred under medium to high flow conditions. Similarly, 3 of 6 samples collected for dissolved nickel and 3 of 6 samples collected for dissolved zinc at ATGM-01 since 1990 have exceeded the calculated acute water quality standard. The exceedences for nickel and zinc also occurred at medium to moderately elevated flow levels. Spreadsheets used for the calculation of load duration curves for copper, nickel and zinc at segment ATGM-01 are provided in Appendix H.

7.2.2.6 Fecal Coliform: Bankston Fork ATGC-01

A flow duration curve was developed for Bankston Fork segment ATGC-01 by determining the percent of days each estimated flow was exceeded, and then graphically plotting the results. Because the fecal coliform standard is seasonal and is only applicable between the months of May and October, only flows during this time period were used in the analysis. The flows in the duration curve were then multiplied by the water quality standard of 200 cfu/100 mL to generate a load duration curve. Fecal coliform data collected between May and October were compiled from data amassed during Stage 1 of TMDL development. These data were then paired with the corresponding flows for the sampling dates and plotted against the load duration curve. Figure 7-20 shows the load duration curve for the segment as a solid line and the observed pollutant loads as points on the graphs. The flow regime categories shown on this figure was shifted from the typical 25^{th}, 50^{th}, and 75^{th} percentile brackets to represent only periods of the year with measurable flow.

The load duration curve for fecal coliform indicates since 1990, 24 of the 64 samples collected between the months of May and October have exceeded the geometric mean standard of 200 cfu/100 mL, with a higher proportion of exceedences occurring in the mid to high flow ranges. Exceedences during high flows are likely attributable to the fecal matter introduced to the stream via overland runoff and the re-suspension of fecal material in the stream sediment. Appendix I contains spreadsheets used for the calculation of the load duration curves for fecal coliform at Bankston Fork segment ATGC-01.

7.2.3 BATHTUB Development for Harrisburg Reservoir

Harrisburg Reservoir is an approximately 220 acre reservoir located 1 mile east of Galatia, Illinois. The reservoir has a reported maximum depth of around 30 feet and an average depth of approximately 10 feet.

The BATHTUB model was used to develop the total phosphorus TMDL for Harrisburg Reservoir. BATHTUB has three primary input interfaces: global, reservoir segment(s), and watershed inputs. The individual inputs for each of these interfaces are described in the following sections along with watershed and operational information for the lake.

7.2.3.1 Global Inputs

Global inputs represent atmospheric contributions of precipitation, evaporation, and atmospheric phosphorus. As discussed in Section 2 of this report, the average annual precipitation input to the model was 38.4 inches, and the average annual evaporation input to the model was 36.1 inches (ISWS 2008). The default atmospheric phosphorus deposition rate suggested in the BATHTUB model was used in absence of site-specific data, which is a value of 30 kilograms per square kilometer (kg/km$^{2)}$-year (U.S. Army Corps of Engineers [USACE] 1999). This value is based on a compilation of available historic data and Illinois EPA believes that it is appropriate for use in this watershed where site-specific rates of deposition are not available.

7.2.3.2 Reservoir Segment Inputs

Reservoir segment inputs in BATHTUB are used for physical characterization of the reservoir. Harrisburg Reservoir is modeled with three segments in BATHTUB. The segment boundaries are shown on Figure 7-21. Segmentation was established based on available water quality sampling locations and lake morphologic data. Segment inputs to the model include average depth, surface area, segment length, and depth to the metalimnion. The lake depth was represented by the 2002 data from the Illinois EPA water quality stations. Segment lengths and surface areas were determined in GIS. These data are shown below (Table 7-2) for reference.

Table 7-2 Harrisburg Reservoir Segment Data

Segment	Surface Area (km^2)	Segment Length (km)	Average Depth (m)
RAI-1	0.232	0.83	7.69
RAI-2	0.433	1.40	4.40
RAI-3	0.286	0.96	2.55

7.2.3.3 Tributary Inputs

Tributary inputs to BATHTUB include drainage area, flow, and total phosphorus (dissolved and solid-phase) loading. The drainage area of each tributary is equivalent to the basin or subbasin it represents, which was determined with GIS analyses. Figure 7-21 also shows the subbasin boundaries. The watershed was broken up into three tributaries for purposes of the model. There is one primary tributary stream that flows into Harrisburg Reservoir, however, no water quality or flow data are available for this tributary. Therefore, the three areas contributing loads to each lake segment were used for the BATHTUB tributary inputs.

As discussed in Section 7.4.1, there are no flow gages within the watershed and the drainage area ratio method was used to estimate flows. The total mean flow into Harrisburg Reservoir was estimated to be 6.09 cfs. The flow contribution from each tributary was estimated by multiplying the average inflow by the ratio of the subbasin areas. The estimated flow from each tributary is shown in Table 7-3.

Table 7-3 Harrisburg Reservoir Tributary Subbasin Areas and Estimated Flows

Tributary Name	Lake Segment	Area (acres)	Flow Rate (cfs)
Overland Flow to RAI-3	Segment 1: RAI-3	3,226	4.88
Overland Flow to RAI-2	Segment 2: RAI-2	589	0.89
Overland Flow to RAI-1	Segment 3: RAI-1	212	0.32
	TOTAL	**4,027**	**6.09**

According to the USACE, the normal storage volume for Harrisburg Reservoir is 6,233 acre-feet (USACE, National Dam Inventory data for the Harrisburg Reservoir dam). Based on this storage volume and the inflow of 6.09 cfs, the lake residence time is approximately 1.41 years.

Because there are no available historic concentration data, phosphorus loads from the contributing watershed were estimated based on land use data and the median annual export coefficients for each land use. Export coefficients for each land use category found in the Harrisburg Reservoir watershed were extracted from the USEPA's PLOAD version 3.0 user's manual. This document provides an extensive list of phosphorus export coefficients for various land uses in several regions of the country compiled from a number of sources in the literature. The export coefficients for each land use are reported in lbs/acre/year which can then be multiplied by the number of acres of each land use in the Harrisburg Reservoir watershed to provide a total median phosphorus load into the reservoir. The overall load is then distributed to each tributary area for modeling input based on the proportion of the overall watershed represented by each subbasin.

7.2.3.4 BATHTUB Confirmatory Analysis

Historical water quality data for Harrisburg Reservoir are summarized in Section 5.1.2 of this report. These data were used to help confirm model calculations. Although the analyses presented below do lend confidence to the modeling, they should not be considered a true model "calibration." Additional lake and tributary water quality and flow data are required to fully calibrate the model.

The Harrisburg Reservoir BATHTUB model was initially simulated assuming default phosphorus kinetic parameters (assimilation and decay) and no internal phosphorus loading. The lake concentrations are lower than the incoming tributary concentrations indicating that the lake is a net sink of total phosphorus. Therefore, in order to achieve a calibration, the model calibration coefficients for "sedimentation" rates (nutrient removal rates) were adjusted, rather than adjusting internal loads.

Table 7-4 Summary of Model Confirmatory Analysis- Harrisburg Reservoir Total Phosphorus (mg/L)

Lake Site	***Observed***	***Predicted***
Segment 1 : RAI-3	0.0920	0.0923
Segment 2 : RAI-2	0.0855	0.0854
Segment 3 : RAI-1	0.0697	0.0698
Lake Average	0.0836	0.0837

The model was simulated using the median phosphorus loads calculated with the unit area load method. These initial results showed that the predicted lake concentrations were consistently lower than observed lake concentrations. Therefore, the default phosphorus decay coefficient was lowered to increase predicted total phosphorus concentration. The reduction in phosphorus decay rate brought predicted phosphorus levels in line with the observed concentrations. As can be seen in Table 7-4, an excellent match was achieved, lending significant support to the predictive ability of this simple model. A printout of the BATHTUB model files is provided in Appendix J of this report.

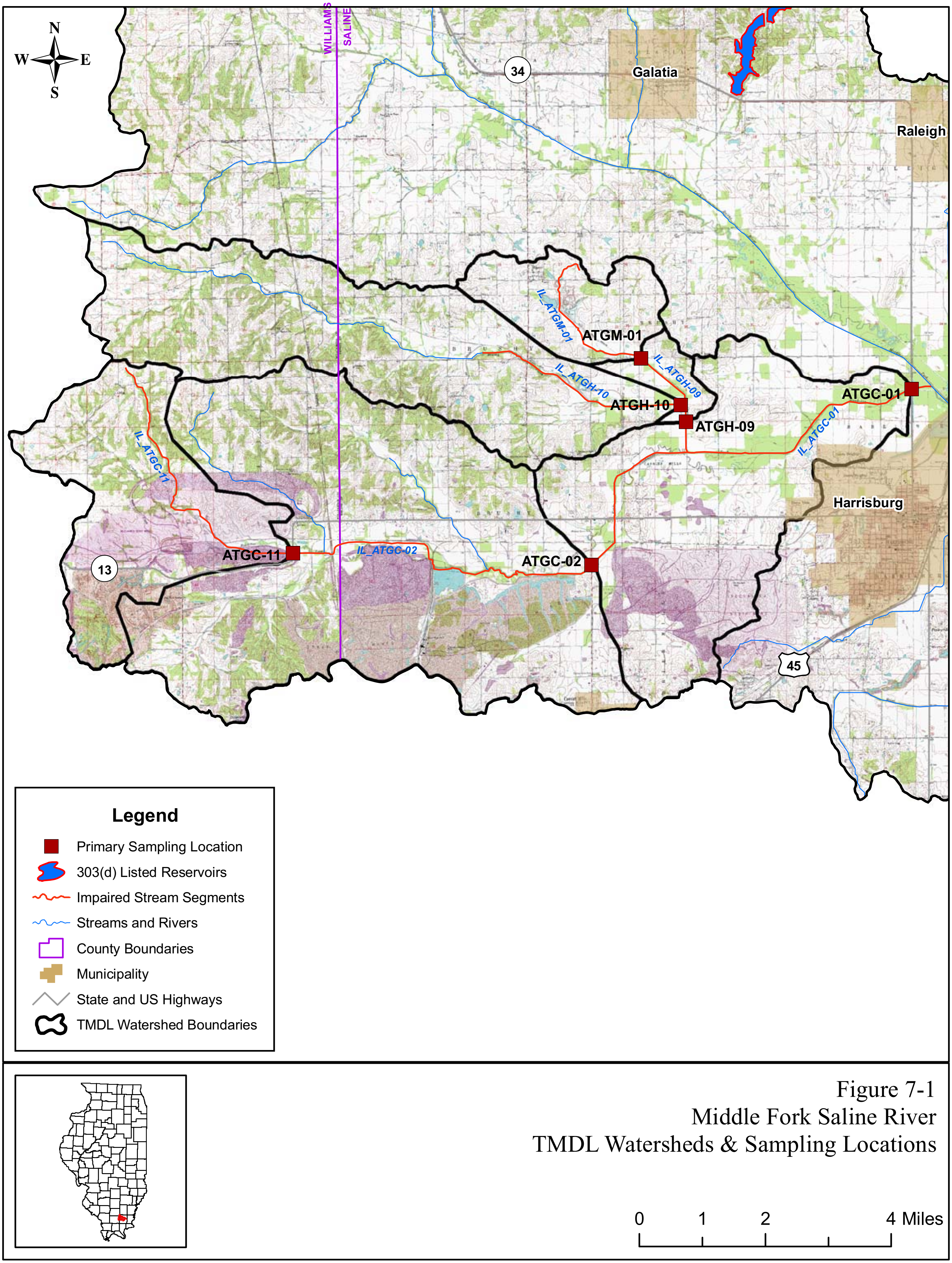


Figure 7-1
Middle Fork Saline River
TMDL Watersheds & Sampling Locations

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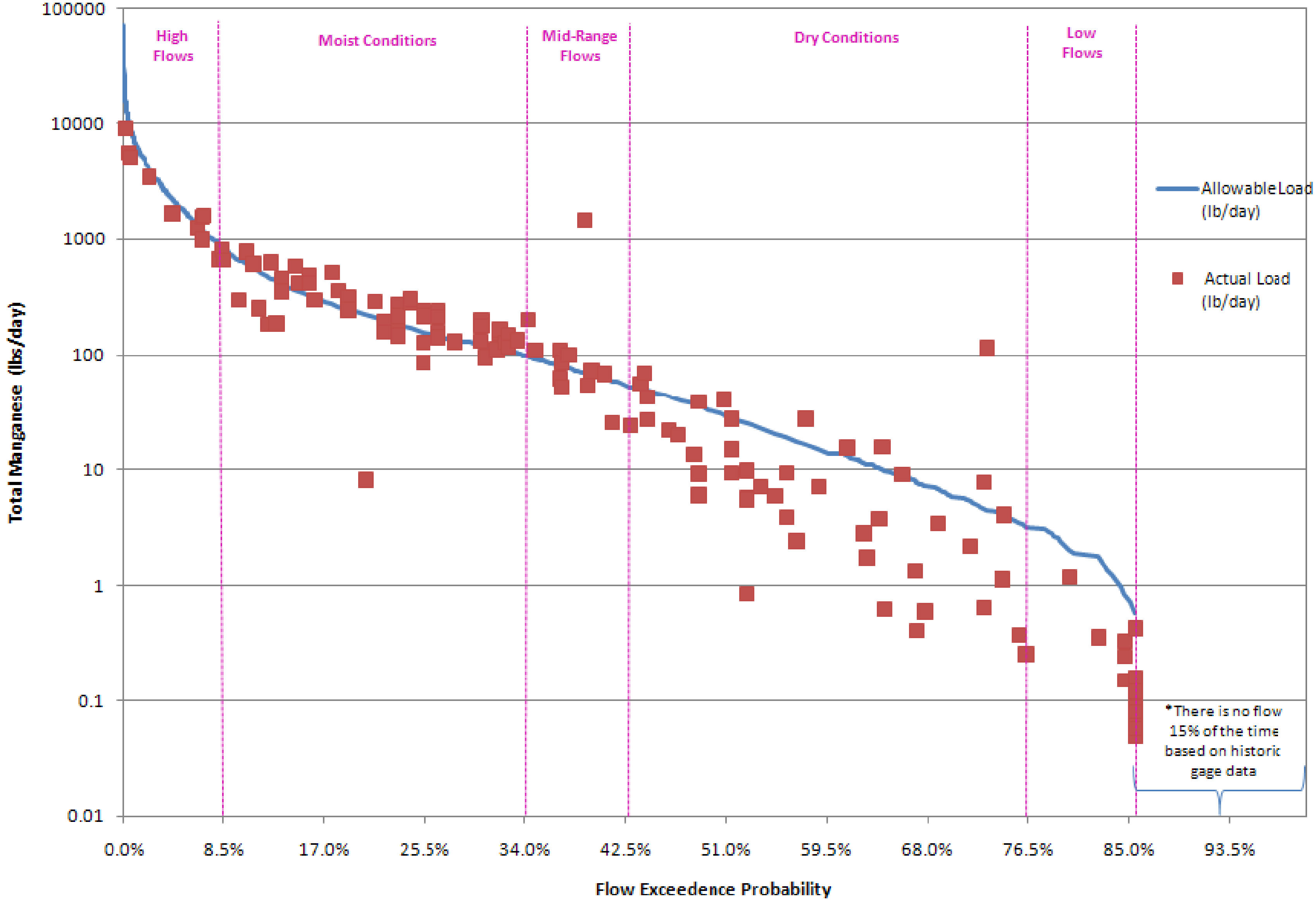

Figure 7-2
Bankston Fork Segment ATGC-01
Manganese Load Duration Curve

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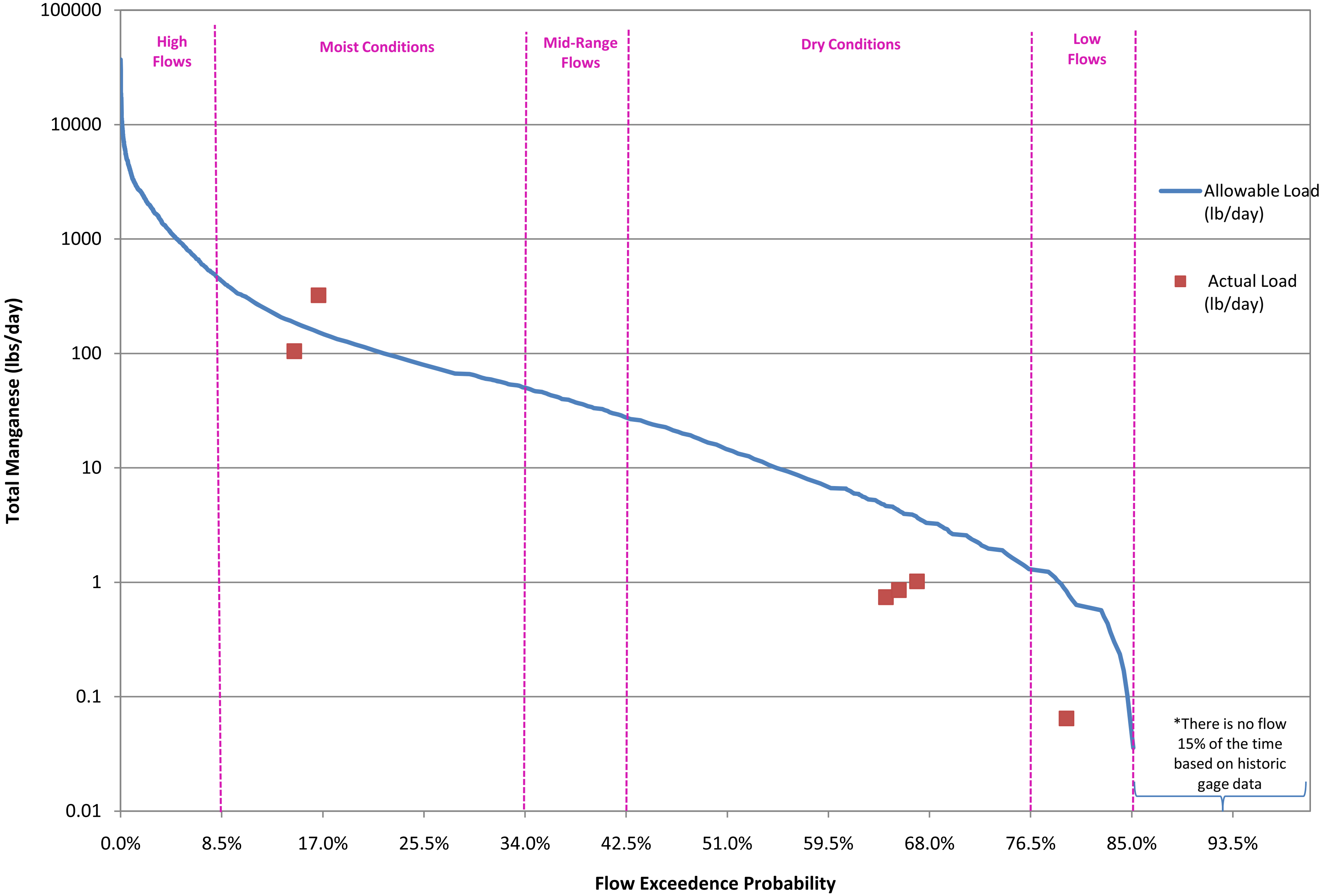

Figure 7-3
Bankston Fork Segment ATGC-02
Manganese Load Duration Curve

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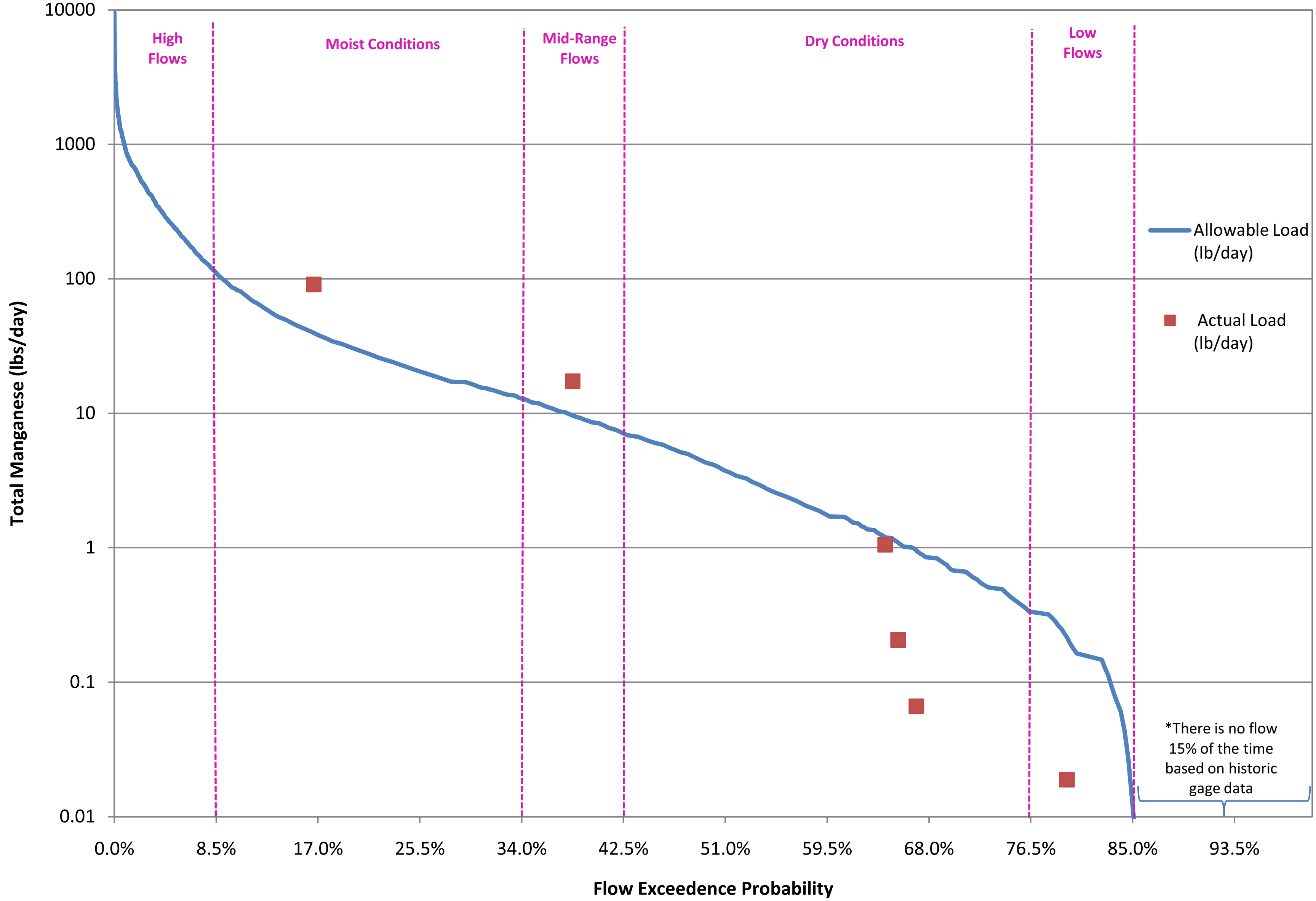

Figure 7-4
Bankston Fork Segment ATGC-11
Manganese Load Duration Curve

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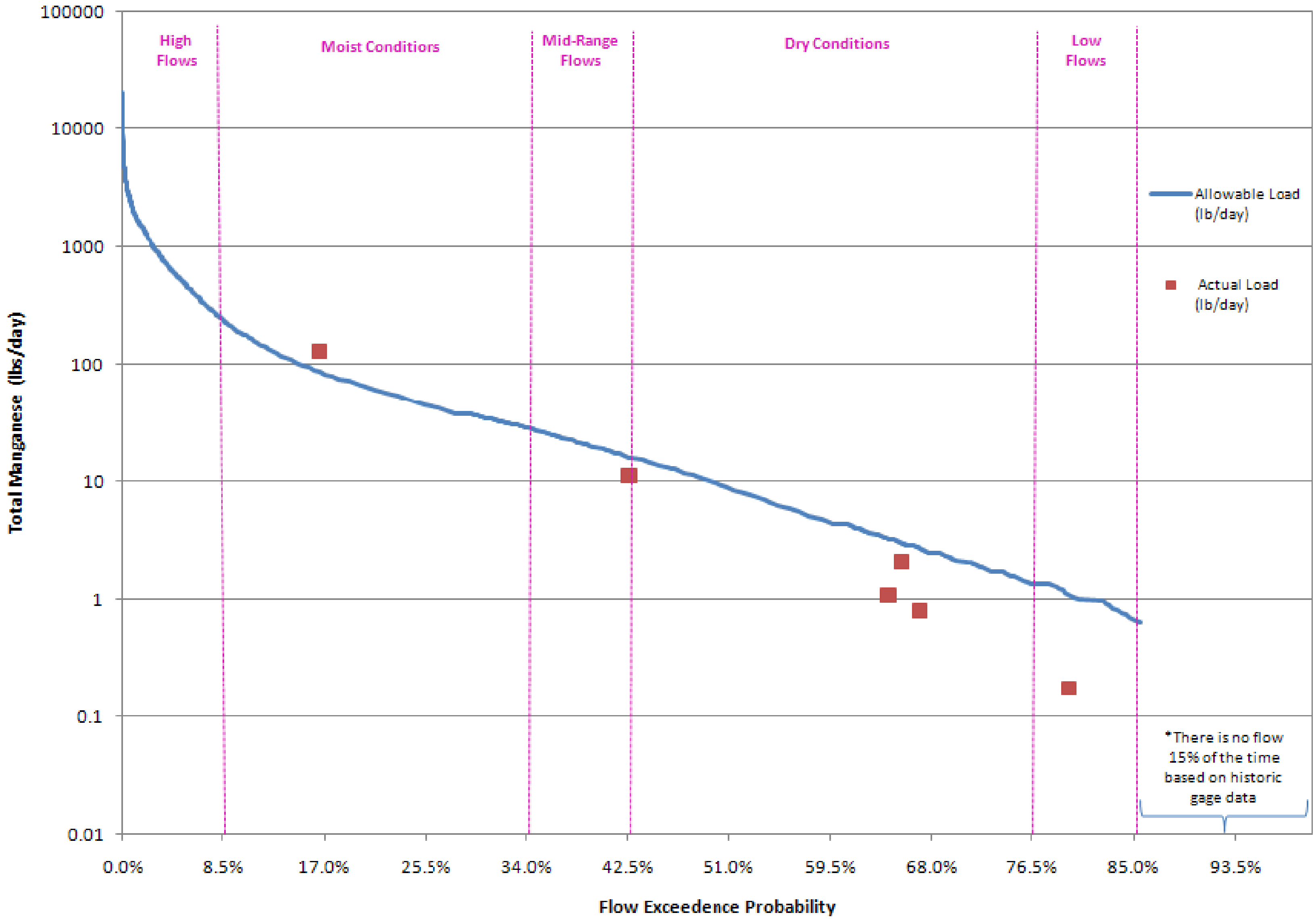

Figure 7-5
Brushy Creek Segment ATGH-09
Manganese Load Duration Curve

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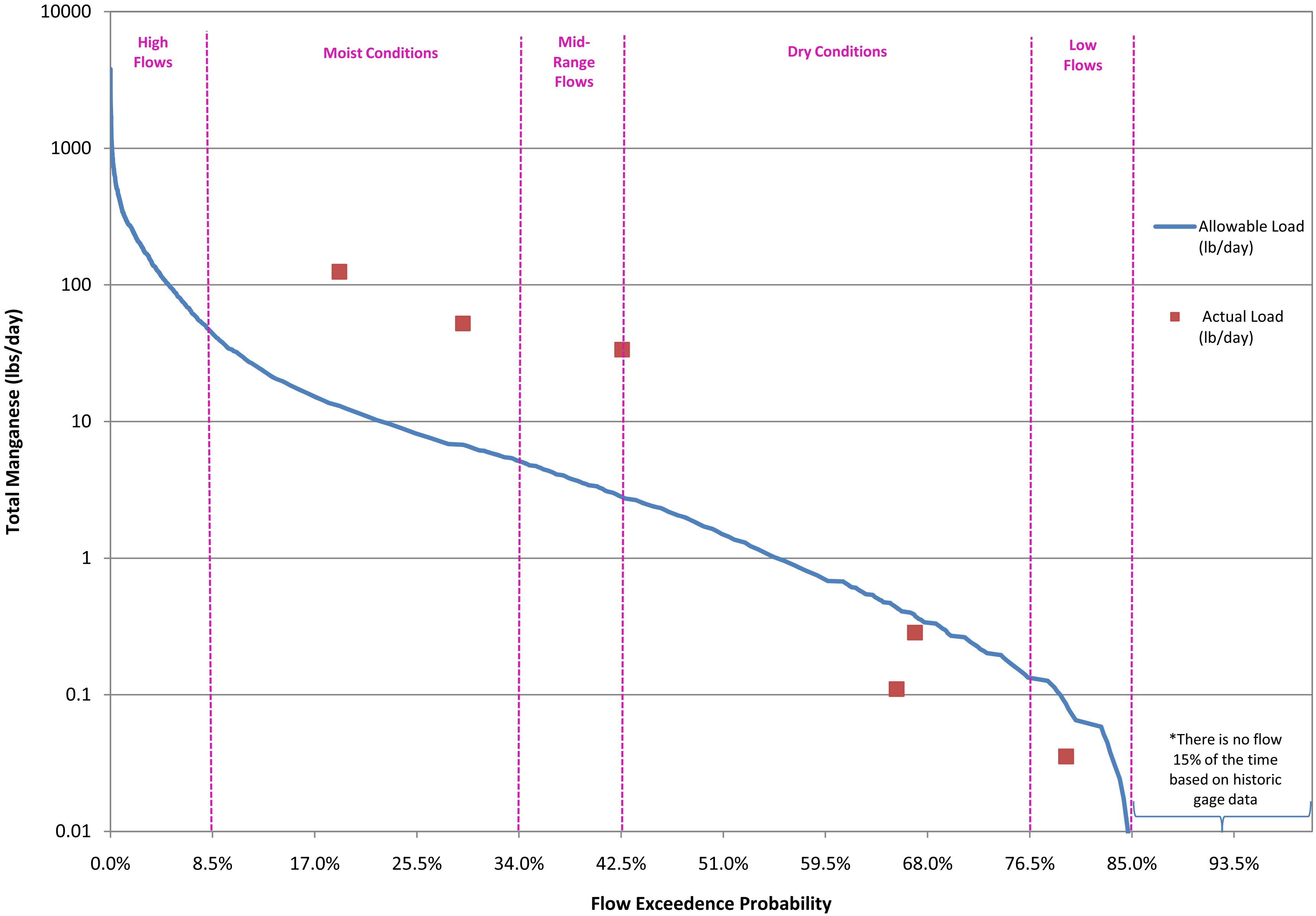

Figure 7-6
Harco Branch Segment ATGM-01
Manganese Load Duration Curve

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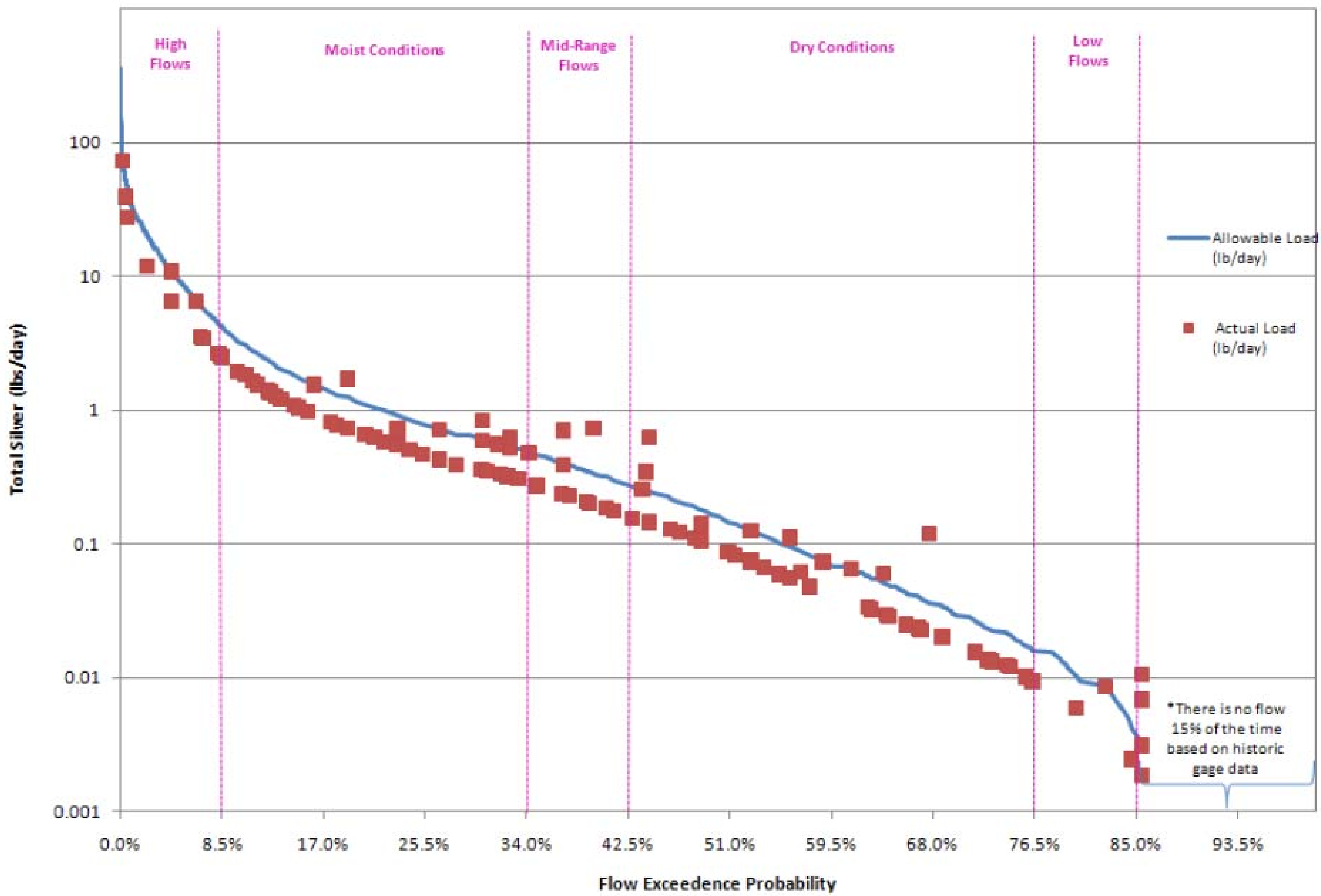

Figure 7-7
Bankston Fork Segment ATGC-01
Silver Load Duration Curve

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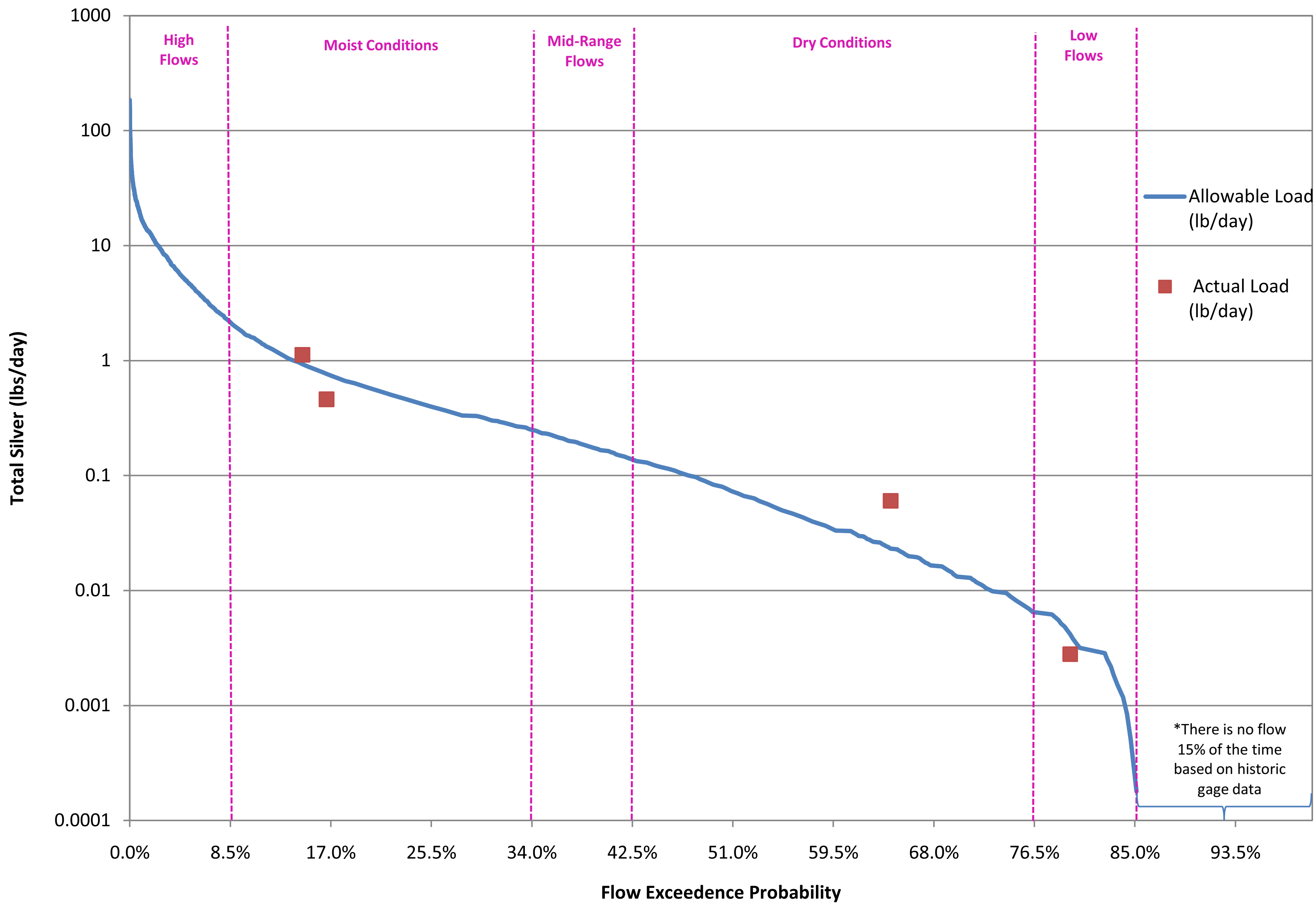

Figure 7-8
Bankston Fork Segment ATGC-02
Silver Load Duration Curve

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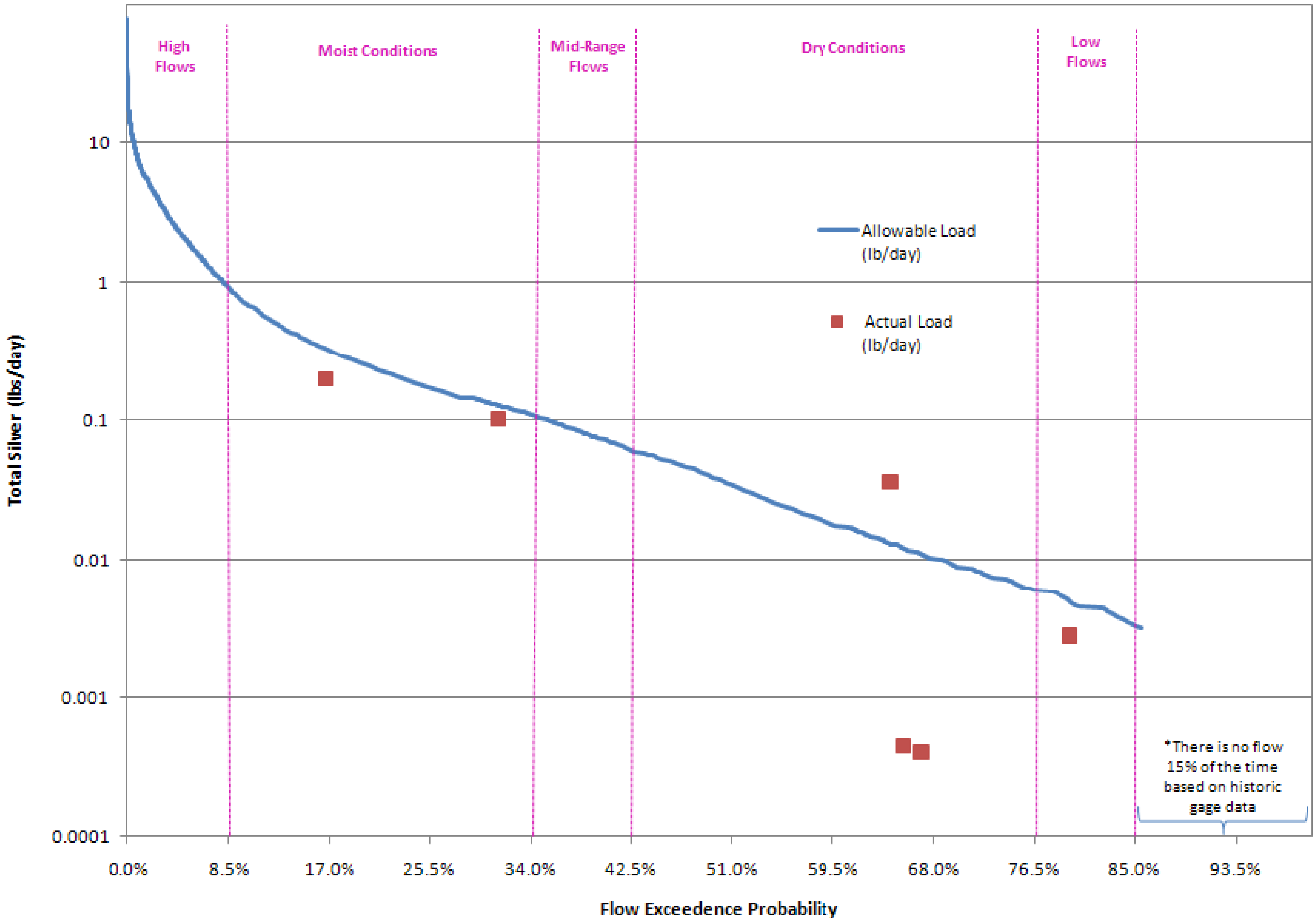

Figure 7-9
Brushy Creek Segment ATGH-10
Silver Load Duration Curve

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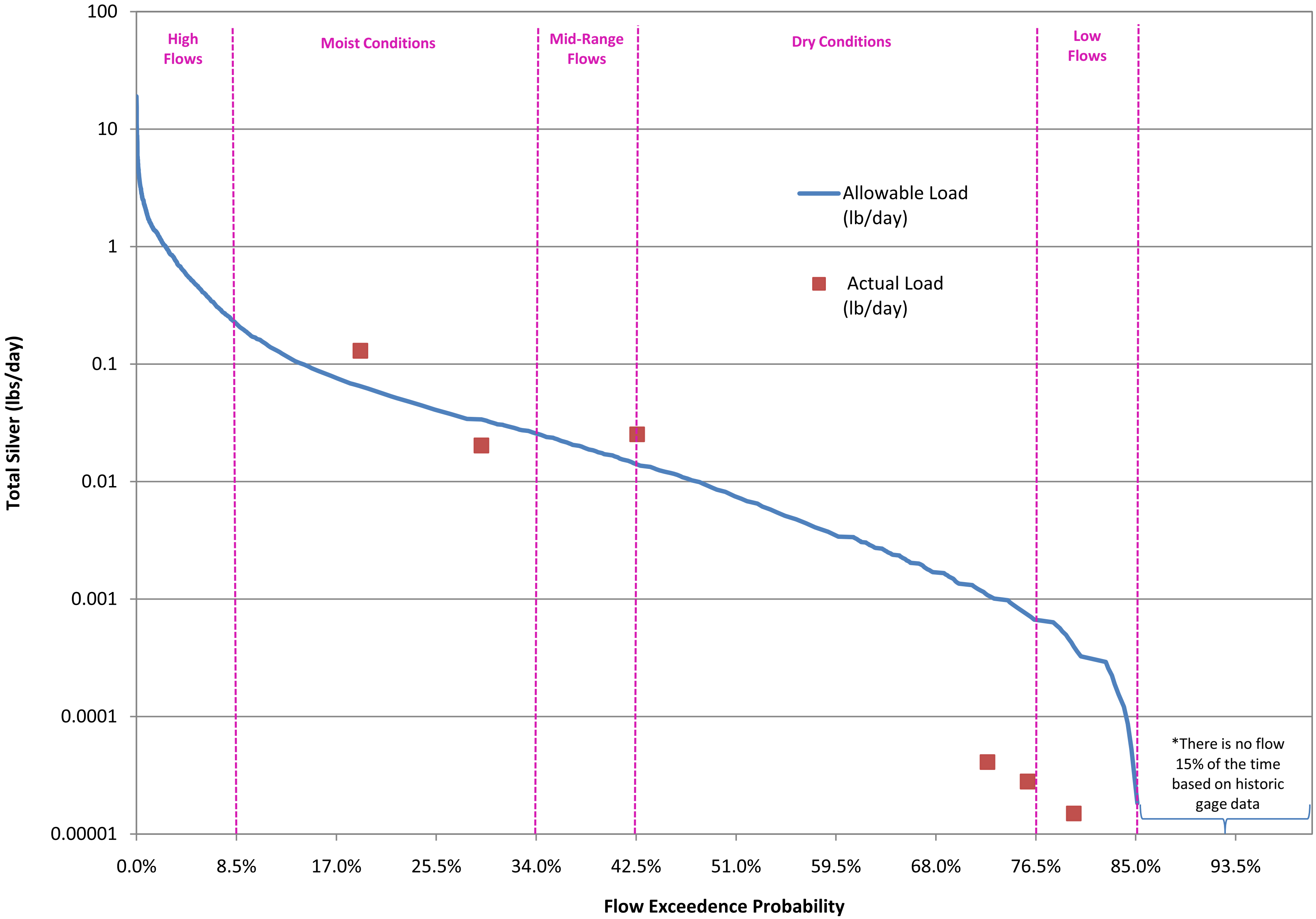

Figure 7-10
Harco Branch Segment ATGM-01
Silver Load Duration Curve

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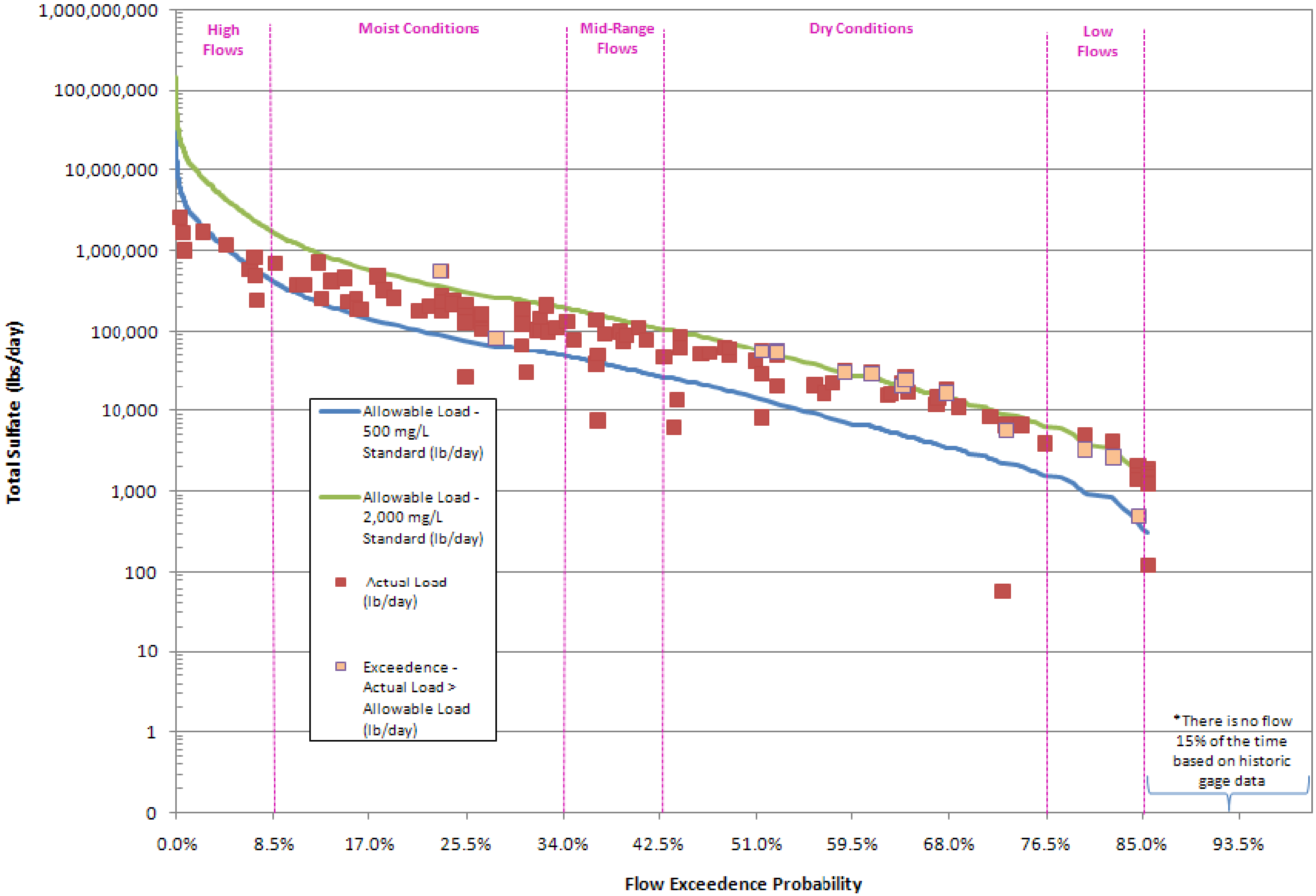

Figure 7-11
Bankston Fork Segment ATGC-01
Sulfate Load Duration Curve

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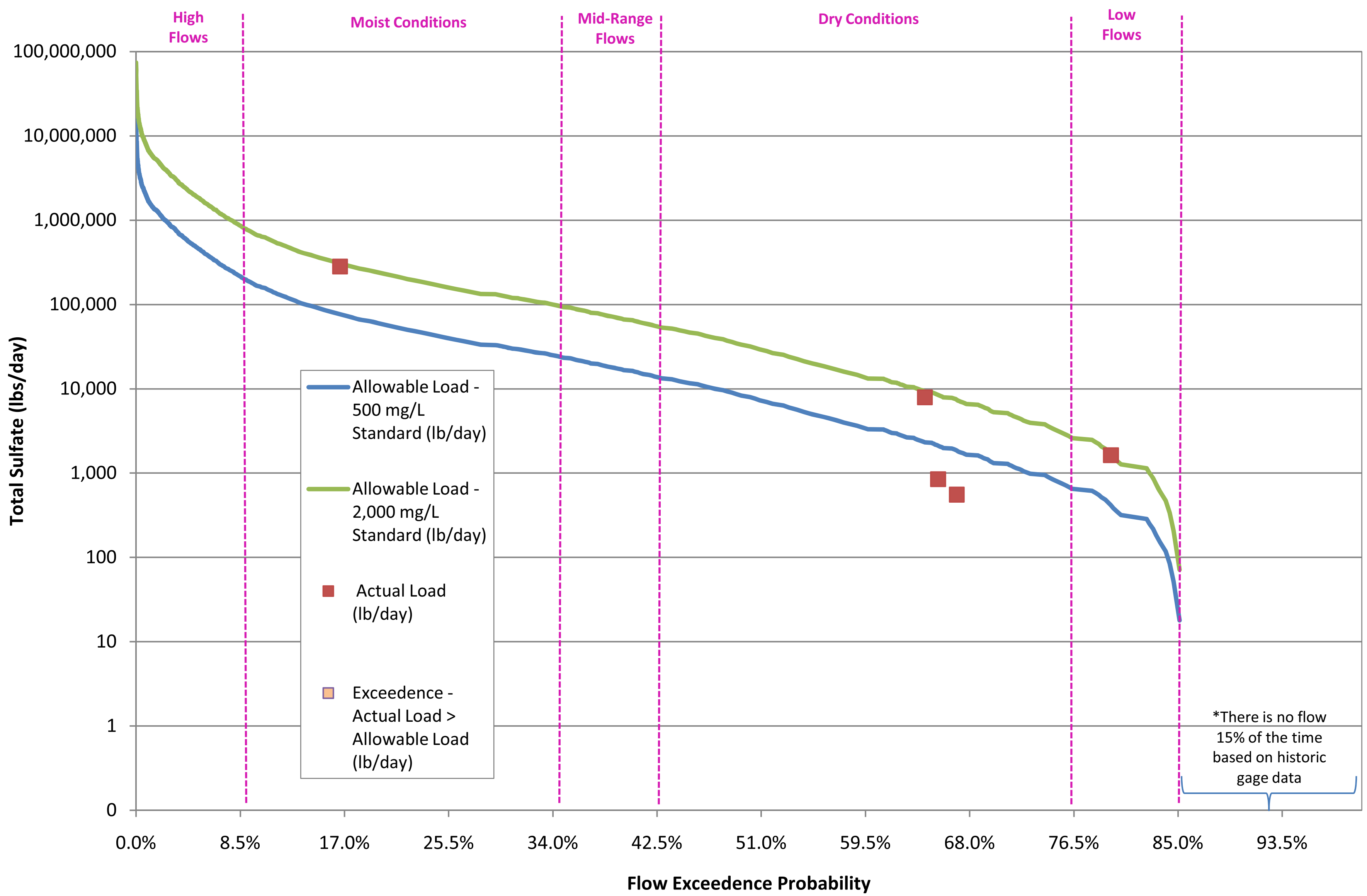

Figure 7-12
Bankston Fork Segment ATGC-02
Sulfate Load Duration Curve

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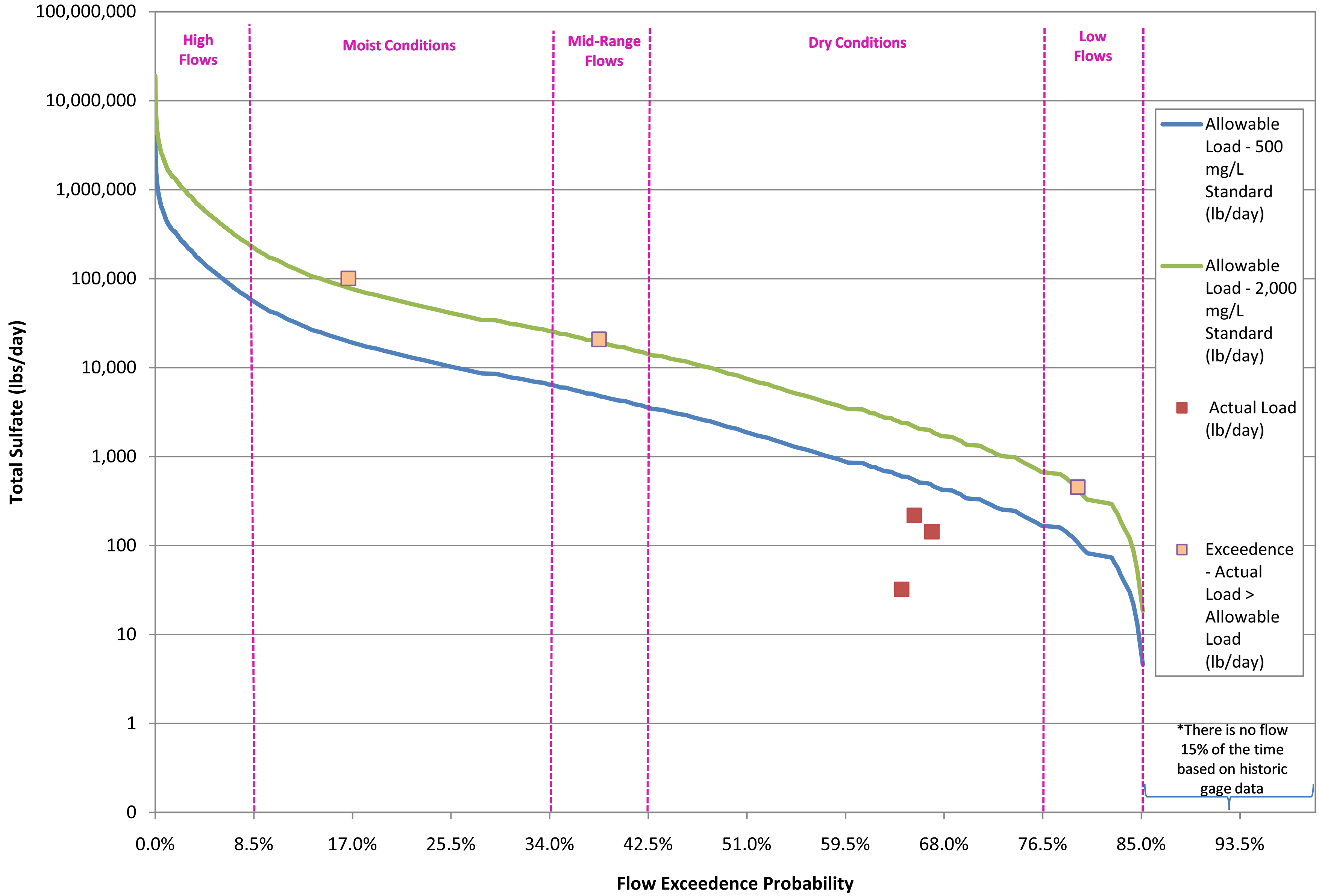

Figure 7-13
Bankston Fork Segment ATGC-11
Sulfate Load Duration Curve

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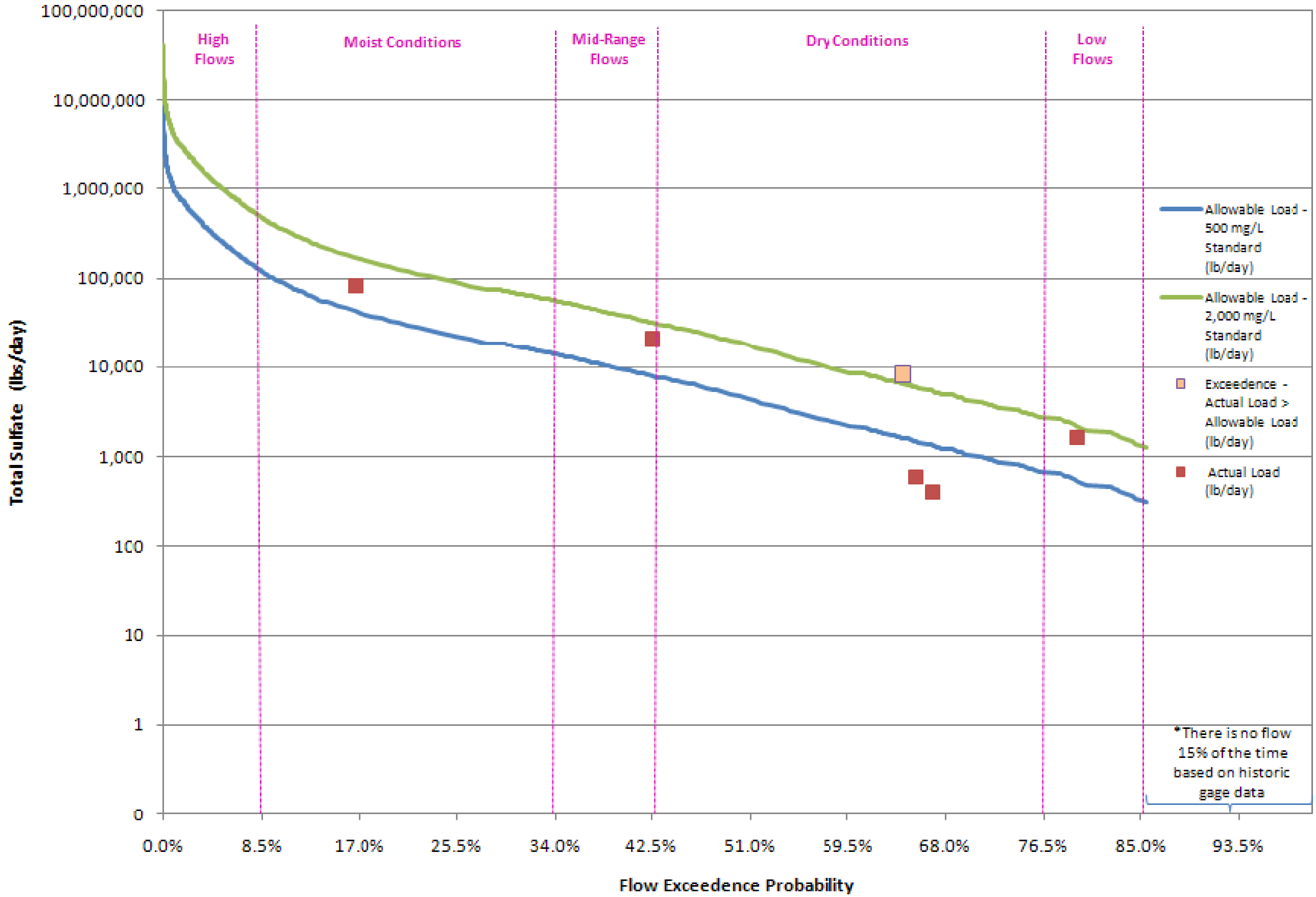

Figure 7-14
Brushy Creek Segment ATGH-09
Sulfate Load Duration Curve

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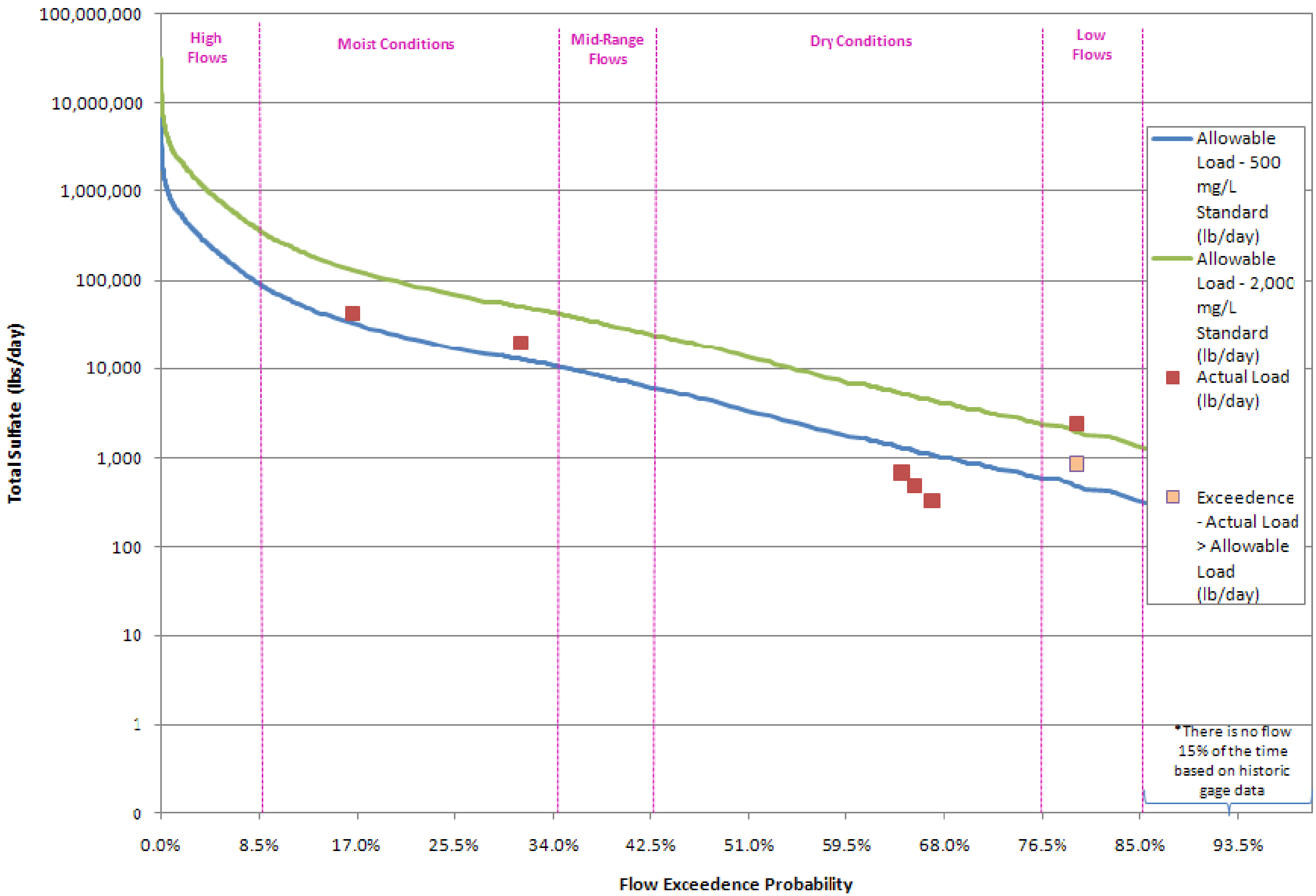

Figure 7-15
Brushy Creek Segment ATGH-10
Sulfate Load Duration Curve

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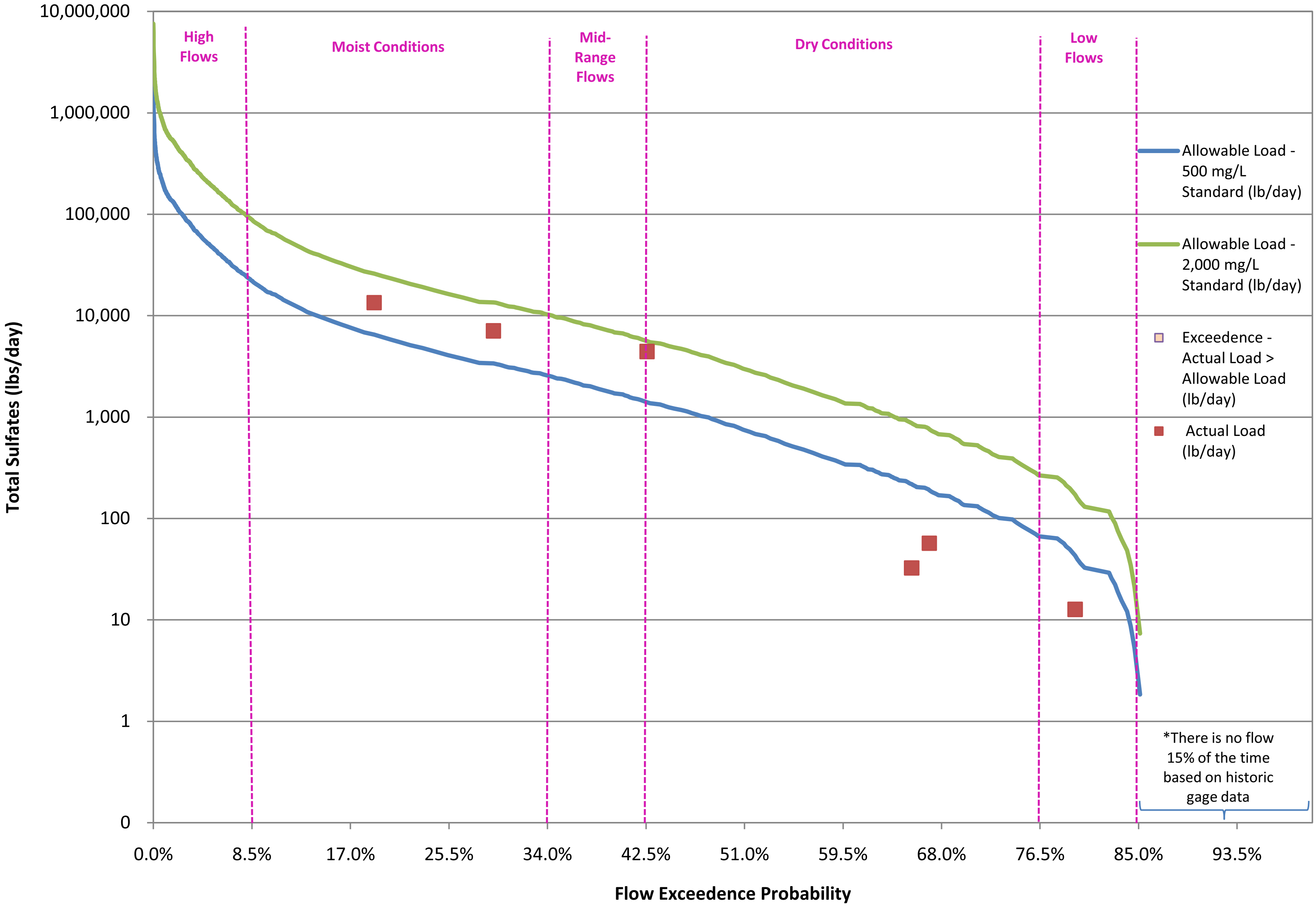

Figure 7-16
Harco Branch Segment ATGM-01
Sulfate Load Duration Curve

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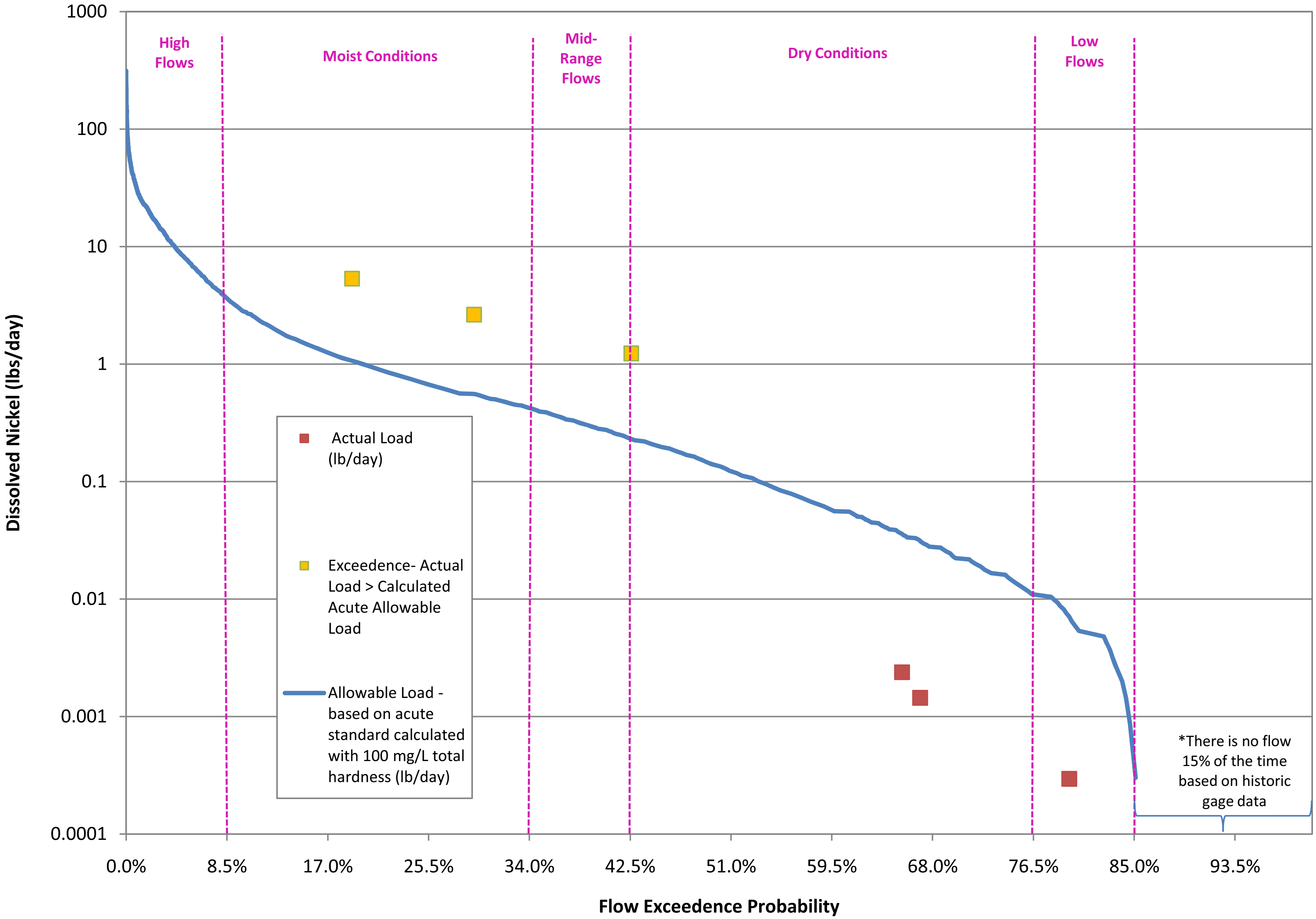

Figure 7-17
Harco Branch Segment ATGM-01
Nickel Load Duration Curve

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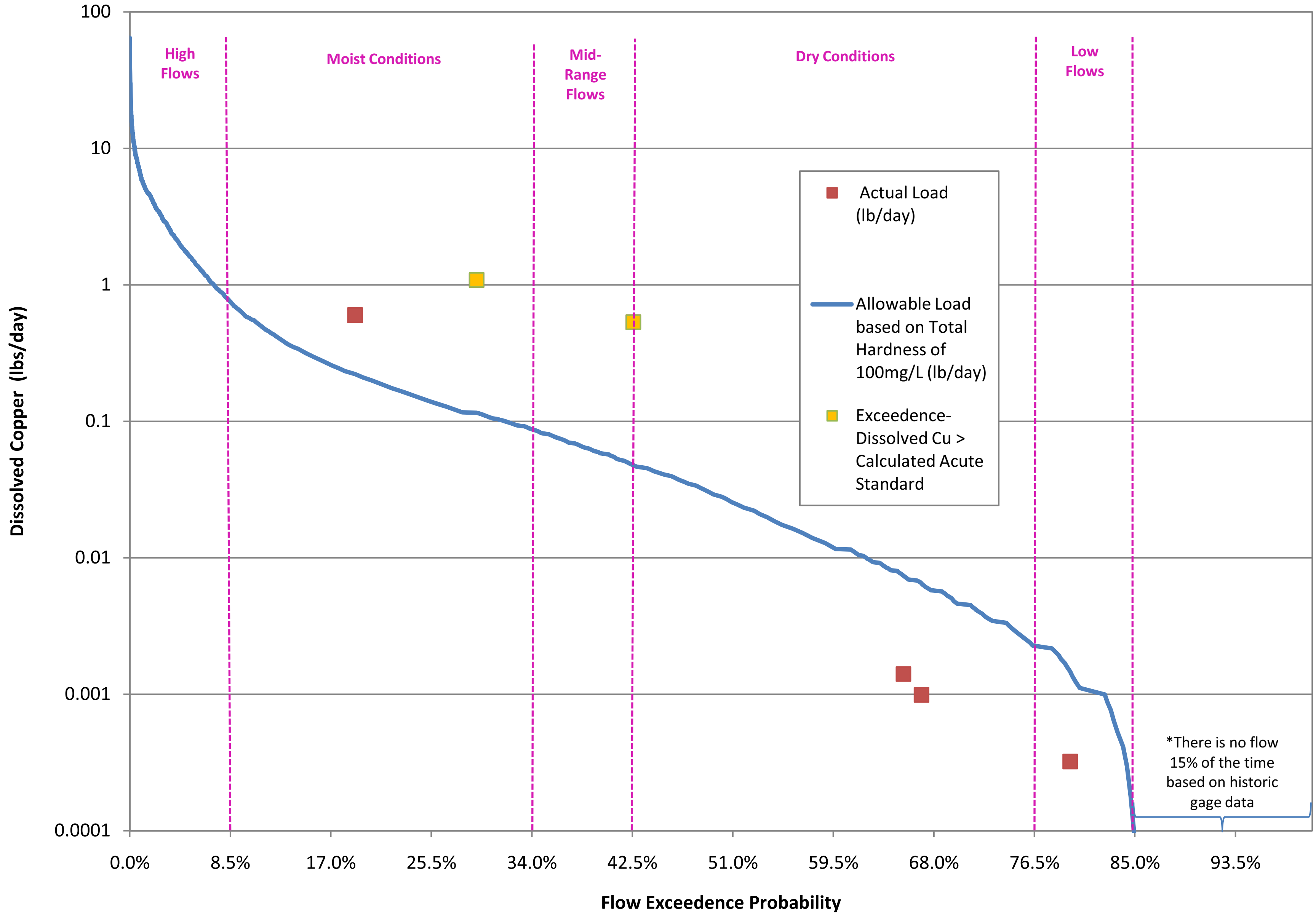

Figure 7-18
Harco Branch Segment ATGM-01
Copper Load Duration Curve

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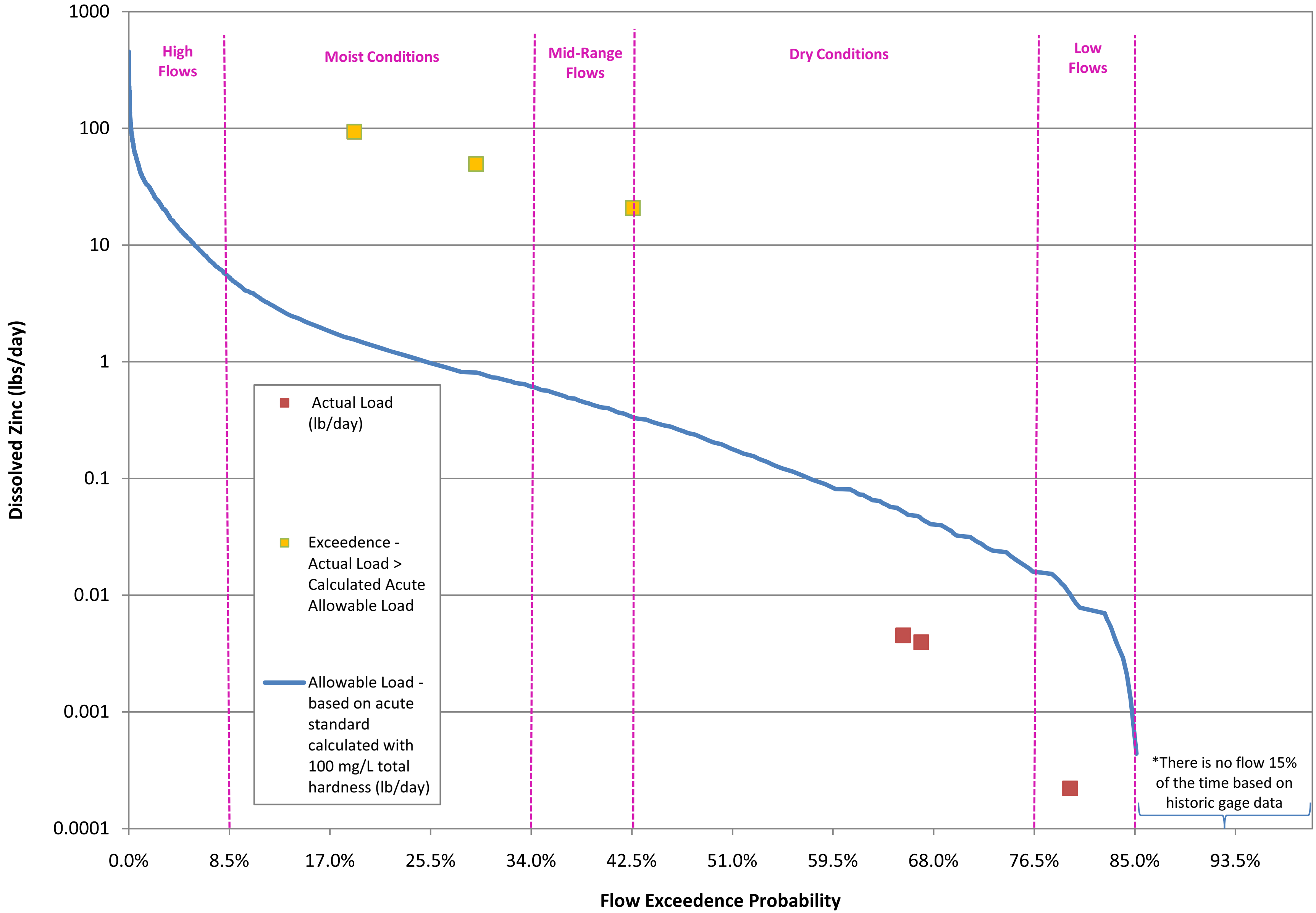

Figure 7-19
Harco Branch Segment ATGM-01
Zinc Load Duration Curve

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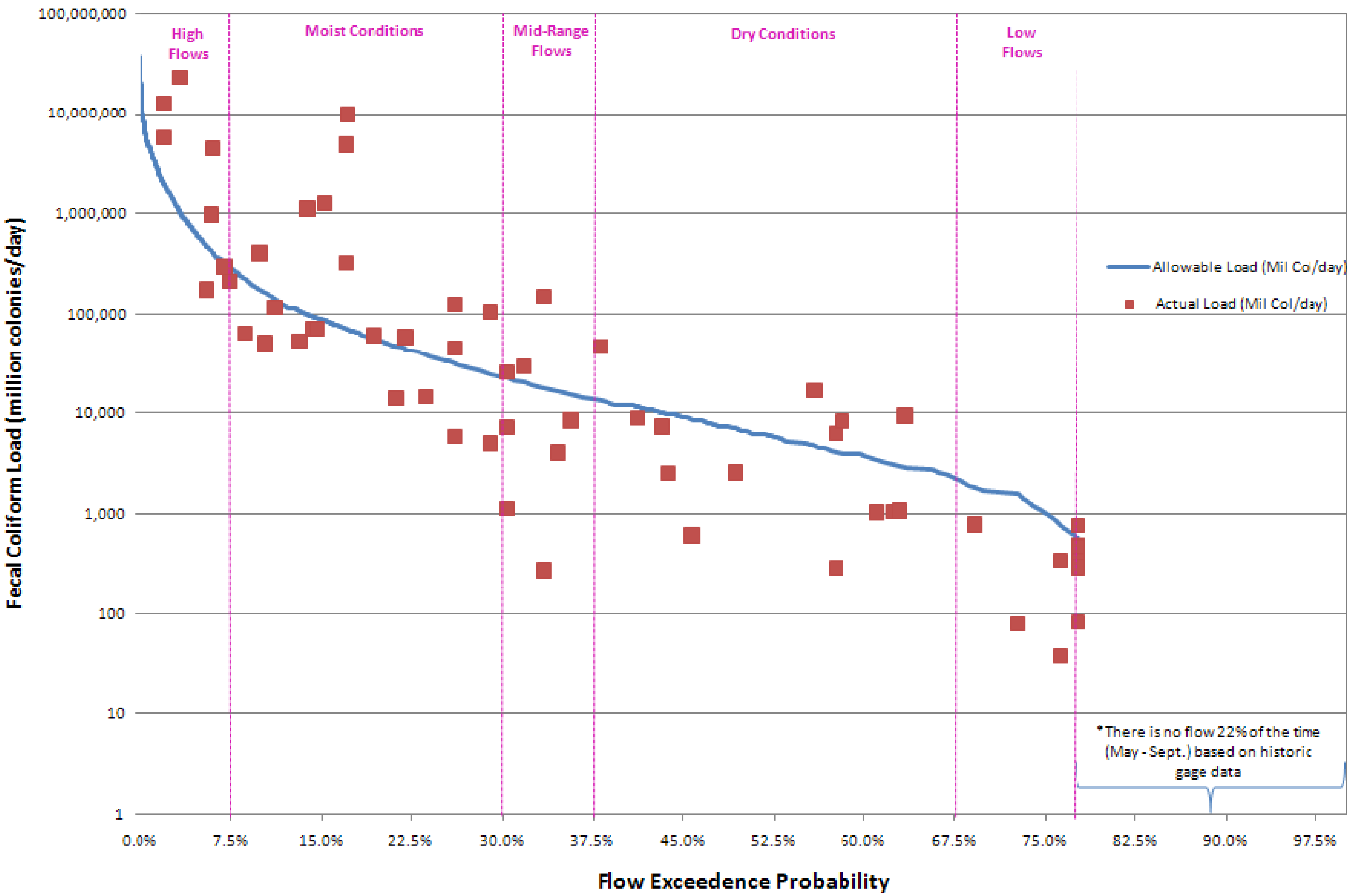

Figure 7-20
Bankston Fork Segment ATGC-01
Fecal Coliform Load Duration Curve

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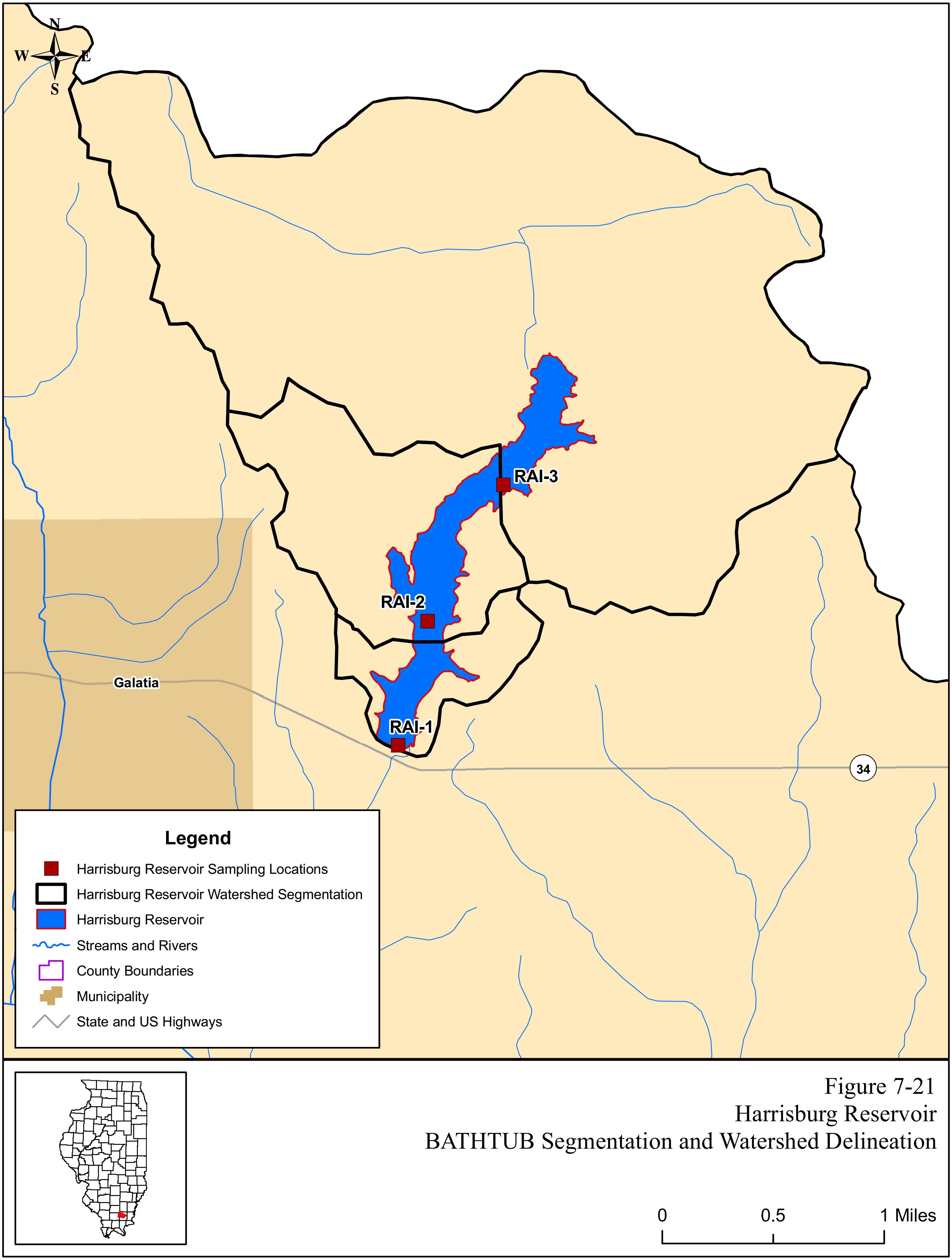

Figure 7-21
Harrisburg Reservoir
BATHTUB Segmentation and Watershed Delineation

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Section 8
Total Maximum Daily Load for the Middle Fork Saline River Watershed

8.1 TMDL Endpoints for the Middle Fork Saline River Watershed

The TMDL endpoints for copper, manganese, nickel, phosphorus, silver, sulfates, fecal coliform, and zinc are summarized in Table 8-1. For all parameters, the concentrations must be below the TMDL endpoint. The TMDL endpoint for copper, nickel, and zinc can vary from sample to sample because the water quality standards are derived through calculations based on the measured total hardness of the water at the time of sampling. TMDL endpoints for sulfates are also variable due to the water quality standards for sulfates, which are calculated for each sample based on total hardness and chloride concentrations. All of these endpoints, plus the TMDL endpoints for manganese and silver, are based on protection of aquatic life in the impaired segments of Bankston Fork, Brushy Creek, and Harco Branch. TMDL endpoints for fecal coliform on segment ATGC-01 of Bankston Fork are based on protection of the primary body contact recreation designated use and endpoints for phosphorus in Harrisburg Reservoir are established to protect the aesthetic quality designated use for this reservoir.

Some of the average concentrations presented in Table 8-1 meet the desired endpoints. However, the data sets have maximum or minimum values, presented earlier in this report, which do not meet the desired endpoints and this was the basis for TMDL analysis. Further monitoring as outlined in the monitoring plan presented in Section 9, will help further define when impairments are occurring in the watershed and support the TMDL allocations outlined in the remainder of this section.

Table 8-1 TMDL Endpoints and Average Observed Concentrations for Impaired Constituents in the Middle Fork Saline River Watershed

Segment Name/ID	Parameter	TMDL Endpoint	Average Observed Value
Bankston Fork - ATGC-01	Manganese	1,000 µg/L	1,147 µg/L
	Silver	5 µg/L	4.00 µg/L
	Sulfate	Calculated based on Total Hardness and Chlorides	1,287 mg/L
	Fecal Coliform	400 cfu/100 mL (October - May)	1,063 cfu/100mL
Bankston Fork - ATGC-02	Manganese	1,000 µg/L	562 µg/L
	Silver	5 µg/L	4.35 µg/L
	Sulfate	Calculated based on Total Hardness and Chlorides	1,170 mg/L
Bankston Fork - ATGC-11	Manganese	1,000 µg/L	888 µg/L
	Sulfate	Calculated based on Total Hardness and Chlorides	1,198 mg/L

Table 8-1 TMDL Endpoints and Average Observed Concentrations for Impaired Constituents in the Middle Fork Saline River Watershed (cont)

Segment Name/ID	Parameter	TMDL Endpoint	Average Observed Value
Brushy Creek - ATGH-09	Manganese	1,000 µg/L	620 µg/L
	Sulfate	Calculated based on Total Hardness and Chlorides	1,217 mg/L
Brushy Creek - ATGH-10	Silver	5 µg/L	4.1 µg/L
	Sulfate	Calculated based on Total Hardness and Chlorides	739 mg/L
Harco Branch - ATGM-01	Copper	Calculated base on Total Hardness	68 µg/L
	Manganese	1,000 µg/L	5,119 µg/L
	Nickel	Calculated base on Total Hardness	209 µg/L
	pH	6.5 - 9.0	2.64
	Silver	5 µg/L	3.9 µg/L
	Sulfates	Calculated based on Total Hardness and Chlorides	672 mg/L
	Zinc	Calculated base on Total Hardness	3,654 µg/L
Harrisburg Reservoir - RAI	Total Phosphorus	0.05 mg/L	0.08 mg/L

8.2 Pollutant Source and Linkages

Potential pollutant sources for the Middle Fork Saline River watershed include both point and nonpoint sources as described in Section 5 of this report. Load duration curves were developed for the majority of the TMDLs described in this section. Load duration curves are useful in that they provide a link between historic sampling values and hydraulic condition. Table 8-2 shows the example source area/hydrologic condition consideration developed by EPA.

Table 8-2 Example Source Area/Hydrologic Condition Considerations (EPA, 2007)

Contributing Source Area	Duration Curve Zone				
	High Flow	Moist	Mid-Range	Dry	Low Flow
Point Source				M	H
Onsite Wastewater System			H	M	
Riparian Areas		H	H	H	
Stormwater: Impervious Areas		H	H	H	
Combined sewer overflows	H	H	H		
Stormwater: Upland	H	H	M		
Bank Erosion	H	M			

Note: potential relative importance of source area to contribute loads under given hydrologic conditions (H: High; M: Medium)

Further pollutant source discussion is provided throughout this section and implementation activities to reduce loading from the potential sources are outlined in Section 9.

8.3 Allocation

As explained in the Section 1of this report, the TMDL for impaired segments in the Middle Fork Saline River watershed will address the following equation:

$$\textbf{TMDL = LC = } \Sigma\textbf{WLA + } \Sigma\textbf{LA + MOS}$$

where: LC = Maximum amount of pollutant loading a water body can receive without violating water quality standards
WLA = The portion of the TMDL allocated to existing or future point sources
LA = Portion of the TMDL allocated to existing or future nonpoint sources and natural background
MOS = An accounting of uncertainty about the relationship between pollutant loads and receiving water quality

Each of these elements will be discussed in this section as well as consideration of seasonal variation in the TMDL calculation.

8.3.1 Manganese TMDLs

Five segments within the Middle Fork Saline River watershed are listed for impairment caused by manganese: Bankston Fork ATGC-01, ATGC-02, and ATGC-11; Brushy Creek ATGH09; and Harco Branch ATGM-01. Load duration curves were developed (see Section 7) to determine load reductions needed to meet the instream water quality standard of 1,000 µg/L total manganese at varying flow levels.

8.3.1.1 Loading Capacities

The LC is the maximum amount of manganese that the impaired segments can receive and still maintain compliance with the water quality standard. In order to determine the loading capacity at various flow conditions, a range of flows were multiplied by the water quality standard. Table 8-3 contains the loading capacity for manganese.

Table 8-3 Manganese Loading Capacity for Impaired Segments in the Middle Fork Saline River Watershed

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs/day)
5	27
10	54
50	270
100	539
500	2,697
1,000	5,394
5,000	26,969
10,000	53,938
15,000	80,907

8.3.1.2 Seasonal Variations

Consideration to seasonality is inherent in the load duration analysis described above. The standard is not seasonal and the full range of expected flows is represented in the loading capacity table (Table 8-3). Therefore, the loading capacity represents conditions throughout the year. Load duration curve development and analysis (Section 7) showed that manganese violations in the impaired segments are most likely to occur under mid-range to moist conditions. By considering and addressing all flow scenarios, these critical conditions when the stream segments are most vulnerable to water quality exceedences were addressed.

8.3.1.3 Margins of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The manganese TMDLs developed for the impaired segments within the Middle Fork Saline River watershed contain an explicit MOS of 10 percent. Ten percent is considered adequate by the Illinois EPA to compensate for any uncertainty in the manganese TMDLs developed for these watersheds. The use of the load duration curve approach minimizes a great deal of uncertainty associated with the development of TMDLs because the calculation of the loading capacity is simply a function of flow multiplied by the target value. Most of the uncertainty is therefore associated with the estimated flows in each assessed segment which were based on extrapolating flows from downstream surrogate USGS gage. The methodology employed in estimating watershed flows was discussed in Section 7.2 of this document.

8.3.1.4 Waste Load Allocations

There are two permitted facilities in the Middle Fork Saline River watershed. The Delta Mine Holding Company (NPDES Permit No. IL0060402) is a reclaimed surface coal mine site that is permitted to discharge stormwater from multiple outfalls to Bankston Fork and Brushy Creek. The permit requires monitoring for pH and settlable solids only and has no flow information. Additionally, Western Fuels-Illinois, Inc operates the Liberty under NPDES Permit No. IL0059749. The facility is currently in the process of permit renewal for acid mine drainage from outfalls 002 and 005. These outfalls discharge to Brushy Creek ATGH-04 which is upstream of segments ATGH-10 and ATGH-09. Outfalls 002 and 005 are permit to discharge a maximum daily concentration of 1 mg/L manganese at 0.002 mgd and 0.074 mgd, respectively. WLA are included for segment ATGC-09 which is the closest segment downstream of the point source discharges which is listed as impaired for manganese. The WLA for segment ATGH-09 was developed based on the permitted concentrations and discharge rates. Both permits have conditions that state that the facilities will be considered in violation if it is determined that the permittee is not utilizing "good mining practices which are applicable in order to minimize the discharge of TDS, chloride, sulfate, iron, and manganese".

8.3.1.5 Load Allocations and TMDL Summaries

The manganese loads have been allocated between the LAs (nonpoint sources) and the MOSs. Table 8-4 shows the summary of the manganese TMDLs for the impaired segments along with the percent reductions required at various flow levels. For stream segments that have annual periods of zero low flow, the flow regime zones were shifted from the typical 25th, 50th, and 75th percentile brackets to represent only periods of the year with measurable flow.

Table 8-4 Total Manganese TMDLs for the Middle Fork Saline River Watershed

Bankston Fork Segment ATGC-01							
		LC	**LA**	**WLA**	**MOS**		
Zone	**Flow Exceedence Range (%)**	**(lbs/day)**	**(lbs/day)**	**(lbs/day)**	**(10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	2,166.8	1,950.1	0	216.7	6,166.0	65%
Moist	8.5-17	441.6	397.4	0	44.2	705.9	37%
	17-25.5	208.1	187.3	0	20.8	364.3	43%
	25.5-34	119.9	107.9	0	12.0	233.9	49%
Mid-Range	34-42.5	71.9	64.7	0	7.2	215.9	67%
Dry	42.5-51	40.8	36.7	0	4.1	60.9	33%
	51-59.5	18.7	16.9	0	1.9	25.9	28%
	59.5-68	9.7	8.7	0	1.0	16.7	42%
	68-76.5	4.5	4.0	0	0.4	28.4	84%
Low Flow	76.5-85	1.9	1.7	0	0.2	0.7	0%
Bankston Fork Segment ATGC-02							
		LC	**LA**	**WLA**	**MOS**		
Zone	**Flow Exceedence Range (%)**	**(lbs/day)**	**(lbs/day)**	**(lbs/day)**	**(10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	1,113.40	1,002.00	n/a	111.3	-	-
Moist	8.5-17	226.7	204	0	22.7	300.4	25%
	17-25.5	106.6	96	0	10.7	-	-
	25.5-34	61.3	55.2	0	6.13	-	-
Mid-Range	34-42.5	36.6	33	0	3.66	-	-
Dry	42.5-51	20.6	18.6	0	2.06	-	-
	51-59.5	9.3	8.4	0	0.93	-	-
	59.5-68	4.6	4.2	0	0.46	1	0%
	68-76.5	2	1.8	0	0.2	-	-
Low Flow	76.5-85	0.6	0.6	0	0.06	0.1	0%
Bankston Fork Segment ATGC-11							
		LC	**LA**	**WLA**	**MOS**		
Zone	**Flow Exceedence Range (%)**	**(lbs/day)**	**(lbs/day)**	**(lbs/day)**	**(10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	286.84	258.16	0	28.68	-	-
Moist	8.5-17	58.39	52.55	0	5.84	90.9	36%
	17-25.5	27.47	24.73	0	2.75	-	-
	25.5-34	15.79	14.21	0	1.58	-	-
Mid-Range	34-42.5	9.44	8.5	0	0.944	17.31	45%
Dry	42.5-51	5.32	4.79	0	0.532	-	-
	51-59.5	2.4	2.16	0	0.24	-	-
	59.5-68	1.19	1.07	0	0.119	0.88	0%
	68-76.5	0.51	0.46	0	0.051	-	-
Low Flow	76.5-85	0.16	0.15	0	0.016	0.02	0%

Table 8-4 Total Manganese TMDLs for the Middle Fork Saline River Watershed (cont)

Brushy Creek Segment ATGH-09							
		LC	LA	WLA	MOS		
Zone	Flow Exceedence Range (%)	(lbs/day)	(lbs/day)	(lbs/day)	(10% of LC)	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-8.5	618.62	556.12	0.63	61.86	-	-
Moist	8.5-17	126.44	113.16	0.63	12.64	127.72	11%
	17-25.5	59.83	53.21	0.63	5.98	-	-
	25.5-34	34.66	30.56	0.63	3.47	-	-
Mid-Range	34-42.5	20.97	18.24	0.63	2.10	10.77	0%
Dry	42.5-51	12.09	10.25	0.63	1.21	-	-
	51-59.5	5.80	4.58	0.63	0.58	-	-
	59.5-68	3.21	2.25	0.63	0.32	1.50	0%
	68-76.5	1.73	0.92	0.63	0.17	-	-
Low Flow	76.5-85	0.99	0.25	0.63	0.10	0.08	0%
Harco Branch Segment ATGM-01							
		LC	LA	WLA	MOS		
Zone	Flow Exceedence Range (%)	(lbs/day)	(lbs/day)	(lbs/day)	(10% of LC)	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-8.5	114.27	102.84	0	11.43	-	-
Moist	8.5-17	23.26	20.94	0	2.33	-	-
	17-25.5	10.95	9.85	0	1.09	124.86	91%
	25.5-34	6.29	5.66	0	0.63	52.17	88%
Mid-Range	34-42.5	3.76	3.38	0	0.38	33.65	89%
Dry	42.5-51	2.12	1.91	0	0.21	-	-
	51-59.5	0.95	0.86	0	0.1	-	-
	59.5-68	0.48	0.43	0	0.05	0.27	0%
	68-76.5	0.2	0.18	0	0.02	-	-
Low Flow	76.5-85	0.07	0.06	0	0.007	0.04	0%

[1] Actual Load was calculated using the 90th percentile of observed total manganese concentrations in a given flow range (EPA 2007)

8.3.2 Silver TMDLs

Four segments within the Middle Fork Saline River watershed are listed for impairment caused by silver: Bankston Fork ATGC-01 and ATGC-02; Brushy Creek ATGH10; and Harco Branch ATGM-01. Load duration curves were developed (see Section 7) to determine load reductions needed to meet the instream water quality standard of 5 µg/L silver at varying flow scenarios.

Table 8-5 Loading Capacity for Silver for Impaired Segments in the Middle Fork Saline River Watershed

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs/day)
5	0.13
10	0.27
50	1.3
100	2.7
500	13.5
1,000	27.0
5,000	134.8
10,000	269.7
15,000	404.5

8.3.2.1 Loading Capacities

The LC is the maximum amount of silver that the impaired segments can receive and still maintain compliance with the water quality standard. In order to determine the loading capacity at various flow conditions, a range of flows were multiplied by the water quality standard. Table 8-5 contains the loading capacity for manganese.

8.3.2.2 Seasonal Variations

Consideration to seasonality is inherent in the load duration analysis described above. The standard is not seasonal and the full range of expected flows is represented in the loading capacity table (Table 8-5). Therefore, the loading capacity represents conditions throughout the year. Load duration analysis showed that exceedances have occurred over most flow regimes on the impaired segments. By considering and addressing all flow scenarios, the critical conditions when the stream segment is most vulnerable to water quality exceedences were addressed.

8.3.2.3 Margins of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The TMDLs developed for silver contain an explicit MOS of 10 percent. Ten percent is considered adequate by the Illinois EPA to compensate for any uncertainty in the silver TMDLs developed for these watersheds. The use of the load duration curve approach minimizes a great deal of uncertainty associated with the development of TMDLs because the calculation of the loading capacity is simply a function of flow multiplied by the target value. Most of the uncertainty is therefore associated with the estimated flows in each assessed segment which were based on extrapolating flows from the surrogate USGS gage. The methodology employed in estimating watershed flows was discussed in Section 7.2 of this document.

8.3.2.4 Waste Load Allocations

There are two permitted facilities in the Middle Fork Saline River watershed. The Delta Mine Holding Company (NPDES Permit No. IL006402) is a reclaimed surface coal mine site that is permitted to discharge stormwater from multiple outfalls to Bankston Fork and Brushy Creek. The permit requires monitoring for pH and settlable solids only and has no flow information. Additionally, Western Fuels-Illinois, Inc operates the Liberty under NPDES Permit No. IL0059749. The facility is currently in the process of permit renewal for acid mine drainage from outfalls 002 and 005. These outfalls discharge to Brushy Creek ATGH-04 which is upstream of segments ATGH-10 and ATGH-09. Outfalls 002 and 005 are permit to discharge 0.002mgd and 0.074mgd, respectively. Brushy Creek segment ATGH-10 is the closest segment downstream of the point source that is impaired for silver and although the NPDES permit does not require monitoring for silver, a WLA was developed based on the discharge rates and the water quality standard.

8.3.2.5 Load Allocations and TMDL Summaries

Because there is no WLA in these TMDLs, the silver loads have been allocated between the LAs (nonpoint sources) and the MOSs. Table 8-6 shows the summary of the silver TMDLs for the impaired segments along with reductions needed at various flow levels. For stream segments that have annual periods of zero-flow, the flow regime zones were shifted from the typical 25^{th}, 50^{th}, and 75^{th} percentile brackets to represent only periods of the year with measurable flow.

Table 8-6 Silver TMDLs for the Middle Fork Saline River Watershed

Bankston Fork Segment ATGC-01							
Zone	**Flow Exceedence Range (%)**	**LC (lbs/day)**	**LA (lbs/day)**	**WLA (lbs/day)**	**MOS (10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	10.834	9.750	0	1.083	36.985	74%
Moist	8.5-17	2.208	1.987	0	0.221	1.783	0%
	17-25.5	1.041	0.937	0	0.104	0.782	0%
	25.5-34	0.600	0.540	0	0.060	0.714	24%
Mid-Range	34-42.5	0.360	0.324	0	0.036	0.678	52%
Dry	42.5-51	0.204	0.184	0	0.020	0.336	45%
	51-59.5	0.094	0.084	0	0.009	0.119	29%
	59.5-68	0.048	0.043	0	0.005	0.067	35%
	68-76.5	0.022	0.020	0	0.002	0.015	0%
Low Flow	76.5-85	0.009	0.008	0	0.001	0.005	0%
Bankston Fork Segment ATGC-02							
Zone	**Flow Exceedance Range (%)**	**LC (lbs/day)**	**LA (lbs/day)**	**WLA (lbs/day)**	**MOS (10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	5.567	5.010	0	0.5567	-	-
Moist	8.5-17	1.133	1.020	0	0.1133	1.055	0%
	17-25.5	0.533	0.480	0	0.0533	-	-
	25.5-34	0.307	0.276	0	0.0307	-	-
Mid-Range	34-42.5	0.183	0.165	0	0.0183	-	-
Dry	42.5-51	0.103	0.093	0	0.0103	-	-
	51-59.5	0.047	0.042	0	0.0047	-	-
	59.5-68	0.023	0.021	0	0.0023	0.060	62%
	68-76.5	0.010	0.009	0	0.0010	-	-
Low Flow	76.5-85	0.003	0.003	0	0.0003	0.003	0%
Brushy Creek Segment ATGH-10							
Zone	**Flow Exceedence Range (%)**	**LC (lbs/day)**	**LA (lbs/day)**	**WLA (lbs/day)**	**MOS (10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	2.3588	2.1197	0.003	0.2359	-	-
Moist	8.5-17	0.4827	0.4344	0.003	0.0483	0.1947	0%
	17-25.5	0.2288	0.2059	0.003	0.0229	-	-
	25.5-34	0.1329	0.1196	0.003	0.0133	0.0993	0%
Mid-Range	34-42.5	0.0807	0.0726	0.003	0.0081	-	-
Dry	42.5-51	0.0468	0.0421	0.003	0.0047	-	-
	51-59.5	0.0229	0.0206	0.003	0.0023	-	-
	59.5-68	0.0130	0.0117	0.003	0.0013	0.0231	44%
	68-76.5	0.0073	0.0066	0.003	0.0007	-	-
Low Flow	76.5-85	0.0045	0.0041	0.003	0.0005	0.0010	0%
Harco Branch Segment ATGM-01							
Zone	**Flow Exceedence Range (%)**	**LC (lbs/day)**	**LA (lbs/day)**	**WLA (lbs/day)**	**MOS (10% of LC)**	**Actual Load[1] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	0.5714	0.5142	0	0.05714	-	-
Moist	8.5-17	0.1163	0.1047	0	0.01163	-	-
	17-25.5	0.0547	0.0493	0	0.00547	0.1301	58%
	25.5-34	0.0315	0.0283	0	0.00315	0.0203	0%
Mid-Range	34-42.5	0.0188	0.0169	0	0.00188	0.0252	25%
Dry	42.5-51	0.0106	0.0095	0	0.00106	-	-
	51-59.5	0.0048	0.0043	0	0.00048	-	-
	59.5-68	0.0024	0.0021	0	0.00024	-	-
	68-76.5	0.0010	0.0009	0	0.00010	0.00004	0%
Low Flow	76.5-85	0.0003	0.0003	0	0.00003	0.00002	0%

[1] Actual Load was calculated using the 90th percentile of observed total silver concentrations in a given flow range (EPA 2007)

8.3.3 Sulfate TMDLs

Six segments within the Middle Fork Saline River watershed are listed for impairment caused by sulfate: Bankston Fork ATGC-01, ATGC-02, and ATGC-11; Brushy Creek ATGH09 and ATGH10; and Harco Branch ATGM-01. The water quality standard for sulfates in Illinois was revised in 2008. The new standard considers the total hardness and chloride conditions present at the time of sample collection to calculate the sulfate standard. Using the new calculated standard, data showed no violations on segment ATGC-02 of Bankston Fork or on Harco Branch segment ATGM-01. No further TMDL analysis for sulfates will be completed for these segments as loads do not need to be reduced. The load duration curves for the remaining impaired segments were used to determine load reductions needed to meet an instream water quality standard of 500 mg/L at varying flow scenarios (further discussion provided in Section 8.3.3.1 below).

8.3.3.1 Loading Capacities

The LC is the maximum amount of sulfate that the impaired segments can receive and still maintain compliance with the water quality standards. As discussed above, the water quality standard for sulfates in Illinois was revised in 2008. The new standard considers the total hardness and chloride conditions present at the time of sample collection to calculate the sulfate standard. The minimum hardness and chloride values seen in the watershed result in a sulfate standard of 500 mg/L. Table 8-7 contains the loading capacity for sulfate at 500 mg/L for varying flows in the impaired segments.

Table 8-7 Sulfate Loading Capacity for Impaired Segments in the Middle Fork Saline River Watershed

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs/day)
5	13,484
10	26,969
50	134,844
100	269,689
500	1,348,444
1,000	2,696,888
5,000	13,484,440
10,000	26,968,879
15,000	40,453,319

8.3.3.2 Seasonal Variations

Consideration to seasonality is inherent in the load duration analysis described above. The standard is not seasonal and the full range of expected flows is represented in the loading capacity table (Table 8-7). Therefore, the loading capacity represents conditions throughout the year. Exceedances of the standard have been recorded under most flow scenarios with the highest percent of exceedances occurring during dry and low flows. By considering and addressing all flow scenarios, the critical conditions when the stream segment is most vulnerable to water quality exceedences were addressed.

8.3.3.3 Margins of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The TMDLs developed for sulfate in impaired segments in the Middle Fork Saline River watershed contain implicit MOSs because the TMDLs are based on the allowable loads calculated for the minimum calculated water quality standard of 500 mg/L. Therefore, the TMDL calculations underestimate the allowable loads for the stream segment under various flow conditions, providing a conservative estimate of the TMDLs.

8.3.3.4 Waste Load Allocation

There are two permitted facilities in the Middle Fork Saline River watershed. The Delta Mine Holding Company (NPDES Permit No. IL006402) is a reclaimed surface coal mine site that is permitted to discharge stormwater from multiple outfalls to Bankston Fork and Brushy Creek. The permit requires monitoring for pH and settlable solids only and has no flow information. Additionally, Western Fuels-Illinois, Inc operates the Liberty under NPDES Permit No. IL0059749. The facility is currently in the process of permit renewal for acid mine drainage from outfalls 002 and 005. These outfalls discharge to Brushy Creek ATGH-04 which is upstream of segments ATGH-10 and ATGH-09. Outfalls 002 and 005 are permit to discharge a maximum daily concentration of 2000 mg/L sulfate at 0.002 mgd and 0.074 mgd, respectively. WLA for Brushy Creek segments ATGH-09 and ATGH-10 were developed based on the permitted concentrations and discharge rates. The TMDL was developed based on the endpoint of 500 mg/L sulfate. At low flows, the WLA based on maximum permitted concentrations and flow rates exceed the LCs of the segments. In these instances, the WLA was set to the LC. Both permits have conditions that state that the facilities will be considered in violation if it is determined that the permittee is not utilizing "good mining practices which are applicable in order to minimize the discharge of TDS, chloride, sulfate, iron, and manganese."

8.3.3.5 Load Allocation and TMDL Summary

The sulfate loads have been allocated between the LA (nonpoint sources) and the MOS. Table 8-8 shows the summary of the sulfate TMDLs for the impaired segments along with the percent reductions required at various flow levels. For stream segments that have annual periods of zero-flow, the flow regime zones were shifted from the typical 25th, 50th, and 75th percentile brackets to represent only periods of the year with measurable flow.

Table 8-8 Total Sulfate TMDLs for the Middle Fork Saline River Watershed

Bankston Fork Segment ATGC-01							
Zone	**Flow Exceedence Range (%)**	**LC[1] (lbs/day)**	**LA[1] (lbs/day)**	**WLA (lbs/day)**	**MOS**	**Actual Load[2] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	1,083,385	1,083,385	0	implicit	1,769,911	39%
Moist	8.5-17	220,798	220,798	0	implicit	479,314	54%
	17-25.5	104,057	104,057	0	implicit	400,972	74%
	25.5-34	59,955	59,955	0	implicit	174,635	66%
Mid-Range	34-42.5	35,958	35,958	0	implicit	129,057	72%
Dry	42.5-51	20,392	20,392	0	implicit	60,879	67%
	51-59.5	9,367	9,367	0	implicit	56,023	83%
	59.5-68	4,827	4,827	0	implicit	25,016	81%
	68-76.5	2,233	2,233	0	implicit	8,811	75%
Low Flow	76.5-85	935	935	0	implicit	3,094	70%
Bankston Fork Segment ATGC-11							
Zone	**Flow Exceedence Range (%)**	**LC[1] (lbs/day)**	**LA[1] (lbs/day)**	**WLA (lbs/day)**	**MOS**	**Actual Load[2] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	143,420	143,420	0	implicit	-	-
Moist	8.5-17	29,196	29,196	0	implicit	100,464	71%
	17-25.5	13,737	13,737	0	implicit	-	-
	25.5-34	7,897	7,897	0	implicit	-	-
Mid-Range	34-42.5	4,720	4,720	0	implicit	20,772	77%
Dry	42.5-51	2,658	2,658	0	implicit	-	-
	51-59.5	1,198	1,198	0	implicit	-	-
	59.5-68	597	597	0	implicit	203	0%
	68-76.5	254	254	0	implicit	-	-
Low Flow	76.5-85	82	82	0	implicit	455	82%
Brushy Creek Segment ATGH-09							
High	0-8.5	309,308	308,041	1268	implicit	-	-
Moist	8.5-17	63,219	61,951	1268	implicit	81,145	22%
	17-25.5	29,913	28,645	1268	implicit	-	-
	25.5-34	17,331	16,063	1268	implicit	-	-
Mid-Range	34-42.5	10,485	9,217	1268	implicit	19,865	47%
Dry	42.5-51	6,044	4,777	1268	implicit	-	-
	51-59.5	2,899	1,631	1268	implicit	-	-
	59.5-68	1,604	336	1268	implicit	6,727	76%
	68-76.5	863	0	863	implicit	-	-
Low Flow	76.5-85	493	0	493	implicit	682	28%
Brushy Creek Segment ATGH-10							
Zone	**Flow Exceedence Range (%)**	**LC[1] (lbs/day)**	**LA[1] (lbs/day)**	**WLA (lbs/day)**	**MOS**	**Actual Load[2] (lbs/day)**	**Percent Reduction Needed (%)**
High	0-8.5	235,878	234,610	1,268	implicit	-	-
Moist	8.5-17	48,270	47,002	1,268	implicit	41,609	0%
	17-25.5	22,880	21,612	1,268	implicit	-	-
	25.5-34	13,288	12,020	1,268	implicit	19,118	30%
Mid-Range	34-42.5	8,069	6,801	1,268	implicit	-	-
Dry	42.5-51	4,683	3,415	1,268	implicit	-	-
	51-59.5	2,285	1,017	1,268	implicit	-	-
	59.5-68	1,298	30	1,268	implicit	480	0%
	68-76.5	734	0	734	implicit	-	-
Low Flow	76.5-85	451	0	451	implicit	853	47%

1 Allowable loads calculated based on the minimum calculated water quality standard of 500 mg/L
2 Actual Load was calculated using the 90th percentile of observed total sulfate concentrations in a given flow range (EPA 2007)

8.3.4 Copper, Nickel, and Zinc TMDLs

Harco Branch segment ATGM-01 in the Middle Fork Saline River Watershed is also listed for impairment caused by copper, nickel, and zinc. Load duration curves were developed (see Section 7) to determine load reductions needed to meet the instream water quality standards at varying flow scenarios.

8.3.4.1 Loading Capacities

The LC is the maximum amount of a constituent that an impaired segment can receive and still maintain compliance with the water quality standard. In order to determine the loading capacity of each constituent at various flow conditions, a range of flows were multiplied by the water quality standard. The water quality standards copper, nickel, and zinc are dependent on total hardness. Therefore, the minimum reported hardness in the watershed of 100 mg/L was used for calculation of the standard and development of the load duration curves for each parameter. Table 8-9 contains the loading capacities for copper, nickel, and zinc based on a total hardness of 100 mg/L.

Table 8-9 Copper, Nickel, and Zinc Loading Capacities for Harco Branch Based on Minimum Reported Hardness in the Watershed

Estimated Mean Daily Flow (cfs)	Copper Load Capacity (lbs/day)	Nickel Load Capacity (lbs/day)	Zinc Load Capacity (lbs/day)
1	0.1	0.4	0.6
5	0.5	2.2	3.2
10	0.9	4.4	6.4
25	2.3	11.1	16.1
50	4.6	22.2	32.2
100	9.2	44.4	64.4
500	45.9	222.2	322.2
1,000	91.8	444.3	644.5

8.3.4.2 Seasonal Variations

Consideration to seasonality is inherent in the load duration analysis described above. The standards for copper, nickel, or zinc apply year-round and the full range of expected flows is represented in the loading capacity table (Table 8-9). Therefore, the loading capacity represents conditions throughout the year. Load duration curve development and analysis (Section 7) showed that violations for copper, nickel, and zinc segment ATGM-01 are most likely to occur under mid-range to moist conditions. By considering and addressing all flow scenarios, these critical conditions when the stream segments are most vulnerable to water quality exceedences were addressed.

8.3.4.3 Margins of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The TMDLs developed for copper, nickel, and zinc for Harco Branch segment ATGM-01 contain implicit MOSs because of conservative assumptions made in the development of the TMDL. The TMDL calculations were made using the minimum reported total hardness value for the watershed as a variable in the acute water quality standard calculations. The water quality criteria increases with total hardness and therefore, using the minimum reported total hardness results in an underestimation of the loading capacity of the segment.

8.3.4.4 Waste Load Allocations

There are no facilities within the watershed that discharge to Harco Branch. Because of this, WLAs were not calculated and were set to zero.

8.3.4.5 Load Allocations and TMDL Summaries

Table 8-10 shows the summary of the copper, nickel, and zinc TMDLs for Harco Branch segment ATGM-01 along with the percent reductions required at various flow levels. The flow regime zones were shifted from the typical 25th, 50th, and 75th percentile brackets to represent only periods of the year with measurable flow.

Table 8-10 Dissolved Copper, Nickel, and Zinc TMDLs for Harco Branch Segment ATGM-01

Copper TMDL for Harco Branch Segment ATGM-01							
		LC	LA	WLA			
Zone	Flow Exceedence Range (%)	(lbs/day)	(lbs/day)	(lbs/day)	MOS	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-8.5	1.944	1.944	0	implicit	-	-
Moist	8.5-17	0.396	0.396	0	implicit	-	-
	17-25.5	0.186	0.186	0	implicit	0.598	69%
	25.5-34	0.107	0.107	0	implicit	1.084	90%
Mid-Range	34-42.5	0.064	0.064	0	implicit	0.533	88%
Dry	42.5-51	0.036	0.036	0	implicit	-	-
	51-59.5	0.016	0.016	0	implicit	-	-
	59.5-68	0.008	0.008	0	implicit	0.001	0%
	68-76.5	0.003	0.003	0	implicit	-	-
Low Flow	76.5-85	0.001	0.001	0	implicit	0.0003	0%
Nickel TMDL for Harco Branch Segment ATGM-01							
		LC	LA	WLA			
Zone	Flow Exceedence Range (%)	(lbs/day)	(lbs/day)	(lbs/day)	MOS	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-8.5	9.413	9.413	0	implicit	-	-
Moist	8.5-17	1.916	1.916	0	implicit	-	-
	17-25.5	0.902	0.902	0	implicit	5.33	83%
	25.5-34	0.518	0.518	0	implicit	2.64	80%
Mid-Range	34-42.5	0.31	0.31	0	implicit	1.23	75%
Dry	42.5-51	0.174	0.174	0	implicit	-	-
	51-59.5	0.079	0.079	0	implicit	-	-
	59.5-68	0.039	0.039	0	implicit	0.002	0%
	68-76.5	0.017	0.017	0	implicit	-	-
Low Flow	76.5-85	0.005	0.005	0	implicit	-	-

Table 8-10 Dissolved Copper, Nickel, and Zinc TMDLs for Harco Branch Segment ATGM-01 (cont)

Zinc TMDL for Harco Branch Segment ATGM-01

Zone	Flow Exceedence Range (%)	LC (lbs/day)	LA (lbs/day)	WLA (lbs/day)	MOS	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-8.5	13.654	13.654	0	implicit	-	-
Moist	8.5-17	2.78	2.78	0	implicit	-	-
	17-25.5	1.308	1.308	0	implicit	93.64	99%
	25.5-34	0.752	0.752	0	implicit	49.46	98%
Mid-Range	34-42.5	0.449	0.449	0	implicit	20.75	98%
Dry	42.5-51	0.253	0.253	0	implicit	-	-
	51-59.5	0.114	0.114	0	implicit	-	-
	59.5-68	0.057	0.057	0	implicit	0.004	0%
	68-76.5	0.024	0.024	0	implicit	-	-
Low Flow	76.5-85	0.008	0.008	0	implicit	0.0002	0%

1 Actual Load was calculated using the 90th percentile of observed concentrations in a given flow range (EPA 2007)
2 Allowable loads calculated using minimum reported hardness in watershed (100mg/L)

8.3.5 Fecal Coliform TMDL

Bankston Fork segment ATGC-01 in the Middle Fork Saline River watershed is also listed for impairment caused by fecal coliform. A load duration curve was developed (see Section 7) to determine load reductions needed to meet the instream water quality standards at varying flow scenarios.

8.3.5.1 Loading Capacity

Table 8-11 Fecal Coliform Loading Capacity for Bankston Fork Segment ATGC-01

Estimated Mean Daily Flow (cfs)	Load Capacity (mil col/day)
5	24,466
10	48,932
50	244,663
100	489,332
500	2,446,689
1,000	4,893,434
5,000	24,467,455
10,000	48,935,475
15,000	73,404,063

The LC is the maximum amount of fecal coliform that Bankston Fork segment ATGC-01 can receive and still maintain compliance with the water quality standards. The allowable fecal coliform loads that can be generated in the watershed and still maintain the geometric mean standard of 200 cfu/100mL were determined with the methodology discussed in Section 7. The fecal coliform loading capacity according to flow is presented in Table 8-11.

8.3.5.2 Seasonal Variation

Consideration of seasonality is inherent in the load duration analysis. Because the load duration analysis represents the range of expected stream flows, the TMDL has been calculated to meet the standard during all flow conditions. In addition, seasonality is addressed because the TMDL has been calculated to address loading only when the seasonal standard is applicable (May through October).

For this TMDL, the critical period for fecal coliform is the primary contact recreation season which is May through October each year. There is no one critical condition during the recreation season. The fecal coliform standard must be met under all flow scenarios and standard exceedances have occurred during the majority of flow scenarios. By using the load duration curve method, all of these "critical conditions" are accounted for in the loading allocations.

8.3.5.3 Margin of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The MOS for the ATGC-01 TMDL is implicit as the analysis used the more conservative 200 cfu/100mL standard and did not consider die-off of bacteria which is likely occurring in the system but unquantified.

8.3.5.4 Waste Load Allocation

There are no facilities within the watershed that discharge to segment ATGC-01 of Bankston Fork. Because of this, WLAs were not calculated and were set to zero.

8.3.5.5 Load Allocation and TMDL Summary

Table 8-12 shows a summary of the TMDL for Bankston Fork segment ATGC-01. The flow regime zones were shifted from the typical 25th, 50th, and 75th percentile brackets to represent only periods of the year with measurable flow.

Table 8-12 Fecal Coliform TMDL for Bankston Fork segment ATGC-01

Zone	Flow Exceedence Range (%)	LC (lbs/day)	LA (lbs/day)	WLA (lbs/day)	MOS	Actual Load[1] (lbs/day)	Percent Reduction Needed (%)
High	0-7.5	883,694	883,694	0	implicit	15,940,920	94%
Moist	7.5-15	141,830	141,830	0	implicit	618,236	77%
	15-22.5	60,578	60,578	0	implicit	6,881,269	99%
	22.5-30	31,139	31,139	0	implicit	113,695	73%
Mid-Range	30-37.5	18,186	18,186	0	implicit	63,310	71%
Dry	37.5-45	11,474	11,474	0	implicit	34,163	66%
	45-52.5	7,470	7,470	0	implicit	2,214	0%
	52.5-60	4,644	4,644	0	implicit	12,536	63%
	60-67.5	2,878	2,878	0	implicit	5,583	48%
Low Flow	67.5-77	1,700	1,700	0	implicit	353	0%

[1] Actual Load was calculated using the 90th percentile of observed fecal coliform concentrations in a given flow range (EPA 2007)

8.3.6 Total Phosphorus TMDL for Harrisburg Reservoir

8.3.6.1 Loading Capacity

The LC of Harrisburg Reservoir is the pounds of total phosphorus that can be allowed as input to the lake per day and still meet the water quality standard of 0.05 mg/L total phosphorus. The allowable phosphorus loads that can be generated in the watershed and still maintain water quality standards were determined with the BATHTUB model that was set up and confirmed as discussed in Section 7. To accomplish this, the loads calculated using average values from the historic data were reduced by a percentage and entered into the BATHTUB models until the water quality standard of 0.05 mg/L total phosphorus was met in Harrisburg Reservoir. The allowable phosphorus load determined by reducing modeled inputs to Harrisburg Reservoir through BATHTUB is 2.66 lbs/day.

8.3.6.2 Seasonal Variation

A season is represented by changes in weather; for example, a season can be classified as warm or cold as well as wet or dry. Seasonal variation is represented in the Harrisburg Reservoir TMDL as conditions were modeled on an annual basis. Modeling on an annual basis takes into account the seasonal effects the lake will undergo during a given year. Since the pollutant source can be expected to contribute loadings in different quantities during different time periods (e.g., various portions of the agricultural season resulting in different runoff characteristics), the loadings for this TMDL will focus on average annual loadings converted to daily loads rather than specifying different loadings by season. The Harrisburg Reservoir Watershed would most likely experience critical conditions annually based on the growing season. Because an average annual basis was used for TMDL development, it is assumed that the critical condition is accounted for within the analysis.

8.3.6.3 Margin of Safety

The margin of safety (MOS) can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The MOS for the Harrisburg Reservoir TMDL is implicit. The analysis completed for this waterbody was conservative because of the following:

- In the absence of site-specific data, an atmospheric loading rate of 30 mg/m^2-yr total phosphorus (USACE 1999) was taken from literature values and used in the BATHTUB model. This is a conservative value because atmospheric loadings of phosphorus are attributed to erosion that becomes wind borne and because of the low amount of agricultural practices in the surrounding area, the atmospheric loading is most likely negligible. This conservative value likely overestimates loading resulting in a conservatively high percentage reduction needed to meet the TMDL endpoints.

- Default values were used in the BATHTUB model, which in absence of site-specific information are conservative. Default model values, such as the phosphorus assimilation rate, are based on scientific data accumulated from a large survey of lakes. Because no site-specific data are available, default model rates are used which are based on error analysis calculations. The model used for this analysis uses estimates of second-order sedimentation coefficients which are generally accurate to within a factor of 2 for phosphorus and a factor of 3 for nitrogen. This provides a conservation range of where the predictions could fall and provides confidence in the predicted values.

8.3.6.4 Waste Load Allocation

There are no point sources within the Harrisburg Reservoir watershed. Therefore, the WLA is set to zero for this TMDL.

8.3.6.5 Load Allocation and TMDL Summary

Table 8-13 shows a summary of the TMDL for Harrisburg Reservoir. A total reduction of 52 percent of total phosphorus loads to Harrisburg Reservoir would result in compliance with the water quality standard of 0.05 mg/L total phosphorus.

Table 8-13 TMDL Summary for Harrisburg Reservoir

Load Source	LC (lb/day)	WLA (lb/day)	LA (lb/day)	MOS (lb/day)	Current Load (lb/day)	Reduction Needed (lb/day)	Reduction Needed (percent)
Total	2.66	0	2.66	Implicit	5.54	2.88	52%
Internal	0.00	0	0.00	Implicit	0.00	0.00	0%
External	2.66	0	2.66	implicit	5.54	2.88	52%

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Section 9
Implementation Plan for the Middle Fork Saline River Watershed

9.1 Adaptive Management

An adaptive management or phased approach is recommended for the TMDLs developed for the Middle Fork Saline River watershed due to the limited amount of data available for the TMDL analysis. Adaptive management is a systematic process for continually improving management policies and practices through learning from the outcomes of operational programs. Some of the differentiating characteristics of adaptive management are:

- Acknowledgement of uncertainty about what policy or practice is "best" for the particular management issue
- Thoughtful selection of the policies or practices to be applied (the assessment and design stages of the cycle)
- Careful implementation of a plan of action designed to reveal the critical knowledge that is currently lacking
- Monitoring of key response indicators
- Analysis of the management outcomes in consideration of the original objectives and incorporation of the results into future decisions (British Columbia Ministry of Forests 2000)

Implementation actions, point source controls, management measures, or BMPs are used to control the generation or distribution of pollutants. BMPs are either structural, such as wetlands, sediment basins, fencing, or filter strips; or managerial, such as conservation tillage, nutrient management plans, or crop rotation. Both types require good management to be effective in reducing pollutant loading to water resources (Osmond et al. 1995).

It is generally more effective to install a combination of point source controls and BMPs or a BMP system. A BMP system is a combination of two or more individual BMPs that are used to control a pollutant from the same critical source. In other words, if the watershed has more than one identified pollutant, but the transport mechanism is the same, then a BMP system that establishes controls for the transport mechanism can be employed (Osmond et al. 1995).

To assist in adaptive management, implementation actions, management measures, available assistance programs, and recommended continued monitoring are all discussed throughout the remainder of this section.

9.2 Implementation Actions and Management Measures for Metals, pH, and Sulfates in the Middle Fork Saline River Watershed

Violations of the water quality standards for manganese have been documented on segments ATGC-01, ATGC-02, ATGC-11, ATGH-09, and ATGM-01 in the Middle Fork Saline River watershed. Segments ATGC-01, ATGC-02, ATGH-10, and ATGM-01 have had violations for silver recorded since 1990. Violations of the sulfate standards have been reported on all 6 impaired stream segments in the watershed. In addition, segment ATGM-01 has had violations of the water quality standards for copper, nickel, zinc, and pH. The most likely sources of these contaminants are runoff from historic mining operations in the watershed as well as natural sources including overland runoff, soil erosion, and groundwater.

There are a number of active and historic mining operations in the Middle Fork Saline River watershed that may contribute to the loads of these contaminants to the impaired stream segments. Impacts from abandoned mine lands, acid mine drainages, surface mining, and mine tailings have all been identified in the 303(d) list as potential sources of sulfates, metals, and pH violations in the watershed. Implementation actions and management measures available to address the water quality issues associated with these sources of contaminants in each of the impaired stream segments in the Middle Fork Saline River watershed are discussed below.

9.2.1 Point Sources of Metals, pH, and Sulfates

9.2.1.1 Permitted Mining Outfalls

There are two permitted facilities in the Middle Fork Saline River watershed. The Delta Mine Holding Company (NPDES Permit No. IL006402) is a reclaimed surface coal mine site that is permitted to discharge stormwater from multiple outfalls to Bankston Fork and Brushy Creek. The permit requires monitoring for pH and settlable solids only and has no flow information. Additionally, Western Fuels-Illinois, Inc operates the Liberty under NPDES Permit No. IL0059749. The facility is currently in the process of permit renewal for acid mine drainage from outfalls 002 and 005. These outfalls discharge to Brushy Creek ATGH-04 which is upstream of segments ATGH-10 and ATGH-09. It should be noted that segment ATGH-04 is not listed for impairment on the 303(d) list.

Table 9-1 contains permit information for these facilities. The Liberty Mine permit is currently in the process of renewal and Table 9-1 contains information to reflect this.

Table 9-1 Point Source Discharges in the Middle Fork Saline River Watershed

Facility Name	Outfall	Permit Number	Daily Average Flow (mgd)	Manganese (mg/L) Daily Maximum	Sulfate (mg/L) Daily Maximum
Liberty Mine - previous permit	002. 005. 009	IL0059749	n/a	4	3500
Liberty Mine - 2010 renewal	002. 005. 009	IL0059749	0.002, 0.074, 0*	1	2000
Delta Mining Company	**	IL0060402	0	-	-

n/a = information not available
* 009 only is described in the permit as "emergency only"
** The Delta Mine has multiple stormwater outfalls. Receiving waters include Bankston Fork, Unnamed Tribs to Bankston Fork, and Brushy Creek

Illinois EPA will evaluate the need for point source controls through the NPDES permitting program as the permits are due for renewal. The City of Paris STP permit has limits for BOD_5 and ammonia-nitrogen. Both permits have conditions that state that the facilities will be considered in violation if it is determined that the permittee is not utilizing "good mining practices which are applicable in order to minimize the discharge of TDS, chloride, sulfate, iron and manganese". Mine effluent limitations are provided in Part 406 of the Illinois Administrative Code Section 406.202 states:

> *In addition to the other requirements of this Part, no mine discharge or non-point source mine discharge shall, alone or in combination with other sources, cause a violation of any water quality standards of 35 Ill. Adm. Code 302 or 303. When the Agency finds that a discharge which would comply with effluent standards contained in this Part would cause or is causing a violation of water quality standards, the Agency shall take appropriate action under Section 31 or 39 of the Environmental Protection Act to require the discharge to meet whatever effluent limits are necessary to ensure compliance with the water quality standards. When such a violation is caused by the cumulative effect of more than one source, several sources may be joined in an enforcement or variance proceeding and measures for necessary effluent reductions will be determined on the basis of technical feasibility, economic reasonableness and fairness to all discharges (IPCB 1999b).*

These permit and their associated limits are thought to be adequately protective of aquatic life uses within the receiving waters.

9.2.2 Nonpoint Sources of Sulfates, pH, and Metals

A potential source of metals, sulfates, and pH in the Middle Fork Saline River watershed is abandoned mining operations. For this source, chemical treatment methods, passive treatment methods, and mine reclamation are potential implementation activities. Active chemical treatment typically involves the addition of alkaline chemicals, such as calcium carbonate, sodium hydroxide, sodium bicarbonate, and anhydrous ammonia to acid mine drainage. These chemicals raise the pH to acceptable levels and decrease the solubility of dissolved metals. Metal precipitates form and settle out of the solution. Active chemical treatment is not likely to be a viable option for the Middle Fork Saline River watershed because the chemicals are expensive, and the treatment system requires additional costs associated with operation and maintenance, as well as the disposal of metal-laden sludge.

Reclamation of abandoned mines is another method of controlling pollutants. Reclamation of abandoned mine land involves clearing site vegetation, removing contaminated topsoil and coal, and restoring functionality of the site for recreational, agricultural, or wildlife habitat purposes. The environmental benefits realized from abandoned mine reclamation projects are numerous and significant, including restoring land for future use and improving water quality. Restoration of the land can result in increased and enhanced pasture land, recreational areas, or wildlife habitat (Pennsylvania Department of Environmental Protection [PDEP] 2002). However, reclamation projects tend to be costly and resource intensive and may not be appropriate for all abandoned mine sites in Middle Fork Saline River watershed.

Passive methods could be utilized until full reclamation of a mine occurs. Chemical addition and energy consuming treatment processes are virtually eliminated with passive treatment systems. The operation and maintenance requirements of passive systems are considerably less than active treatment systems (PDEP 2002). Therefore, passive treatment systems may be the best solution for controlling metals, sulfates, and pH originating from mining operations in the Middle Fork Saline River watershed.

Following are examples of the passive treatment technologies:

- Aerobic wetland
- Compost or anaerobic wetland
- Open limestone channels
- Diversion wells
- Anoxic limestone drains
- Vertical flow reactors
- Pyrolusite process

Additional sources of some metals contamination may be from high background levels of the metals in the soils of the watershed. As such, nonpoint source controls that are designed to reduce erosion may provide a secondary benefit of reducing any contaminants that may be attached to the soil.

Following are examples of potentially applicable erosion control measures:

- Filter Strips
- Sediment Control Basins
- Streambank Stabilization/Erosion Control

The remainder of this section discusses these technologies and management options.

9.2.2.1 Aerobic Wetland

An aerobic wetland consists of a large surface area pond with horizontal surface flow. The pond may be planted with cattails and other wetland species. Aerobic wetlands can only effectively treat water that is net alkaline (pH greater than 7). In aerobic wetland systems, metals are precipitated through oxidation reactions to form oxides and hydroxides. A typical aerobic wetland will have a water depth of 6 to 18 inches (PDEP 2002).

9.2.2.2 Compost or Anaerobic Wetland

Compost wetlands, or anaerobic wetlands as they are sometimes called, consist of a large pond with a lower layer of organic substrate. The flow is horizontal within the substrate layer of the basin. Piling the compost a little higher than the free water surface can encourage the flow within the substrate. Typically, the compost layer consists of spent mushroom compost that contains about 10 percent calcium carbonate. Other compost materials include peat moss, wood chips, sawdust, or hay. A typical compost wetland will have 12 to 24 inches of organic substrate and be planted with cattails or other emergent vegetation (PDEP 2002).

9.2.2.3 Open Limestone Channels

Open limestone channels may be the simplest passive treatment method available. Open limestone channels are constructed in two ways. In the first method, a drainage ditch constructed of limestone collects contaminated acid mine drainage water. The other method consists of placing limestone fragments directly in a contaminated stream. Dissolution of the limestone adds alkalinity to the water and raises the pH. This treatment requires large quantities of limestone for long-term success (PDEP 2002).

9.2.2.4 Diversion Wells

Diversion wells are another simple way to increase the alkalinity of contaminated waters. Acidic water is conveyed by a pipe to a downstream "well," which contains crushed limestone aggregate. The hydraulic force of the pipe flow causes the limestone to turbulently mix and abrade into fine particles preventing armoring (PDEP 2002).

9.2.2.5 Anoxic Limestone Drains

An anoxic limestone drain is a buried bed of limestone constructed to intercept subsurface mine water flow and prevent contact with atmospheric oxygen. Keeping oxygen out of the water prevents oxidation of metals and armoring of the limestone. An anoxic limestone drain can be considered a pretreatment step to increase alkalinity and raise pH before the water enters a constructed aerobic wetland (PDEP 2002).

9.2.2.6 Vertical Flow Reactors

Vertical flow reactors were conceived as a way to overcome the alkalinity producing limitations of anoxic limestone drains and the large area requirements of compost wetlands. The vertical flow reactor consists of a treatment cell with an underdrained limestone base topped with a layer of organic substrate and standing water. The water flows vertically through the compost and limestone and is collected and discharged through a system of pipes. The vertical flow reactor increases alkalinity by limestone dissolution and bacterial sulfate reduction (PDEP 2002).

9.2.2.7 Pyrolusite Process

The pyrolusite process is a patented process, which utilizes site-specific cultured microbes to remove iron, manganese, and aluminum from acid mine drainage. The treatment process consists of a shallow bed of limestone aggregate inundated with acid mine drainage. After laboratory testing determines the proper combination, microorganisms are introduced to the limestone bed by inoculation ports located throughout the bed. The microorganisms grow on the surface of the limestone chips and oxidize the metal contaminants while etching away limestone, which in turn increases the alkalinity and raises the pH of water. This process has been used on several sites in western Pennsylvania with promising results (PDEP 2002).

9.2.2.8 Filter Strips

Filter strips can be used as a control to reduce pollutant loads from runoff and sedimentation to impaired stream segments in the Middle Fork Saline River watershed. Filter strips implemented along stream segments slow and filter runoff and provide bank stabilization decreasing erosion and deposition. The following paragraphs focus on the implementation of filter strips in the watershed.

Filter strips may help control contaminant levels by removing loads associated with sediment from runoff; however, no studies were identified as providing an estimate of removal efficiency. Grass filter strips have been shown to remove as much as 75 percent of sediment and 45 percent of total phosphorus from runoff, so it is assumed that the removal of other contaminants such as metals and sulfates from runoff may fall within this range (NCSU 2000). Riparian vegetation also provides bank stability that further reduces sediment loading to the stream and therefore reduces the loading of silver and manganese found in soils.

Filter strip widths for the impaired stream segments TMDLs were estimated based on the land slope. According to the NRCS Planning and Design Manual, the majority of sediment is removed in the first 25 percent of the width (NRCS 1994). Table 9-2 outlines the guidance for filter strip flow length by slope (NRCS 1999).

Table 9-2 Filter Strip Flow Lengths Based on Land Slope

Percent Slope	0.5%	1.0%	2.0%	3.0%	4.0%	5.0% or greater
Minimum	36	54	72	90	108	117
Maximum	72	108	144	180	216	234

GIS land use data described in Section 5 were used in conjunction with soil slope data to provide an estimate of acreage where filter strips could be installed. As discussed in Section 2.4.1 of this report, there is a wide diversity of soil types in the watershed with no single soil type accounting for more than 2% of the watershed. Because soil type and corresponding slope values vary so widely across the watershed, maximum values associated with 5% or greater slopes were used for this analysis. Based on this slope value, filter strip widths of 234 feet could be incorporated into agricultural lands adjacent to the ditch and its tributaries.

Mapping software was then used to buffer impaired stream segments and their major tributaries to determine the total area found within 234 feet the stream channels. There are approximately 2,260 total acres within this buffer distance throughout the watershed. The land use data were then clipped to the buffer area to determine the amount of this land that is agricultural. There are an estimated 932 acres of agricultural land surrounding tributaries of the Middle Fork Saline River watershed where filter strips and riparian buffers could potentially be installed. The relative areas within the buffer distance for each impaired stream segment and its tributaries are provided in Table 9-3. Landowners should evaluate their land near the stream and its tributaries and install or extend filter strips according to the NRCS guidance provided in Table 9-1. Programs available to fund the construction of these buffer strips are discussed in Section 9.5.

Table 9-3 Total Area and Area of Agricultural Land Within 234-feet Buffer by Segment

Stream Name	Segment ID	Area in 234 ft Buffer (Acres)	Agricultural Land In 234 ft Buffer (Acres)
Bankston Fork	ATGC-01	2260.5	932.2
	ATGC-02	1142.3	460.2
	ATGC-11	483.9	243.3
Brushy Creek	ATGH-09	869.4	346.0
	ATGH-10	605.1	119.2
Harco Branch	ATGM-01	178.7	90.2

9.2.2.9 Sediment Control Basins

Sediment control basins are designed to trap sediments (and the pollutants bound to the sediment) prior to reaching a receiving water. Sediment control basins are typically earthen embankments that act similarly to a terrace. The basin traps water and sediment running off cropland upslope from the structure, and reduces gully erosion by controlling flow within the drainage area. The basin then releases water slowly, which also helps to decrease streambank erosion in the receiving water.

Sediment control basins are usually designed to drain an area of 30 acres or less and should be large enough to control runoff form a 10-year, 24-hour storm. Locations are determined based on slopes, tillage and crop management, and local NRCS can often provide information and advice for design and installation. Maintenance includes reseeding and fertilizing the basins in order to maintain vegetation and periodic checking, especially after large storms to determine the need for embankment repairs or excess sediment removal.

9.2.2.10 Streambank Stabilization/Erosion Control

Soil erosion is the process of moving soil particles or sediment by flowing water or wind. Eroding soil transports pollutants, such as manganese, that can potentially degrade water quality.

Following are three available approaches to stabilizing eroding banks that could, in turn, decrease nonpoint source manganese and silver loads:

- Stone Toe Protection (STP)
- Rock Riffle Grade Control (RR)
- Floodplain Excavation

Stone Toe Protection uses non-erodible materials to protect the eroding banks. Meandering bends found in the ATGC-01 watershed could possibly be stabilized by placing the hard armor only on the toe of the bank. STP is most commonly implemented "using stone quarry stone that is sized to resist movement and is placed on the lower one third of the bank in a windrow fashion" (STREAMS 2005).

Naturally stable stream systems typically have an alternating riffle-pool sequence that helps to dissipate stream energy. Rock Riffle Grade Control places loose rock grade control structures at locations where natural riffles would occur to create and enhance the riffle-pool flow sequence of stable streams. By installing RR in an incised channel, the riffles will raise the water surface elevation resulting in lower effective bank heights, which increases the bank stability by reducing the tractive force on the banks (STREAMS 2005).

Rather than raising the water level, Floodplain Excavation lowers the floodplain to create a more stable stream. Floodplain Excavation uses mechanical means to restore the floodplain by excavating and utilizing the soil that would eventually be eroded away and deposited in the stream (STREAMS 2005).

The extent of streambank erosion in the Middle Fork Saline River watershed is unknown. It is recommended that further investigation be performed to determine the extent that erosion control measures could help manage nonpoint source manganese and silver loads to the creek.

9.3 Implementation Actions and Management Measures for Fecal Coliform in Bankston Fork Segment ATGC-01

The TMDL analysis performed for fecal coliform in ATGC-01 showed that although exceedences were reported over the full range of flow conditions, the majority of the samples collected that exceeded the standard were collected during higher flow conditions. This indicates the majority of the exceedances have occurred as a result of stormwater runoff and resuspension of instream fecal material.

9.3.1 Point Sources of Fecal Coliform

9.3.1.1 Stormwater Sources

A portion of the Bankston Fork segment ATGC-01 watershed is urban in nature (approximately 6% of the watershed area). However, none of the municipalities within the ATGC-01 watershed are required to have stormwater permits. Therefore, little information is available regarding stormwater runoff in the watershed. It is recommended that a storm sewer survey be performed to determine the amount of fecal coliform that may be contributed to the stream via urban stormwater sources.

9.3.1.2 Permitted Mining Operations

The permitted mining facilities in the Middle Fork Saline River watershed were discussed in Section 9.2.1.1. The facilities associated with these NPDES permits are significantly upstream of the impaired segment and are not expected to be a significant source of fecal coliform loads to the stream segment.

9.3.2 Nonpoint Sources of Fecal Coliform

Several management options have been identified to help reduce fecal coliform counts in Bankston Fork segment ATGC-01. These management options focus on the most likely sources of fecal coliform within the basin, such as agricultural runoff, septic systems, and livestock. The alternatives that were identified are:

- Filter Strips
- Private Septic System Inspection and Maintenance Program
- Restrict Livestock Access to Harding Ditch and Tributaries

Each alternative is discussed briefly in this section.

9.3.2.1 Filter Strips

Filter strips were discussed in Section 9.2.2.8 for control of sulfates and metals loadings into impaired waterbodies. Filter strips will have a similar impact in reducing loads of fecal coliform from overland runoff in the watershed. Therefore the same technique for evaluating available land can be applied to fecal coliform controls. As described in Section 9.2.2.8, there are approximately 2,260 acres of land within 234 feet of ATGC-01 and its major tributaries, of this area, approximately 932 acres are categorized as agricultural and could potentially be converted into filter.

9.3.2.2 Private Septic System Inspection and Maintenance Program

As previously discussed in Section 5 a relatively small number of septic systems are likely to exist in the ATGC-01 watershed associated with the rural residences in the area. Failing or leaking septic systems can be a significant source of fecal coliform pollution. A program that actively manages functioning systems and addresses non-functioning systems could be put in place. The USEPA has developed guidance for managing septic systems, which includes assessing the functionality of systems, public health, and environmental risks (EPA 2005). It also introduces procedures for selecting and implementing a management plan.

To reduce the excessive amounts of contaminants from a faulty septic system, a regular maintenance plan that includes regular pumping and maintenance of the septic system should be followed. The majority of failures originate from excessive suspended solids, nutrients, and BOD loading to the septic system. Reduction of solids to the tank can be achieved via limiting garbage disposals use and water conservation.

Septic system management activities can extend the life and maintain the efficiency of a septic system. Water conservation practices, such as limiting daily water use or using low flow toilets and faucets, are the most effective methods to maintain a properly functioning septic system. Additionally, the system should not be used for the disposal of solids, such as cigarette butts, cat litter, cotton swabs, coffee grinds, disposable diapers, etc. Finally, physical damage to the drainfield can be prevented by:

- Maintaining a vegetative cover over the drainfield to prevent erosion
- Avoiding construction over the system
- Protecting the area down slope of the system from excavation
- Landscape the area to divert surface flow away from the drainfield (Johnson 1998)

The cost of each management measure is site specific and there is not specific data on septic systems and management practices for the watershed; therefore, costs for these practices were not outlined in Section 9.5.

Alternatively, a long-range solution to failing septic systems is a connection to a municipal sanitary sewer system. Installation of a sanitary sewer would reduce existing fecal coliform sources by replacing failing septic systems and will allow communities to develop without further contribution of fecal material to Bankston Fork. Costs for the installation are generally paid over a period of several years (average of 20 years) instead of forcing homeowners to shoulder the entire cost of installing a new septic system. In addition, costs are sometimes shared between the community and the utility responsible for treating the wastewater generated from replacing the septic tanks. The planning process is involved and requires participation from townships, cities, counties, and citizens.

9.3.2.3 Restrict Livestock Access to Bankston Fork and Tributaries

As discussed in Section 5, livestock are present in the ATGC-01 watershed. Saline County NRCS reported a few small cattle operations and a few chicken and hog CAFOs, but no definite numbers of operations were available. It is unknown to what extent these animals have access to the Bankston Fork or its tributaries. Reduction of livestock access to streams, however, is recommended to reduce bacteria loads. The USEPA found that livestock exclusion from waterways and other grazing management measures were successful in reducing fecal coliform counts by 29 to 46 percent (2003). Fencing and alternate watering systems are effective ways to restrict livestock from streams.

9.4 Implementation Actions and Management Measures for Phosphorus in Harrisburg Reservoir

Phosphorus loads in the Harrisburg Reservoir watershed originates from external sources. As discussed in previous sections, possible sources of total phosphorus in the Harrisburg Reservoir watershed include runoff from the surrounding watershed. To achieve a reduction of total phosphorus for this reservoir, management measures must address loading through sediment and surface runoff controls and internal nutrient cycling through in-lake management.

9.4.1 Point Sources of Phosphorus

Harrisburg Reservoir does not have any point source contributions and the associated WLA was therefore set to zero.

9.4.1.1 Urban Stormwater Sources

The 303(d) list identified urban runoff and storm sewers as potential pollutant sources of total phosphorus to Harrisburg Reservoir. Land use analysis indicates that there are approximately 65 acres of developed urban land in the watershed that may contribute urban runoff of phosphorus into the reservoir. In addition the town of Galatia, Illinois is located just west of the Harrisburg Reservoir watershed and may contribute urban runoff to the reservoir. There are no MS4 stormwater permits issued for Galatia or other nearby areas so quantification of urban runoff contributions is not possible. However, due to the limited amount of urban area in the watershed, the overall contribution from urban stormwater runoff is unlikely to be a major source of phosphorus into Harrisburg Reservoir.

9.4.2 Nonpoint Sources of Phosphorus

Potential sources of nonpoint source phosphorus pollution to Harrisburg Reservoir identified by the 303(d) list include crop production, forest/grassland/parkland runoff, Littoral/shore area modifications, and urban runoff.

BMPs available that could be utilized to treat these nonpoint sources in the watershed include:

- Conservation tillage practices
- Filter strips
- Wetlands
- Nutrient management

Total phosphorus originating from cropland is most efficiently treated with a combination of no-till or conservation tillage practices and grass filter strips. Wetlands located upstream of the reservoir could provide further reductions in total and dissolved phosphorus in runoff from croplands in the watershed. Nutrient management focuses on source control of nonpoint source contributions to the reservoir.

9.4.2.1 Conservation Tillage Practices

For the Harrisburg Reservoir watershed, conservation tillage practices could help reduce nutrient loads into the reservoir. The reservoir potentially receives nonpoint source runoff from the approximately 1,530 acres in the watershed which is under cultivation, which accounts for 38 percent of the total watershed area. Total phosphorus loading from cropland can be controlled through management BMPs, such as conservation tillage. Conservation tillage maintains at least 30 percent of the soil surface covered by residue after planting. Crop residuals or living vegetation cover on the soil surface protect against soil detachment from water and wind erosion. Conservation tillage practices can remove up to 45 percent of the dissolved and total phosphorus from runoff and approximately 75 percent of the sediment. Additionally, studies have found around 93 percent less erosion occurred from no-till acreage compared to acreage subject to moldboard plowing (USEPA 2003). The 2006 Illinois Department of Agriculture's Soil Transect Survey estimated that conventional till currently accounts for 45 percent of corn, 15 percent of soybean, and 0 percent of small grain tillage practices in Saline County. To achieve TMDL load allocations, tillage practices already in place should be continued, and practices should be assessed and improved upon for all agricultural areas in Harrisburg Reservoir watershed.

9.4.2.2 Filter Strips

Filter strips were discussed in Section 9.2.2.8. The same technique for evaluating available land was applied to the Harrisburg Reservoir watershed. In the Harrisburg Reservoir watershed there are 410 acres of land within 234 feet of the lake and its tributaries. Of this area, 187 acres are categorized as agricultural and could potentially be converted into filter strips.

9.4.2.3 Wetlands

The use of wetlands as a structural control is applicable to nutrient reduction from agricultural lands in the Harrisburg Reservoir watershed. To treat loads from agricultural runoff, a wetland could be constructed on the upstream end of the reservoir. Wetlands are an effective BMP for sediment and phosphorus control because they:

- Prevent floods by temporarily storing water, allowing the water to evaporate or percolate into the ground
- Improve water quality through natural pollution control such as plant nutrient uptake
- Filter sediment
- Slow overland flow of water thereby reducing soil erosion (USDA 1996)

A properly designed and functioning wetland can provide very efficient treatment of pollutants, such as phosphorus. Design of wetland systems is very important and should consider soils in the proposed location, hydraulic retention time, and space requirements. Constructed wetlands, which comprise the second or third stage of nonpoint source treatment, can be effective at improving water quality. Studies have shown that artificial wetlands designed and constructed specifically to remove pollutants from surface water runoff have removal rates for suspended solids of greater than 90 percent, 0 to 90 percent for total phosphorus, 20 to 80 percent of orthophosphate, and 10 to75 percent for nitrogen species (Johnson, Evans, and Bass 1996; Moore 1993; USEPA 1993; Kovosic et al. 2000). Although the removal rate for phosphorus is low in long-term studies, the rate can be improved if sheet flow is maintained to the wetland and vegetation and substrate are monitored to ensure the wetland is operation optimally. Sediment or vegetation removal may be necessary if the wetland removal efficiency is lessened over time (USEPA 1993; NCSU 2000).

Table 9-4 Acres of Wetland for Harrisburg Reservoir Watershed

Subbasin	Area (acres)	Recommended Wetlands (acres)
RAI-1	212	1.3
RAI-2	589	3.5
RAI-3	3,226	19.4
Total	4,027	24.2

Guidelines for wetland design suggest a wetland to watershed ratio of 0.6 percent for nutrient and sediment removal from agricultural runoff. Table 9-4 outlines estimated wetland areas for each agricultural subbasin in the Harrisburg Reservoir watershed based on these recommendations. A wetland system to treat agricultural runoff from the three subbasins could be approximately 68 acres (Denison and Tilton 1993).

9.4.2.4 Nutrient Management

Nutrient management could result in reduced nutrient loads to Harrisburg Reservoir. Crop management of nitrogen and phosphorus originating in the agricultural portions of the watershed can be accomplished through Nutrient Management Plans, which focus on increasing the efficiency with which applied nutrients are used by crops, thereby reducing the amount available to be transported to both surface and groundwater. In the past, nutrient management focused on application rates designed to meet crop nitrogen requirements but avoid groundwater quality problems created by excess nitrogen leaching. This results in buildup of soil phosphorus above amounts sufficient for optimal crop yields. Illinois, along with most Midwestern states, demonstrates high soil test phosphorus in greater than 50 percent of soil samples analyzed (Sharpley et al. 1999).

The overall goal of phosphorus reduction from agriculture should increase the efficiency of phosphorus use by balancing phosphorus inputs in feed and fertilizer with outputs in crops and animal produce as well as managing the level of phosphorus in the soil. Reducing phosphorus loss in agricultural runoff may be brought about by source and transport control measures, such as filter strips or grassed waterways. The Nutrient Management Plans account for all inputs and outputs of phosphorus to determine reductions. Nutrient Management Plans include:

- Review of aerial photography and soil maps
- Regular soil testing

- Review of current and/or planned crop rotation practices
- Yield goals and associated nutrient application rates
- Nutrient budgets with planned rates, methods, timing and form of application
- Identification of sensitive areas and restrictions on application when land is snow covered, frozen or saturated

In Illinois, Nutrient Management Plans have successfully reduced phosphorus application to agricultural lands by 36-lb/acre. National reductions range from 11 to 106-lb/acre, with an average reduction of 35-lb/acre (USEPA 2003).

9.5 Reasonable Assurance

Reasonable assurance means that a demonstration is given that nonpoint source reductions in this watershed will be implemented. It should be noted that all programs discussed in this section are voluntary and some may currently be in practice in the watershed. The discussion in Sections 9.2 through 9.4 provided information on available BMPs for reducing phosphorus loads from point and nonpoint sources. The remainder of this section discusses an estimate of costs to the watershed for implementing nonpoint source management practices and programs available to assist with funding.

9.5.1 Available Programs for Nonpoint Source Management

There are several voluntary conservation programs established through the 2008 U.S. Farm Bill, which encourage landowners to implement resource-conserving practices for water quality and erosion control purposes. These programs would apply to crop fields and rural grasslands that are presently used as pasture land. Each program is discussed separately in the following paragraphs.

9.5.1.1 Illinois Department of Agriculture and Illinois EPA Nutrient Management Plan Project

The IDA and Illinois EPA are presently co-sponsoring a cropland Nutrient Management Plan project in watersheds that have or are developing a TMDL. This voluntary project supplies incentive payments to producers to have Nutrient Management Plans developed and implemented. Additionally, watersheds that have sediments or phosphorus identified as a cause for impairment (as is the case in this watershed), are eligible for cost-share assistance in implementing traditional erosion control practices through the Nutrient Management Plan project.

9.5.1.2 Conservation Reserve Program

This voluntary program encourages landowners to plant long-term resource-conserving cover to improve soils, water, and wildlife resources. The Conservation Reserve Program (CRP) is the USDA's single largest environmental improvement program and one of its most productive and cost-efficient. It is administered through the Farm Service Agency (FSA) by USDA's Commodity Credit Corporation (CCC). The program was initially established in the Food & Security Act of 1985. The duration of the contracts under CRP range from 10 to 15 years.

Eligible land must be one of the following:

1. Cropland that is planted or considered planted to an agricultural commodity four of the six most recent crop years (including field margins) and must be physically and legally capable of being planted in a normal manner to an agricultural commodity.

2. Certain marginal pastureland enrolled in the Water Bank Program.

In addition to the eligible land requirements, cropland must meet one of the following criteria:

- Have a weighted average erosion index of 8 or higher;
- Be expiring CRP acreage; or
- Be located in a national or state CRP conservation priority area.

The CCC bases rental rates on the relative productivity of soils within each county and the average of the past three years of local dry land cash rent or cash-rent equivalent. The maximum rental rate is calculated in advance of enrollment. Producers may offer land at the maximum rate or at a lower rental rate to increase likelihood of offer acceptance. In addition, the CCC provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices (USDA 2006).

Finally, CCC offers additional financial incentives of up to 20 percent of the annual payment for certain continuous sign-up practices (USDA 2006). Continuous sign-up provides management flexibility to farmers and ranchers to implement certain high-priority conservation practices on eligible land. The land must be determined by NRCS to be eligible and suitable for any of the following practices:

- Riparian buffers
- Filter strips
- Grass waterways
- Shelter belts
- Field windbreaks
- Living snow fences
- Contour grass strips
- Salt tolerant vegetation
- Shallow water areas for wildlife
- Eligible acreage within an EPA-designated wellhead protection area (FSA 1997)

The current extent of land enrolled in CRP within the Middle Fork Saline River Watershed watershed is unknown.

9.5.1.3 Clean Water Act Section 319 Grants

Section 319 was added to the CWA to establish a national program to address nonpoint sources of water pollution. Through this program, each state is allocated Section 319 funds on an annual basis according to a national allocation formula based on the total annual appropriation for the section 319 grant program. The total award consists of two categories of funding: incremental funds and base funds. A state is eligible to receive EPA 319(b) grants upon USEPA's approval of the state's Nonpoint Source Assessment Report and Nonpoint Source Management Program. States may reallocate funds through subawards (e.g., contracts, subgrants) to both public and private entities, including local governments, tribal authorities, cities, counties, regional development centers, local school systems, colleges and universities, local nonprofit organizations, state agencies, federal agencies, watershed groups, for-profit groups, and individuals.

USEPA designates incremental funds, a $100-million award, for the restoration of impaired water through the development and implementation of watershed-based plans and TMDLs for impaired waters. Base funds, funds other than incremental funds, are used to provide staffing and support to manage and implement the state Nonpoint Source Management Program. Section 319 funding can be used to implement activities which improve water quality, such as filter strips, streambank stabilization, etc. (USEPA 2003).

Illinois EPA receives federal funds through Section 319(h) of the CWA to help implement Illinois' Nonpoint Source (NPS) Pollution Management Program. The purpose of the program is to work cooperatively with local units of government and other organizations toward the mutual goal of protecting the quality of water in Illinois by controlling NPS pollution. The program emphasizes funding for implementing cost-effective corrective and preventative BMPs on a watershed scale; funding is also available for BMPs on a non-watershed scale and the development of information/education NPS pollution control programs.

The Maximum Federal funding available is 60 percent, with the remaining 40 percent coming from local match. The program period is two years unless otherwise approved. This is a reimbursement program.

Section 319(h) funds are awarded for the purpose of implementing approved NPS management projects. The funding will be directed toward activities that result in the implementation of appropriate BMPs for the control of NPS pollution or to enhance the public's awareness of NPS pollution. Applications are accepted June 1 through August 1.

9.5.1.4 Wetlands Reserve Program

The Wetlands Reserve Program (WRP) is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. The goal of WRP is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection.

The program offers three enrollment options:

1. *Permanent Easement* is a conservation easement in perpetuity. USDA pays 100 percent of the easement value and up to 100 percent of the restoration costs.

2. *30-Year Easement* is an easement that expires after 30 years. USDA pays up to 75 percent of the easement value and up to 75 percent of the restoration costs. For both permanent and 30-year easements, USDA pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance.

3. *Restoration Cost-Share Agreement* is an agreement to restore or enhance the wetland functions and values without placing an easement on the enrolled acres. USDA pays up to 75 percent of the restoration costs.

The total number of acres that can be enrolled in the program is 3,041,200 – an increase of 766,200 additional acres over the previous Farm Bill.

- Payments for easements valued at $500,000 or more will be made in at least five annual payments.

- For restoration cost-share agreements, annual payments may not exceed $50,000 per year.

- No easement shall be created on land that has changed ownership during the preceding 7 years.

- Eligible acres are limited to private and Tribal lands.

9.5.1.5 Environmental Quality Incentive Program

The Environmental Quality Incentive Program (EQIP) is a voluntary USDA conservation program for farmers and private landowners engaged in livestock or agricultural production who are faced with serious threats to soil, water, and related natural resources. Through EQIP, the NRCS develops contracts with agricultural producers to implement conservation practices to address environmental natural resource problems. Payments are made to producers once conservation practices are completed according to NRCS requirements.

Persons engaged in livestock or agricultural production and owners of non-industrial private forestland are eligible for the program. Eligible land includes cropland, rangeland, pastureland, private non-industrial forestland, and other farm or ranch lands. Persons interested in entering into a cost-share agreement with the USDA for EQIP assistance may file an application at any time.

NRCS works with the participant to develop the EQIP plan of operations. This plan becomes the basis of the EQIP contract between NRCS and the participant. NRCS provides conservation practice payments to landowners under these contracts that can be up to 10 years in duration.

The EQIP objective to optimize environmental benefits is achieved through a process that begins with National priorities that address: impaired water quality, conservation of ground and surface water resources improvement of air quality reduction of soil erosion and sedimentation, and improvement or creation of wildlife habitat for at-risk species. National priorities include: reductions of nonpoint source pollution, such as nutrients, sediment, pesticides, or excess salinity in impaired watersheds consistent with TMDLs where available as well as the reduction of groundwater contamination and reduction of point sources such as contamination from confined animal feeding operations; conservation of ground and surface water resources; reduction of emissions, such as particulate matter, nitrogen oxides (NOx), volatile organic compounds, and ozone precursors and depleters that contribute to air quality impairment violations of National Ambient Air Quality Standards reduction in soil erosion and sedimentation from unacceptable levels on agricultural land; and promotion of at-risk species habitat conservation.

EQIP provides payments up to 75 percent of the incurred costs and income foregone of certain conservation practices and activities. The overall payment limitation is $300,000 per person or legal entity over a 6-year period. The Secretary of Agriculture may raise the limitation to $450,000 for projects of special environmental significance. Payment limitations for organic production may not exceed an aggregate $20,000 per year or $80,000 during any 6-year period for installing conservation practices.

Conservation practices eligible for EQIP funding which are recommended BMPs for this watershed TMDL include field borders, filter strips, cover crops, grade stabilization structures, grass waterways, riparian buffers, streambank shoreline protection, terraces, and wetland restoration.

The selection of eligible conservation practices and the development of a ranking process to evaluate applications are the final steps in the optimization process. Applications will be ranked based on a number of factors, including the environmental benefits and cost effectiveness of the proposal. More information regarding State and local EQIP implementation can be found at www.nrcs.usda.gov/programs/eqip.

9.5.1.6 Wildlife Habitat Incentives Program

The Wildlife Habitat Incentive Plan (WHIP) is a voluntary program administered by NRCS which is designed to assist those who want to develop and improve wildlife habitat primarily on private lands and nonindustrial private forest land. It provides both technical assistance and cost share payments to help:

- Promote the restoration of declining or important native fish and wildlife species.

- Protect, restore, develop, or enhance fish and wildlife habitat to benefit at-risk species.
- Reduce the impacts of invasive species in fish and wildlife habitat.
- Protect, restore, develop, or enhance declining or impaired aquatic wildlife species habitat.

Participants who own or control land agree to prepare and implement a wildlife habitat development plan. The NRCS provides technical and financial assistance for the establishment of wildlife habitat development practices. In addition, if the landowner agrees, cooperating State wildlife agencies and nonprofit or private organizations may provide expertise or additional funding to help complete a project.

Participants work with the NRCS to prepare a wildlife habitat development plan in consultation with the local conservation district. The plan describes the participant's goals for improving wildlife habitat, includes a list of practices and a schedule for installing them, and details the steps necessary to maintain the habitat for the life of the agreement. This plan may or may not be part of a larger conservation plan that addresses other resource needs such as water quality and soil erosion.

The NRCS and the participant enter into a cost-share agreement for wildlife habitat development. This agreement generally lasts from 5 to 10 years from the date the agreement is signed for general applications and up to 15 years for essential habitat applications. Cost-share payments may be used to establish new practices or replace practices that fail for reasons beyond the participant's control.

WHIP has a continuous sign-up process. Applicants can sign up anytime of the year at their local NRCS field office. Conservation practices eligible for WHIP funding which are recommended BMPs for this watershed TMDL include but are not limited to filter strips, field borders, riparian buffers, streambank and shoreline protection, and wetland restoration.

9.5.1.7 Illinois Conservation and Climate Initiative

The Illinois Conservation and Climate Initiative (ICCI) is a joint project of the State of Illinois and the Delta Institute that allows farmers and landowners to earn revenue through the sale of greenhouse gas emissions credits when they use conservation practices such as no-till, grass plantings, reforestation, or manure digesters.

The Chicago Climate Exchange (CCX®) quantifies, credits, and sells greenhouse gas credits from conservation practices. The credits are aggregated, or pooled, from farmers and landowners in order to sell them to CCX® members that have made voluntary commitments to reduce their greenhouse gas contributions.

ICCI provides an additional financial incentive for farmers and landowners to use conservation practices that also benefit the environment by creating wildlife habitat and limiting soil and nutrient run-off to streams and lakes.

Many farmers and landowners are already using conservation practices eligible for carbon credits on the CCX® such as no-till farming, strip-till farming, grass plantings, afforestation/reforestation, and the use of methane digesters. To be eligible, the producer or landowner must make a contractual commitment to maintain the eligible practice through 2010. CREP and CRP land is eligible for enrollment in the ICCI as long as it meets CCX® eligibility requirements for the practice (www.illinoisclimate.org).

9.5.1.8 Local Program Information

The Farm Service Agency (FSA) administers the CRP. NRCS administers the EQIP, WRP, and WHIP. Local NRCS contact information in Saline, Hamilton, Franklin, and Williamson counties are listed in the Table 9-5 below.

Table 9-5 Local NRCS and FSA Contact Information

County	Contact	Address	Phone
Local SWCD Office			
Franklin County	Carla Barnes	711 N. DuQuoin Street Benton, IL 62812	(618) 438-4021
Hamilton County	Rebecca Barr	R.R.#5, P.O. Box 277 McLeansboro, IL 62859-0277	(618) 643-4326
Saline County	Carolyn R. Hathaway	912 S. Commercial Street Harrisburg, IL 62946	(618) 253-7292
Williamson County	Jodi Hawkins	502 Comfort Drive, Suite C Marion, Illinois 62959	(618) 993-5396
Local FSA Office			
Franklin County	Terry Swift	711 N. DuQuoin Street Benton, IL 62812	(618) 438-4021 ext. 2
Hamilton County	Bruce Morrison	R.R.#5, P.O. Box 277 McLeansboro, IL 62859-0277	(618) 643-4326 ext. 2
Saline County	Gary Ellis	912 S. Commercial Street Harrisburg, IL 62946	(618) 252-8621 ext. 2
Williamson County	Amanda Grundy	502 Comfort Drive, Suite C Marion, Illinois 62959	(618) 993-5396 ext. 2
Local NRCS Office			
Franklin County	Diane Wallace	711 N. DuQuoin Street Benton, IL 62812	(618) 438-4021 ext. 3
Hamilton County	Rhonda Cox	R.R.#5, P.O. Box 277 McLeansboro, IL 62859-0277	(618) 643-4326 ext. 3
Saline County	James R. Warder	912 S. Commercial Street Harrisburg, IL 62946	(618) 253-7292 ext. 3
Williamson County	V. Tony Korando	502 Comfort Drive, Suite C Marion, Illinois 62959	(618) 993-5396 ext. 3

9.5.2 Cost Estimates of BMPs

Cost estimates for different BMPs and individual practice prices such as filter strip installation are detailed in the following sections. Finally, an estimate of the total order of magnitude costs for implementation measures in the Middle Fork Saline River watershed are presented in Section 9.5.2.6 and Table 9-5.

9.5.2.1 Wetlands

The price to establish a wetland is very site specific. There are many different costs that could be incurred depending on wetland construction. Examples of costs associated with constructed wetlands include excavation costs. EQIP program cost documentation for Illinois published in 2009 estimates $1,700/acre for wetland excavation, earthwork, and native seeding. More information can be found at: ftp://ftp-fc.sc.egov.usda.gov/IL/farmbill/EQIPpaymnt_schdl_Tradtnl_0509.pdf

9.5.2.2 Filter Strips and Riparian Buffers

The Illinois EQIP document used for wetland pricing also provides filter strip and riparian buffer cost estimates. Filter strip implementation that includes seedbed preparation and native seed was estimated at $88/acre while riparian buffers ranged from $130/acre for herbaceous cover up to $800/acre for forested buffers

9.5.2.3 Nutrient Management Plan – NRCS

A significant portion of the agricultural land in the Middle Fork Saline River watershed is comprised of cropland. The service for developing a nutrient management plan averages $6 to $18/acre. This includes soil testing, manure analysis, scaled maps, and site specific recommendations for fertilizer management.

9.5.2.4 Nutrient Management Plan – IDA and Illinois EPA

The costs associated with development of Nutrient Management Plans co-sponsored by the IDA and the Illinois EPA is estimated at $10/acre paid to the producer and $3/acre for a third party vendor who develops the plans. There is a 200 acre cap per producer. The total plan development cost is estimated at $13/acre.

9.5.2.5 Conservation Tillage

Conservation tillage is assumed to include tillage practices that preserve at least 30 percent residue cover of the soil after crops are planted. Costs associated with converting to conservation tillage will depend on the degree of conservation tillage practices implemented. The University of Iowa has estimated a cost for conversion to no-till practices. The study acknowledged that some equipment conversion is needed, but converting to no-till only means (for most producers) the addition of heavier down-pressure springs, row cleaners, and possibly a coulter on each planter row unit. The cost of converting existing equipment ranges between $300 and $400 per planter row, which for many producers, amounts to a nominal additional production cost of approximately $1 or $2 per acre per year (Al-Kaisi 2002).

9.5.2.6 Planning Level Cost Estimates for Implementation Measures

Cost estimates for different implementation measures are presented in Table 9-6. The column labeled "Program" or "Sponsor" lists the financial assistance program or sponsor available for various BMPs. The programs and sponsors represented in the table are the Wetlands Reserve Program (WRP), the Conservation Reserve Program (CRP), National Resource Conservation Service (NRCS), Conservation Cost-Share

Program (CPP), Illinois EPA, and Illinois Department of Agriculture (IDA). It should be noted that IEPA 319 Grants are applicable to all of these practices.

Table 9-6 Cost Estimate of Various BMP Measures

Source	Program	Sponsor	BMP	Installation Mean $
Nonpoint	CRP	NRCS and IDA	Filter strip (seeded)	$88/acre
	CRP	NRCS and IDA	Riparian Buffer	$130-$800/acre
	WRP	NRCS	Wetland	$1,700/acre
		NRCS	Nutrient Management Plan	$6-18
		IDA and Illinois EPA	Nutrient Management Plan	$13
	CRP	NRCS and IDA	Conservation Tillage	varies

Total watershed costs will depend on the combination of BMPs selected to target non-point sources within the watershed. Regular monitoring will support adaptive management of implementation activities to most efficiently reach the TMDL goals.

9.6 Monitoring Plan

The purpose of the monitoring plan for the Middle Fork Saline River watershed is to assess the overall implementation of management actions outlined in this section. This can be accomplished by conducting the following monitoring programs:

- Track implementation of management measures in the watershed
- Estimate effectiveness of management measures
- Continued monitoring of impaired stream segments and Harrisburg Reservoir
- Storm-based monitoring of high flow events
- Tributary monitoring

Tracking the implementation of management measures can be used to address the following goals:

- Determine the extent to which management measures and practices have been implemented compared to action needed to meet TMDL endpoints
- Establish a baseline from which decisions can be made regarding the need for additional incentives for implementation efforts
- Measure the extent of voluntary implementation efforts
- Support work-load and costing analysis for assistance or regulatory programs
- Determine the extent to which management measures are properly maintained and operated

Estimating the effectiveness of the BMPs implemented in the watershed could be completed by monitoring before and after the BMP is incorporated into the watershed.

Additional monitoring could be conducted on specific structural systems such as a constructed wetland. Inflow and outflow measurements could be conducted to determine site-specific removal efficiency.

IEPA monitors lakes every three years and conducts Intensive Basin Surveys every five years. Additionally, ambient sites are monitored nine times a year. Continuation of this state monitoring program will assess lake and stream water quality as improvements in the watershed are completed. This data will also be used to assess whether water quality standards in the impaired segments are being attained.

9.7 Implementation Time Line

Implementing the actions outlined in this section for the Middle Fork Saline River watershed should occur in phases and assess effectiveness of the management actions as improvements are made. It is assumed that it may take up to five years to secure funding for actions needed in the watershed and five to seven years after funding to implement the measures. Once improvements are implemented, it may take 10 years or more for impaired waters to reach water quality standard targets. In summary, it may take up to 20 years for the impaired waterbodies to meet the applicable water quality standards.

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Section 10
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Appendix A
Land Use Categories

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File names and descriptions:

Values and class names found in the Land Cover of Illinois 1999-2000 Arc/Info GRID coverage.

Value	Class Names
0	Background
	AGRICULTURAL LAND
11	Corn
12	Soybeans
13	Winter Wheat
14	Other Small Grains & Hay
15	Winter Wheat/Soybeans
16	Other Agriculture
17	Rural Grassland
	FORESTED LAND
21	Upland
25	Partial Canopy/Savannah Upland
26	Coniferous
	URBAN & BUILT-UP LAND
31	High Density
32	Low/Medium Density
35	Urban Open Space
	WETLAND
41	Shallow Marsh/Wet Meadow
42	Deep Marsh
43	Seasonally/Temporally Flooded
44	Floodplain Forest
48	Swamp
49	Shallow Water
	OTHER
51	Surface Water
52	Barren & Exposed Land
53	Clouds
54	Cloud Shadows

Appendix B
SSURGO Soil Series

SSURGO Soil Series Code	SSURGO Soil Series Code Definition	Dominant Hydrologic Soil Group	Acres	Percent of watershed
108	Bonnie silt loam	C/D	5736	3.573%
109	Racoon silt loam	C/D	3728	2.322%
109A	Racoon silt loam, 0 to 2 percent slopes	C/D	250	0.156%
10C	Plumfield silty clay loam, 5 to 10 percent slopes	C	2611	1.626%
10D	Plumfield silty clay loam, 10 to 18 percent slopes	C	632	0.394%
12	Wynoose silt loam	D	11	0.007%
120	Huey silt loam	D	278	0.173%
122B	Colp silt loam, 2 to 5 percent slopes	C	1540	0.959%
12A	Wynoose silt loam, 0 to 2 percent slopes	D	697	0.434%
131B	Alvin fine sandy loam, 2 to 5 percent slopes	B	7	0.005%
131C2	Alvin fine sandy loam, 5 to 10 percent slopes, eroded	B	12	0.008%
131D3	Alvin soils, 6 to 12 percent slopes, severely eroded	B	4	0.002%
138	Shiloh silty clay	B/D	19	0.012%
13A	Bluford silt loam, 0 to 2 percent slopes	C	2535	1.579%
13B	Bluford silt loam, 2 to 5 percent slopes	C	6942	4.324%
13B2	Bluford silt loam, 2 to 5 percent slopes, eroded	C	971	0.605%
142	Patton silty clay loam	B/D	3543	2.206%
14B	Ava silt loam, 1 to 5 percent slopes	C	8944	5.570%
14B2	Ava silt loam, 2 to 5 percent slopes, eroded	C	656	0.409%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	C	9967	6.208%
14C3	Ava silt loam, 5 to 10 percent slopes, severely eroded	C	1365	0.850%
14D2	Ava silt loam, 7 to 12 percent slopes, eroded	C	2245	1.398%
14D3	Ava soils, 7 to 16 percent slopes, severely eroded	C	9111	5.674%
164A	Stoy silt loam, 0 to 2 percent slopes	C	402	0.250%
164B	Stoy silt loam, 2 to 5 percent slopes	C	797	0.496%
165	Weir silt loam	D	1090	0.679%
173	McGary silt loam	C	1116	0.695%
173A	McGary silt loam, 0 to 2 percent slopes	C	111	0.069%
173B	McGary silt loam, 2 to 4 percent slopes	C	16	0.010%
176	Marissa silt loam	C	93	0.058%
199A	Plano silt loam, 0 to 2 percent slopes	B	7	0.004%
208	Sexton silt loam	C/D	6	0.004%
214B	Hosmer silt loam, 2 to 5 percent slopes	C	3033	1.889%
214C	Hosmer silt loam, 4 to 7 percent slopes	C	24	0.015%
214C2	Hosmer silt loam, 5 to 10 percent slopes, eroded	C	6265	3.902%
214C3	Hosmer soils, 4 to 7 percent slopes, severely eroded	C	11	0.007%
214D	Hosmer silt loam, 7 to 12 percent slopes	C	6	0.004%
214D2	Hosmer silt loam, 7 to 12 percent slopes, eroded	C	911	0.567%
214D3	Hosmer soils, 7 to 12 percent slopes, severely eroded	C	2142	1.334%
287A	Chauncey silt loam, 0 to 3 percent slopes	C	22	0.014%
2A	Cisne silt loam, 0 to 2 percent slopes	D	81	0.050%
301B	Grantsburg silt loam, 2 to 5 percent slopes	C	2207	1.374%
301B2	Grantsburg silt loam, 2 to 5 percent slopes, eroded	C	178	0.111%
301C2	Grantsburg silt loam, 5 to 12 percent slopes, eroded	C	818	0.509%
301C3	Grantsburg silty clay loam, 5 to 10 percent slopes, severely eroded	C	1122	0.699%
301D3	Grantsburg silt loam, 7 to 12 percent slopes, severely eroded	C	142	0.088%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	B	1295	0.806%
3108A	Bonnie silt loam, 0 to 2 percent slopes, frequently flooded	C/D	253	0.158%
335B	Robbs silt loam, 1 to 4 percent slopes	D	11	0.007%
337	Creal silt loam	C	2421	1.508%
337A	Creal silt loam, 0 to 3 percent slopes	C	133	0.083%
337B	Creal silt loam, 1 to 5 percent slopes	C	12	0.007%
338	Hurst silt loam	D	1711	1.066%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	C	3493	2.175%
339D2	Wellston silt loam, 5 to 12 percent slopes, eroded	B	170	0.106%
339D3	Wellston silt loam, 10 to 18 percent slopes, severely eroded	B	452	0.281%
339E	Wellston silt loam, 15 to 20 percent slopes	B	303	0.189%
339F	Wellston silt loam, 20 to 35 percent slopes	B	347	0.216%
340D2	Zanesville silt loam, 3 to 12 percent slopes, eroded	C	897	0.558%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	C	1826	1.137%

SSURGO Soil Series Code	SSURGO Soil Series Code Definition	Dominant Hydrologic Soil Group	Acres	Percent of watershed
340E2	Zanesville silt loam, 12 to 18 percent slopes, eroded	C	120	0.075%
340E3	Zanesville soils, 12 to 18 percent slopes, severely eroded	C	164	0.102%
382	Belknap silt loam	C	14163	8.821%
3A	Hoyleton silt loam, 0 to 2 percent slopes	C	214	0.133%
3B	Hoyleton silt loam, 2 to 5 percent slopes	C	970	0.604%
3B2	Hoyleton silt loam, 2 to 5 percent slopes, eroded	C	411	0.256%
420	Piopolis silty clay loam	C/D	100	0.062%
421G	Kell silt loam, 35 to 60 percent slopes	B	22	0.014%
422	Cape silty clay loam	D	16	0.010%
426	Karnak silty clay	D	374	0.233%
461A	Weinbach silt loam, 0 to 2 percent slopes	C	90	0.056%
462A	Sciotoville silt loam, 0 to 2 percent slopes	C	1	0.001%
462B	Sciotoville silt loam, 2 to 4 percent slopes	C	5	0.003%
465	Montgomery silty clay	D	62	0.038%
465+	Montgomery silt loam, overwash	D	37	0.023%
467B	Markland silt loam 1 to 4 percent slopes	C	34	0.021%
467C2	Markland silt loam, 4 to 7 percent slopes, eroded	C	353	0.220%
467D2	Markland silt loam, 7 to 12 percent slopes, eroded	C	6	0.003%
467D3	Markland soils, 7 to 15 percent slopes, severely eroded	C	284	0.177%
482A	Uniontown silt loam, 0 to 2 percent slopes	B	207	0.129%
482B	Uniontown silt loam, 2 to 4 percent slopes	B	516	0.321%
482C3	Uniontown soils, 4 to 7 percent slopes, severely eroded	B	9	0.006%
484	Harco silt loam	B	1352	0.842%
4B2	Richview silt loam, 2 to 5 percent slopes, eroded	C	36	0.022%
4C2	Richview silt loam, 5 to 10 percent slopes, eroded	C	11	0.007%
518B2	Rend silt loam, 2 to 5 percent slopes, eroded	C	8	0.005%
518C2	Rend silt loam, 5 to 10 percent slopes, eroded	C	52	0.033%
518C3	Rend silty clay loam, 5 to 10 percent slopes, severely eroded	C	83	0.052%
524	Zipp silty clay	D	8016	4.992%
524+	Zipp very fine sandy loam, overwash	D	491	0.306%
536	Dumps	(blank)	100	0.062%
583B	Pike silt loam, 2 to 5 percent slopes	B	2	0.001%
5C3	Blair silty clay loam, 5 to 10 percent slopes, severely eroded	C	362	0.225%
639A	Wynoose silt loam, bench, 0 to 2 percent slopes	D	251	0.156%
640A	Bluford silt loam, bench, 0 to 2 percent slopes	C	53	0.033%
640B	Bluford silt loam, bench, 2 to 5 percent slopes	C	70	0.044%
640B2	Bluford silt loam, bench, 2 to 5 percent slopes, eroded	C	13	0.008%
71	Darwin silty clay	D	2392	1.490%
72	Sharon silt loam	B	686	0.427%
723	Reesville silt loam	C	1047	0.652%
723A	Reesville silt loam, 0 to 2 percent slopes	C	50	0.031%
723B	Reesville silt loam, 2 to 4 percent slopes	C	86	0.054%
723B2	Reesville silt loam, 2 to 4 percent slopes, eroded	C	18	0.011%
723C2	Reesville silt loam, 4 to 7 percent slopes, eroded	C	6	0.003%
730B	Bethesda gravelly silt loam, 2 to 7 percent slopes	C	14	0.009%
730D	Bethesda gravelly silt loam, 7 to 20 percent slopes	C	273	0.170%
730G	Bethesda gravelly silt loam, 20 to 60 percent slopes	C	2164	1.348%
754B	Fairpoint gravelly silt loam, 2 to 7 percent slopes	C	313	0.195%
754D	Fairpoint gravelly silt loam, 7 to 20 percent slopes	C	1910	1.190%
754G	Fairpoint gravelly silt loam, 20 to 60 percent slopes	C	676	0.421%
786D3	Frondorf silt loam, 7 to 12 percent slopes, severely eroded	B	983	0.612%
786E	Frondorf silt loam, 12 to 18 percent slopes	B	1286	0.801%
786F	Frondorf silt loam, 15 to 35 percent slopes	B	463	0.288%
787	Banlic silt loam	C	6231	3.881%
802	Orthents, loamy	B	28	0.017%
802B	Orthents, loamy, undulating	B	27	0.017%
802F	Orthents, loamy, hilly and very hilly	B	21	0.013%
803C	Orthents, 5 to 15 percent slopes	B	3363	2.095%
803F	Orthents, 15 to 60 percent slopes	B	3657	2.278%
824B	Swanwick silt loam, 1 to 5 percent slopes	D	361	0.225%

SSURGO Soil Series Code	SSURGO Soil Series Code Definition	Dominant Hydrologic Soil Group	Acres	Percent of watershed
824C	Swanwick silt loam, 5 to 10 percent slopes	D	185	0.115%
84	Okaw silt loam	D	20	0.013%
866	Dumps, slurry	(blank)	20	0.013%
8D2	Hickory loam, 10 to 15 percent slopes, eroded	C	344	0.214%
8D3	Hickory clay loam, 10 to 15 percent slopes, severely er oded	C	931	0.580%
8E	Hickory loam, 12 to 18 percent slopes	C	1080	0.673%
8E2	Hickory loam, 15 to 20 percent slopes, eroded	C	11	0.007%
8E3	Hickory soils, 12 to 18 percent slopes, severely eroded	C	1211	0.754%
8F	Hickory silt loam, 15 to 30 percent slopes	C	796	0.496%
908D2	Hickory-Kell silt loams, 10 to 18 percent slopes, eroded	C	962	0.599%
908D3	Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded	B	791	0.493%
908F	Hickory-Kell silt loams, 18 to 35 percent slopes	C	1240	0.772%
927D3	Blair-Atlas silty clay loams, 10 to 18 percent slopes, severely eroded	C	66	0.041%
929D3	Ava-Hickory complex, 10 to 18 percent slopes, severely eroded	C	176	0.110%
986F	Wellston-Berks complex, 15 to 30 percent slopes	B	97	0.060%
986F2	Wellston-Berks complex, 12 to 60 percent slopes, eroded	B	5	0.003%
986G	Berks-Wellston complex, 30 to 60 percent slopes	C	57	0.035%
W	Water	(blank)	1654	1.030%
W108	Bonnie silt loam, wet	C/D	75	0.047%
Total			**160,562**	**100.000%**

Appendix C
Historical Water Quality Data

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	1/26/2000		Fecal Coliform	130	count/100ml	B
ATGC-01	3/1/2000		Fecal Coliform	675	count/100ml	B
ATGC-01	4/19/2000		Fecal Coliform	166	count/100ml	B
ATGC-01	5/24/2000		Fecal Coliform	4450	count/100ml	C
ATGC-01	6/22/2000		Fecal Coliform	2200	count/100ml	
ATGC-01	8/16/2000		Fecal Coliform	37	count/100ml	
ATGC-01	9/13/2000		Fecal Coliform	3	count/100ml	B
ATGC-01	10/2/2000		Fecal Coliform	165	count/100ml	
ATGC-01	11/15/2000		Fecal Coliform	33	count/100ml	B
ATGC-01	1/10/2001		Fecal Coliform	6	count/100ml	B
ATGC-01	3/14/2001		Fecal Coliform	58	count/100ml	
ATGC-01	4/19/2001		Fecal Coliform	81	count/100ml	B
ATGC-01	5/23/2001		Fecal Coliform	166	count/100ml	B
ATGC-01	6/14/2001		Fecal Coliform	60	count/100ml	
ATGC-01	7/26/2001		Fecal Coliform	410	count/100ml	
ATGC-01	9/4/2001		Fecal Coliform	72	count/100ml	B
ATGC-01	11/1/2001		Fecal Coliform	140	count/100ml	
ATGC-01	12/13/2001		Fecal Coliform	2700	count/100ml	
ATGC-01	1/17/2002		Fecal Coliform	54	count/100ml	
ATGC-01	2/21/2002		Fecal Coliform	450	count/100ml	
ATGC-01	3/20/2002		Fecal Coliform	1500	count/100ml	B
ATGC-01	4/24/2002		Fecal Coliform	144	count/100ml	B
ATGC-01	6/4/2002		Fecal Coliform	58	count/100ml	
ATGC-01	8/19/2002		Fecal Coliform	307	count/100ml	B
ATGC-01	10/2/2002		Fecal Coliform	72	count/100ml	
ATGC-01	12/11/2002		Fecal Coliform	8	count/100ml	B
ATGC-01	5/6/2003		Fecal Coliform	580	count/100ml	
ATGC-01	6/18/2003		Fecal Coliform	74	count/100ml	
ATGC-01	8/7/2003		Fecal Coliform	48	count/100ml	
ATGC-01	9/4/2003		Fecal Coliform	290	count/100ml	
ATGC-01	10/15/2003		Fecal Coliform	66	count/100ml	
ATGC-01	11/18/2003		Fecal Coliform	240	count/100ml	
ATGC-01	1/14/2004		Fecal Coliform	26	count/100ml	B
ATGC-01	2/19/2004		Fecal Coliform	28	count/100ml	B
ATGC-01	4/14/2004		Fecal Coliform	48	count/100ml	
ATGC-01	5/12/2004		Fecal Coliform	60	count/100ml	
ATGC-01	6/9/2004		Fecal Coliform	64	count/100ml	
ATGC-01	8/11/2004		Fecal Coliform	108	count/100ml	
ATGC-01	9/8/2004		Fecal Coliform	90	count/100ml	B
ATGC-01	10/27/2004		Fecal Coliform	460	count/100ml	
ATGC-01	12/20/2004		Fecal Coliform	68	count/100ml	
ATGC-01	5/23/2005		Fecal Coliform	40	count/100ml	
ATGC-01	6/29/2005		Fecal Coliform	86	count/100ml	
ATGC-01	7/20/2005		Fecal Coliform	145	count/100ml	
ATGC-01	9/15/2005		Fecal Coliform	270	count/100ml	
ATGC-01	10/31/2005		Fecal Coliform	28	count/100ml	
ATGC-01	1/25/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1043	mg/L	C
ATGC-01	1/25/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1043	mg/L	C
ATGC-01	3/7/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1243	mg/L	C
ATGC-01	3/7/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1243	mg/L	C
ATGC-01	4/11/1990		HARDNESS, TOTAL (MG/L AS CACO3)	427	mg/L	C
ATGC-01	4/11/1990		HARDNESS, TOTAL (MG/L AS CACO3)	427	mg/L	C
ATGC-01	5/14/1990		HARDNESS, TOTAL (MG/L AS CACO3)	546	mg/L	C
ATGC-01	5/14/1990		HARDNESS, TOTAL (MG/L AS CACO3)	546	mg/L	C
ATGC-01	6/14/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1567	mg/L	C
ATGC-01	6/14/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1567	mg/L	C
ATGC-01	7/24/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1618	mg/L	C
ATGC-01	7/24/1990		HARDNESS, TOTAL (MG/L AS CACO3)	1618	mg/L	C
ATGC-01	9/11/1990		HARDNESS, TOTAL (MG/L AS CACO3)	2100	mg/L	C
ATGC-01	9/11/1990		HARDNESS, TOTAL (MG/L AS CACO3)	2100	mg/L	C
ATGC-01	10/30/1990		HARDNESS, TOTAL (MG/L AS CACO3)	2325	mg/L	C
ATGC-01	10/30/1990		HARDNESS, TOTAL (MG/L AS CACO3)	2325	mg/L	C
ATGC-01	12/20/1990		HARDNESS, TOTAL (MG/L AS CACO3)	754	mg/L	C
ATGC-01	12/20/1990		HARDNESS, TOTAL (MG/L AS CACO3)	754	mg/L	C
ATGC-01	1/30/1991		HARDNESS, TOTAL (MG/L AS CACO3)	492	mg/L	C
ATGC-01	1/30/1991		HARDNESS, TOTAL (MG/L AS CACO3)	492	mg/L	C
ATGC-01	3/7/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1105	mg/L	C
ATGC-01	3/7/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1105	mg/L	C
ATGC-01	4/9/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1014	mg/L	C
ATGC-01	4/9/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1014	mg/L	C
ATGC-01	5/13/1991		HARDNESS, TOTAL (MG/L AS CACO3)	808	mg/L	C
ATGC-01	5/13/1991		HARDNESS, TOTAL (MG/L AS CACO3)	808	mg/L	C
ATGC-01	6/11/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2161	mg/L	C
ATGC-01	6/11/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2161	mg/L	C
ATGC-01	7/18/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2002	mg/L	C
ATGC-01	7/18/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2002	mg/L	C

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	9/30/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2082	mg/L	C
ATGC-01	9/30/1991		HARDNESS, TOTAL (MG/L AS CACO3)	2082	mg/L	C
ATGC-01	11/7/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1891	mg/L	C
ATGC-01	11/7/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1891	mg/L	C
ATGC-01	12/9/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1007	mg/L	C
ATGC-01	12/9/1991		HARDNESS, TOTAL (MG/L AS CACO3)	1007	mg/L	C
ATGC-01	1/21/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1223	mg/L	C
ATGC-01	1/21/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1223	mg/L	C
ATGC-01	2/25/1992		HARDNESS, TOTAL (MG/L AS CACO3)	836	mg/L	C
ATGC-01	2/25/1992		HARDNESS, TOTAL (MG/L AS CACO3)	836	mg/L	C
ATGC-01	3/26/1992		HARDNESS, TOTAL (MG/L AS CACO3)	569	mg/L	C
ATGC-01	3/26/1992		HARDNESS, TOTAL (MG/L AS CACO3)	569	mg/L	C
ATGC-01	4/28/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1044	mg/L	C
ATGC-01	4/28/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1044	mg/L	C
ATGC-01	6/25/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1078	mg/L	C
ATGC-01	6/25/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1078	mg/L	C
ATGC-01	8/10/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1759	mg/L	C
ATGC-01	8/10/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1759	mg/L	C
ATGC-01	9/2/1992		HARDNESS, TOTAL (MG/L AS CACO3)	631	mg/L	C
ATGC-01	9/2/1992		HARDNESS, TOTAL (MG/L AS CACO3)	631	mg/L	C
ATGC-01	10/6/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1260	mg/L	C
ATGC-01	10/6/1992		HARDNESS, TOTAL (MG/L AS CACO3)	1260	mg/L	C
ATGC-01	12/1/1992		HARDNESS, TOTAL (MG/L AS CACO3)	986	mg/L	C
ATGC-01	12/1/1992		HARDNESS, TOTAL (MG/L AS CACO3)	986	mg/L	C
ATGC-01	1/5/1993		HARDNESS, TOTAL (MG/L AS CACO3)	167	mg/L	C
ATGC-01	1/5/1993		HARDNESS, TOTAL (MG/L AS CACO3)	167	mg/L	C
ATGC-01	2/10/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1412	mg/L	C
ATGC-01	2/10/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1412	mg/L	C
ATGC-01	3/18/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1268	mg/L	C
ATGC-01	3/18/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1268	mg/L	C
ATGC-01	4/22/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1094	mg/L	C
ATGC-01	4/22/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1094	mg/L	C
ATGC-01	6/8/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1723	mg/L	C
ATGC-01	6/8/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1723	mg/L	C
ATGC-01	7/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1983	mg/L	C
ATGC-01	7/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1983	mg/L	C
ATGC-01	9/16/1993		HARDNESS, TOTAL (MG/L AS CACO3)	575	mg/L	C
ATGC-01	9/16/1993		HARDNESS, TOTAL (MG/L AS CACO3)	575	mg/L	C
ATGC-01	11/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	169	mg/L	C
ATGC-01	11/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	169	mg/L	C
ATGC-01	12/14/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1283	mg/L	C
ATGC-01	12/14/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1283	mg/L	C
ATGC-01	1/13/1994		HARDNESS, TOTAL (MG/L AS CACO3)	879	mg/L	C
ATGC-01	1/13/1994		HARDNESS, TOTAL (MG/L AS CACO3)	879	mg/L	C
ATGC-01	2/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	693	mg/L	C
ATGC-01	2/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	693	mg/L	C
ATGC-01	4/20/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1138	mg/L	C
ATGC-01	4/20/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1138	mg/L	C
ATGC-01	5/17/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1508	mg/L	C
ATGC-01	5/17/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1508	mg/L	C
ATGC-01	6/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2060	mg/L	C
ATGC-01	6/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2060	mg/L	C
ATGC-01	8/11/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2195	mg/L	C
ATGC-01	8/11/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2195	mg/L	C
ATGC-01	9/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2513	mg/L	C
ATGC-01	9/22/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2513	mg/L	C
ATGC-01	11/1/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2035	mg/L	C
ATGC-01	11/1/1994		HARDNESS, TOTAL (MG/L AS CACO3)	2035	mg/L	C
ATGC-01	12/19/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1192	mg/L	C
ATGC-01	12/19/1994		HARDNESS, TOTAL (MG/L AS CACO3)	1192	mg/L	C
ATGC-01	1/24/1995		HARDNESS, TOTAL (MG/L AS CACO3)	947	mg/L	C
ATGC-01	1/24/1995		HARDNESS, TOTAL (MG/L AS CACO3)	947	mg/L	C
ATGC-01	2/28/1995		HARDNESS, TOTAL (MG/L AS CACO3)	510	mg/L	C
ATGC-01	2/28/1995		HARDNESS, TOTAL (MG/L AS CACO3)	510	mg/L	C
ATGC-01	4/19/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1534	mg/L	C
ATGC-01	4/19/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1534	mg/L	C
ATGC-01	5/23/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1007	mg/L	C
ATGC-01	5/23/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1007	mg/L	C
ATGC-01	7/3/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1031	mg/L	C
ATGC-01	7/3/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1031	mg/L	C
ATGC-01	8/10/1995		HARDNESS, TOTAL (MG/L AS CACO3)	368	mg/L	C
ATGC-01	8/10/1995		HARDNESS, TOTAL (MG/L AS CACO3)	368	mg/L	C
ATGC-01	9/7/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1390	mg/L	C
ATGC-01	9/7/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1390	mg/L	C
ATGC-01	10/16/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1848	mg/L	C
ATGC-01	10/16/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1848	mg/L	C

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	11/21/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1864	mg/L	C
ATGC-01	11/21/1995		HARDNESS, TOTAL (MG/L AS CACO3)	1864	mg/L	C
ATGC-01	1/2/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1603	mg/L	C
ATGC-01	1/2/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1603	mg/L	C
ATGC-01	2/8/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1260	mg/L	C
ATGC-01	2/8/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1260	mg/L	C
ATGC-01	4/15/1996		HARDNESS, TOTAL (MG/L AS CACO3)	248	mg/L	C
ATGC-01	4/15/1996		HARDNESS, TOTAL (MG/L AS CACO3)	248	mg/L	C
ATGC-01	5/23/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1557	mg/L	C
ATGC-01	5/23/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1557	mg/L	C
ATGC-01	6/13/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1173	mg/L	C
ATGC-01	6/13/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1173	mg/L	C
ATGC-01	8/15/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1628	mg/L	C
ATGC-01	8/15/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1628	mg/L	C
ATGC-01	9/30/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1437	mg/L	C
ATGC-01	9/30/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1437	mg/L	C
ATGC-01	11/4/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1217	mg/L	C
ATGC-01	11/4/1996		HARDNESS, TOTAL (MG/L AS CACO3)	1217	mg/L	C
ATGC-01	12/19/1996		HARDNESS, TOTAL (MG/L AS CACO3)	998	mg/L	C
ATGC-01	12/19/1996		HARDNESS, TOTAL (MG/L AS CACO3)	998	mg/L	C
ATGC-01	1/30/1997		HARDNESS, TOTAL (MG/L AS CACO3)	706	mg/L	C
ATGC-01	1/30/1997		HARDNESS, TOTAL (MG/L AS CACO3)	706	mg/L	C
ATGC-01	3/6/1997		HARDNESS, TOTAL (MG/L AS CACO3)	567	mg/L	C
ATGC-01	3/6/1997		HARDNESS, TOTAL (MG/L AS CACO3)	567	mg/L	C
ATGC-01	4/17/1997		HARDNESS, TOTAL (MG/L AS CACO3)	830	mg/L	C
ATGC-01	4/17/1997		HARDNESS, TOTAL (MG/L AS CACO3)	830	mg/L	C
ATGC-01	6/4/1997		HARDNESS, TOTAL (MG/L AS CACO3)	483	mg/L	C
ATGC-01	6/4/1997		HARDNESS, TOTAL (MG/L AS CACO3)	483	mg/L	C
ATGC-01	7/11/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1379	mg/L	C
ATGC-01	7/11/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1379	mg/L	C
ATGC-01	8/18/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1316	mg/L	C
ATGC-01	8/18/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1316	mg/L	C
ATGC-01	9/25/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1427	mg/L	C
ATGC-01	9/25/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1427	mg/L	C
ATGC-01	11/10/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1584	mg/L	C
ATGC-01	11/10/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1584	mg/L	C
ATGC-01	12/17/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1422	mg/L	C
ATGC-01	12/17/1997		HARDNESS, TOTAL (MG/L AS CACO3)	1422	mg/L	C
ATGC-01	1/22/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1311	mg/L	C
ATGC-01	1/22/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1311	mg/L	C
ATGC-01	2/25/1998		HARDNESS, TOTAL (MG/L AS CACO3)	884	mg/L	C
ATGC-01	2/25/1998		HARDNESS, TOTAL (MG/L AS CACO3)	884	mg/L	C
ATGC-01	4/15/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1041	mg/L	C
ATGC-01	4/15/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1041	mg/L	C
ATGC-01	5/20/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1186	mg/L	C
ATGC-01	5/20/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1186	mg/L	C
ATGC-01	6/18/1998		HARDNESS, TOTAL (MG/L AS CACO3)	744	mg/L	C
ATGC-01	6/18/1998		HARDNESS, TOTAL (MG/L AS CACO3)	744	mg/L	C
ATGC-01	7/29/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1240	mg/L	C
ATGC-01	7/29/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1240	mg/L	C
ATGC-01	9/16/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1600	mg/L	C
ATGC-01	9/16/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1600	mg/L	C
ATGC-01	10/22/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1760	mg/L	C
ATGC-01	10/22/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1760	mg/L	C
ATGC-01	11/23/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1855	mg/L	C
ATGC-01	11/23/1998		HARDNESS, TOTAL (MG/L AS CACO3)	1855	mg/L	C
ATGC-01	1/28/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1146	mg/L	C
ATGC-01	1/28/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1146	mg/L	C
ATGC-01	2/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1126	mg/L	C
ATGC-01	2/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1126	mg/L	C
ATGC-01	3/29/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1200	mg/L	C
ATGC-01	3/29/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1200	mg/L	C
ATGC-01	5/7/1999		HARDNESS, TOTAL (MG/L AS CACO3)	715	mg/L	C
ATGC-01	5/7/1999		HARDNESS, TOTAL (MG/L AS CACO3)	715	mg/L	C
ATGC-01	7/6/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1792	mg/L	C
ATGC-01	7/6/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1792	mg/L	C
ATGC-01	8/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1940	mg/L	C
ATGC-01	8/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1940	mg/L	C
ATGC-01	9/23/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1788	mg/L	C
ATGC-01	9/23/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1788	mg/L	C
ATGC-01	11/4/1999		HARDNESS, TOTAL (MG/L AS CACO3)	2063	mg/L	C
ATGC-01	11/4/1999		HARDNESS, TOTAL (MG/L AS CACO3)	2063	mg/L	C
ATGC-01	12/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1047	mg/L	C
ATGC-01	12/17/1999		HARDNESS, TOTAL (MG/L AS CACO3)	1047	mg/L	C
ATGC-01	1/26/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1965	mg/L	C
ATGC-01	1/26/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1965	mg/L	C

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	3/1/2000		HARDNESS, TOTAL (MG/L AS CACO3)	771	mg/L	C
ATGC-01	3/1/2000		HARDNESS, TOTAL (MG/L AS CACO3)	771	mg/L	C
ATGC-01	4/19/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1396	mg/L	C
ATGC-01	4/19/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1396	mg/L	C
ATGC-01	5/24/2000		HARDNESS, TOTAL (MG/L AS CACO3)	245	mg/L	C
ATGC-01	5/24/2000		HARDNESS, TOTAL (MG/L AS CACO3)	245	mg/L	C
ATGC-01	6/22/2000		HARDNESS, TOTAL (MG/L AS CACO3)	618	mg/L	C
ATGC-01	6/22/2000		HARDNESS, TOTAL (MG/L AS CACO3)	618	mg/L	C
ATGC-01	8/16/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1777	mg/L	C
ATGC-01	8/16/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1777	mg/L	C
ATGC-01	10/2/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1812	mg/L	C
ATGC-01	10/2/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1812	mg/L	C
ATGC-01	11/15/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1329	mg/L	C
ATGC-01	11/15/2000		HARDNESS, TOTAL (MG/L AS CACO3)	1329	mg/L	C
ATGC-01	1/10/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1093	mg/L	C
ATGC-01	1/10/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1093	mg/L	C
ATGC-01	4/19/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1383	mg/L	C
ATGC-01	4/19/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1383	mg/L	C
ATGC-01	7/26/2001		HARDNESS, TOTAL (MG/L AS CACO3)	940	mg/L	C
ATGC-01	7/26/2001		HARDNESS, TOTAL (MG/L AS CACO3)	940	mg/L	C
ATGC-01	9/4/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1350	mg/L	C
ATGC-01	9/4/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1350	mg/L	C
ATGC-01	11/1/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1077	mg/L	C
ATGC-01	11/1/2001		HARDNESS, TOTAL (MG/L AS CACO3)	1077	mg/L	C
ATGC-01	1/17/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1551	mg/L	C
ATGC-01	1/17/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1551	mg/L	C
ATGC-01	2/21/2002		HARDNESS, TOTAL (MG/L AS CACO3)	764	mg/L	C
ATGC-01	2/21/2002		HARDNESS, TOTAL (MG/L AS CACO3)	764	mg/L	C
ATGC-01	3/20/2002		HARDNESS, TOTAL (MG/L AS CACO3)	137	mg/L	C
ATGC-01	3/20/2002		HARDNESS, TOTAL (MG/L AS CACO3)	137	mg/L	C
ATGC-01	4/24/2002		HARDNESS, TOTAL (MG/L AS CACO3)	900	mg/L	C
ATGC-01	4/24/2002		HARDNESS, TOTAL (MG/L AS CACO3)	900	mg/L	C
ATGC-01	6/4/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1665	mg/L	C
ATGC-01	6/4/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1665	mg/L	C
ATGC-01	7/15/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1968	mg/L	C
ATGC-01	7/15/2002		HARDNESS, TOTAL (MG/L AS CACO3)	1968	mg/L	C
ATGC-01	8/19/2002		HARDNESS, TOTAL (MG/L AS CACO3)	2071	mg/L	C
ATGC-01	8/19/2002		HARDNESS, TOTAL (MG/L AS CACO3)	2071	mg/L	C
ATGC-01	1/30/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1517	mg/L	C
ATGC-01	1/30/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1517	mg/L	C
ATGC-01	3/5/2003		HARDNESS, TOTAL (MG/L AS CACO3)	916	mg/L	C
ATGC-01	3/5/2003		HARDNESS, TOTAL (MG/L AS CACO3)	916	mg/L	C
ATGC-01	3/26/2003		HARDNESS, TOTAL (MG/L AS CACO3)	714	mg/L	C
ATGC-01	3/26/2003		HARDNESS, TOTAL (MG/L AS CACO3)	714	mg/L	C
ATGC-01	5/6/2003		HARDNESS, TOTAL (MG/L AS CACO3)	405	mg/L	C
ATGC-01	5/6/2003		HARDNESS, TOTAL (MG/L AS CACO3)	405	mg/L	C
ATGC-01	6/18/2003		HARDNESS, TOTAL (MG/L AS CACO3)	941	mg/L	C
ATGC-01	6/18/2003		HARDNESS, TOTAL (MG/L AS CACO3)	941	mg/L	C
ATGC-01	8/7/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1058	mg/L	C
ATGC-01	8/7/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1058	mg/L	C
ATGC-01	9/4/2003		HARDNESS, TOTAL (MG/L AS CACO3)	889	mg/L	C
ATGC-01	9/4/2003		HARDNESS, TOTAL (MG/L AS CACO3)	889	mg/L	C
ATGC-01	10/15/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1690	mg/L	C
ATGC-01	10/15/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1690	mg/L	C
ATGC-01	11/18/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1468	mg/L	C
ATGC-01	11/18/2003		HARDNESS, TOTAL (MG/L AS CACO3)	1468	mg/L	C
ATGC-01	1/14/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1046	mg/L	C
ATGC-01	1/14/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1046	mg/L	C
ATGC-01	2/19/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	2/19/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	4/14/2004		HARDNESS, TOTAL (MG/L AS CACO3)	120	mg/L	C
ATGC-01	4/14/2004		HARDNESS, TOTAL (MG/L AS CACO3)	120	mg/L	C
ATGC-01	5/12/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1300	mg/L	C
ATGC-01	5/12/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1300	mg/L	C
ATGC-01	6/9/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	6/9/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	8/11/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	8/11/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	9/8/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	9/8/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	10/27/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	10/27/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	12/20/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	12/20/2004		HARDNESS, TOTAL (MG/L AS CACO3)	1100	mg/L	C
ATGC-01	1/27/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	1/27/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	2/24/2005		HARDNESS, TOTAL (MG/L AS CACO3)	570	mg/L	C
ATGC-01	2/24/2005		HARDNESS, TOTAL (MG/L AS CACO3)	570	mg/L	C
ATGC-01	4/13/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1200	mg/L	C
ATGC-01	4/13/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1200	mg/L	C
ATGC-01	5/23/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	5/23/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	6/29/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	6/29/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	7/20/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	7/20/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1500	mg/L	C
ATGC-01	9/15/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	9/15/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	10/31/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	10/31/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1900	mg/L	C
ATGC-01	12/6/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	12/6/2005		HARDNESS, TOTAL (MG/L AS CACO3)	1400	mg/L	C
ATGC-01	1/25/1990		MANGANESE, DISSOLVED (UG/L AS MN)	1654	µg/L	
ATGC-01	3/7/1990		MANGANESE, DISSOLVED (UG/L AS MN)	1272	µg/L	
ATGC-01	4/11/1990		MANGANESE, DISSOLVED (UG/L AS MN)	621	µg/L	
ATGC-01	5/14/1990		MANGANESE, DISSOLVED (UG/L AS MN)	631	µg/L	
ATGC-01	6/14/1990		MANGANESE, DISSOLVED (UG/L AS MN)	1096	µg/L	
ATGC-01	7/24/1990		MANGANESE, DISSOLVED (UG/L AS MN)	360	µg/L	
ATGC-01	9/11/1990		MANGANESE, DISSOLVED (UG/L AS MN)	491	µg/L	
ATGC-01	10/30/1990		MANGANESE, DISSOLVED (UG/L AS MN)	143	µg/L	
ATGC-01	12/20/1990		MANGANESE, DISSOLVED (UG/L AS MN)	996	µg/L	
ATGC-01	1/30/1991		MANGANESE, DISSOLVED (UG/L AS MN)	1020	µg/L	
ATGC-01	3/7/1991		MANGANESE, DISSOLVED (UG/L AS MN)	1265	µg/L	
ATGC-01	4/9/1991		MANGANESE, DISSOLVED (UG/L AS MN)	1451	µg/L	
ATGC-01	5/13/1991		MANGANESE, DISSOLVED (UG/L AS MN)	770	µg/L	
ATGC-01	6/11/1991		MANGANESE, DISSOLVED (UG/L AS MN)	380	µg/L	
ATGC-01	7/18/1991		MANGANESE, DISSOLVED (UG/L AS MN)	110	µg/L	
ATGC-01	9/30/1991		MANGANESE, DISSOLVED (UG/L AS MN)	101	µg/L	
ATGC-01	11/7/1991		MANGANESE, DISSOLVED (UG/L AS MN)	84	µg/L	
ATGC-01	12/9/1991		MANGANESE, DISSOLVED (UG/L AS MN)	1300	µg/L	
ATGC-01	1/21/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	2/25/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	3/26/1992		MANGANESE, DISSOLVED (UG/L AS MN)	840	µg/L	
ATGC-01	4/28/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1000	µg/L	
ATGC-01	6/25/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1800	µg/L	
ATGC-01	8/10/1992		MANGANESE, DISSOLVED (UG/L AS MN)	340	µg/L	
ATGC-01	9/2/1992		MANGANESE, DISSOLVED (UG/L AS MN)	610	µg/L	
ATGC-01	10/6/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1000	µg/L	
ATGC-01	12/1/1992		MANGANESE, DISSOLVED (UG/L AS MN)	1600	µg/L	
ATGC-01	1/5/1993		MANGANESE, DISSOLVED (UG/L AS MN)	450	µg/L	
ATGC-01	2/10/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1700	µg/L	
ATGC-01	3/18/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1600	µg/L	
ATGC-01	4/22/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1200	µg/L	
ATGC-01	6/8/1993		MANGANESE, DISSOLVED (UG/L AS MN)	970	µg/L	
ATGC-01	7/13/1993		MANGANESE, DISSOLVED (UG/L AS MN)	130	µg/L	
ATGC-01	9/16/1993		MANGANESE, DISSOLVED (UG/L AS MN)	18000	µg/L	
ATGC-01	11/15/1993		MANGANESE, DISSOLVED (UG/L AS MN)	420	µg/L	
ATGC-01	12/14/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1600	µg/L	
ATGC-01	1/13/1994		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	2/22/1994		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	4/20/1994		MANGANESE, DISSOLVED (UG/L AS MN)	1300	µg/L	
ATGC-01	5/17/1994		MANGANESE, DISSOLVED (UG/L AS MN)	1000	µg/L	
ATGC-01	6/22/1994		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	8/11/1994		MANGANESE, DISSOLVED (UG/L AS MN)	730	µg/L	
ATGC-01	9/22/1994		MANGANESE, DISSOLVED (UG/L AS MN)	240	µg/L	
ATGC-01	11/1/1994		MANGANESE, DISSOLVED (UG/L AS MN)	80	µg/L	
ATGC-01	12/19/1994		MANGANESE, DISSOLVED (UG/L AS MN)	970	µg/L	
ATGC-01	1/24/1995		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	2/28/1995		MANGANESE, DISSOLVED (UG/L AS MN)	750	µg/L	
ATGC-01	4/19/1995		MANGANESE, DISSOLVED (UG/L AS MN)	520	µg/L	
ATGC-01	5/23/1995		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	7/3/1995		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	8/10/1995		MANGANESE, DISSOLVED (UG/L AS MN)	650	µg/L	
ATGC-01	9/7/1995		MANGANESE, DISSOLVED (UG/L AS MN)	75	µg/L	
ATGC-01	10/16/1995		MANGANESE, DISSOLVED (UG/L AS MN)	230	µg/L	
ATGC-01	11/21/1995		MANGANESE, DISSOLVED (UG/L AS MN)	970	µg/L	
ATGC-01	1/2/1996		MANGANESE, DISSOLVED (UG/L AS MN)	960	µg/L	
ATGC-01	2/8/1996		MANGANESE, DISSOLVED (UG/L AS MN)	1200	µg/L	
ATGC-01	4/15/1996		MANGANESE, DISSOLVED (UG/L AS MN)	490	µg/L	
ATGC-01	5/23/1996		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	6/13/1996		MANGANESE, DISSOLVED (UG/L AS MN)	1500	µg/L	
ATGC-01	8/15/1996		MANGANESE, DISSOLVED (UG/L AS MN)	270	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	9/30/1996		MANGANESE, DISSOLVED (UG/L AS MN)	1500	µg/L	
ATGC-01	11/4/1996		MANGANESE, DISSOLVED (UG/L AS MN)	250	µg/L	
ATGC-01	12/19/1996		MANGANESE, DISSOLVED (UG/L AS MN)	1300	µg/L	
ATGC-01	1/30/1997		MANGANESE, DISSOLVED (UG/L AS MN)	1300	µg/L	
ATGC-01	3/6/1997		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	4/17/1997		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	6/4/1997		MANGANESE, DISSOLVED (UG/L AS MN)	1200	µg/L	
ATGC-01	7/11/1997		MANGANESE, DISSOLVED (UG/L AS MN)	500	µg/L	
ATGC-01	8/18/1997		MANGANESE, DISSOLVED (UG/L AS MN)	250	µg/L	
ATGC-01	9/25/1997		MANGANESE, DISSOLVED (UG/L AS MN)	130	µg/L	
ATGC-01	11/10/1997		MANGANESE, DISSOLVED (UG/L AS MN)	47	µg/L	
ATGC-01	12/17/1997		MANGANESE, DISSOLVED (UG/L AS MN)	310	µg/L	
ATGC-01	1/22/1998		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	2/25/1998		MANGANESE, DISSOLVED (UG/L AS MN)	770	µg/L	
ATGC-01	4/15/1998		MANGANESE, DISSOLVED (UG/L AS MN)	430	µg/L	
ATGC-01	5/20/1998		MANGANESE, DISSOLVED (UG/L AS MN)	470	µg/L	
ATGC-01	6/18/1998		MANGANESE, DISSOLVED (UG/L AS MN)	870	µg/L	
ATGC-01	7/29/1998		MANGANESE, DISSOLVED (UG/L AS MN)	120	µg/L	
ATGC-01	9/16/1998		MANGANESE, DISSOLVED (UG/L AS MN)	60	µg/L	
ATGC-01	10/22/1998		MANGANESE, DISSOLVED (UG/L AS MN)	58	µg/L	
ATGC-01	11/23/1998		MANGANESE, DISSOLVED (UG/L AS MN)	30	µg/L	
ATGC-01	1/28/1999		MANGANESE, DISSOLVED (UG/L AS MN)	1200	µg/L	
ATGC-01	2/17/1999		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	3/29/1999		MANGANESE, DISSOLVED (UG/L AS MN)	1000	µg/L	
ATGC-01	5/7/1999		MANGANESE, DISSOLVED (UG/L AS MN)	710	µg/L	
ATGC-01	7/6/1999		MANGANESE, DISSOLVED (UG/L AS MN)	450	µg/L	
ATGC-01	8/17/1999		MANGANESE, DISSOLVED (UG/L AS MN)	200	µg/L	
ATGC-01	9/23/1999		MANGANESE, DISSOLVED (UG/L AS MN)	130	µg/L	
ATGC-01	11/4/1999		MANGANESE, DISSOLVED (UG/L AS MN)	190	µg/L	
ATGC-01	12/17/1999		MANGANESE, DISSOLVED (UG/L AS MN)	480	µg/L	
ATGC-01	1/26/2000		MANGANESE, DISSOLVED (UG/L AS MN)	1500	µg/L	
ATGC-01	3/1/2000		MANGANESE, DISSOLVED (UG/L AS MN)	990	µg/L	
ATGC-01	4/19/2000		MANGANESE, DISSOLVED (UG/L AS MN)	470	µg/L	
ATGC-01	5/24/2000		MANGANESE, DISSOLVED (UG/L AS MN)	930	µg/L	
ATGC-01	6/22/2000		MANGANESE, DISSOLVED (UG/L AS MN)	1400	µg/L	
ATGC-01	8/16/2000		MANGANESE, DISSOLVED (UG/L AS MN)	240	µg/L	
ATGC-01	10/2/2000		MANGANESE, DISSOLVED (UG/L AS MN)	120	µg/L	
ATGC-01	11/15/2000		MANGANESE, DISSOLVED (UG/L AS MN)	420	µg/L	
ATGC-01	1/10/2001		MANGANESE, DISSOLVED (UG/L AS MN)	1500	µg/L	
ATGC-01	4/19/2001		MANGANESE, DISSOLVED (UG/L AS MN)	820	µg/L	
ATGC-01	7/26/2001		MANGANESE, DISSOLVED (UG/L AS MN)	23000	µg/L	
ATGC-01	9/4/2001		MANGANESE, DISSOLVED (UG/L AS MN)	140	µg/L	
ATGC-01	11/1/2001		MANGANESE, DISSOLVED (UG/L AS MN)	810	µg/L	
ATGC-01	1/17/2002		MANGANESE, DISSOLVED (UG/L AS MN)	1700	µg/L	
ATGC-01	2/21/2002		MANGANESE, DISSOLVED (UG/L AS MN)	830	µg/L	
ATGC-01	3/20/2002		MANGANESE, DISSOLVED (UG/L AS MN)	220	µg/L	
ATGC-01	4/24/2002		MANGANESE, DISSOLVED (UG/L AS MN)	1200	µg/L	
ATGC-01	6/4/2002		MANGANESE, DISSOLVED (UG/L AS MN)	900	µg/L	
ATGC-01	7/15/2002		MANGANESE, DISSOLVED (UG/L AS MN)	300	µg/L	
ATGC-01	8/19/2002		MANGANESE, DISSOLVED (UG/L AS MN)	97	µg/L	
ATGC-01	1/30/2003		MANGANESE, DISSOLVED (UG/L AS MN)	1100	µg/L	
ATGC-01	3/5/2003		MANGANESE, DISSOLVED (UG/L AS MN)	880	µg/L	
ATGC-01	3/26/2003		MANGANESE, DISSOLVED (UG/L AS MN)	700	µg/L	
ATGC-01	5/6/2003		MANGANESE, DISSOLVED (UG/L AS MN)	540	µg/L	
ATGC-01	6/18/2003		MANGANESE, DISSOLVED (UG/L AS MN)	460	µg/L	
ATGC-01	8/7/2003		MANGANESE, DISSOLVED (UG/L AS MN)	200	µg/L	
ATGC-01	9/4/2003		MANGANESE, DISSOLVED (UG/L AS MN)	240	µg/L	
ATGC-01	10/15/2003		MANGANESE, DISSOLVED (UG/L AS MN)	110	µg/L	
ATGC-01	11/18/2003		MANGANESE, DISSOLVED (UG/L AS MN)	26	µg/L	
ATGC-01	1/14/2004		MANGANESE, DISSOLVED (UG/L AS MN)	800	µg/L	
ATGC-01	2/19/2004		MANGANESE, DISSOLVED (UG/L AS MN)	780	µg/L	
ATGC-01	4/14/2004		MANGANESE, DISSOLVED (UG/L AS MN)	480	µg/L	
ATGC-01	5/12/2004		MANGANESE, DISSOLVED (UG/L AS MN)	360	µg/L	
ATGC-01	6/9/2004		MANGANESE, DISSOLVED (UG/L AS MN)	83	µg/L	
ATGC-01	8/11/2004		MANGANESE, DISSOLVED (UG/L AS MN)	130	µg/L	
ATGC-01	9/8/2004		MANGANESE, DISSOLVED (UG/L AS MN)	140	µg/L	
ATGC-01	10/27/2004		MANGANESE, DISSOLVED (UG/L AS MN)	240	µg/L	
ATGC-01	12/20/2004		MANGANESE, DISSOLVED (UG/L AS MN)	960	µg/L	
ATGC-01	1/27/2005		MANGANESE, DISSOLVED (UG/L AS MN)	970	µg/L	
ATGC-01	2/24/2005		MANGANESE, DISSOLVED (UG/L AS MN)	1000	µg/L	
ATGC-01	4/13/2005		MANGANESE, DISSOLVED (UG/L AS MN)	720	µg/L	
ATGC-01	5/23/2005		MANGANESE, DISSOLVED (UG/L AS MN)	310	µg/L	
ATGC-01	6/29/2005		MANGANESE, DISSOLVED (UG/L AS MN)	540	µg/L	
ATGC-01	7/20/2005		MANGANESE, DISSOLVED (UG/L AS MN)	190	µg/L	
ATGC-01	9/15/2005		MANGANESE, DISSOLVED (UG/L AS MN)	240	µg/L	
ATGC-01	10/31/2005		MANGANESE, DISSOLVED (UG/L AS MN)	130	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	12/6/2005		MANGANESE, DISSOLVED (UG/L AS MN)	980	µg/L	
ATGC-01	1/25/1990		MANGANESE, TOTAL (UG/L AS MN)	1717	µg/L	
ATGC-01	3/7/1990		MANGANESE, TOTAL (UG/L AS MN)	1407	µg/L	
ATGC-01	4/11/1990		MANGANESE, TOTAL (UG/L AS MN)	880	µg/L	
ATGC-01	5/14/1990		MANGANESE, TOTAL (UG/L AS MN)	772	µg/L	
ATGC-01	6/14/1990		MANGANESE, TOTAL (UG/L AS MN)	1393	µg/L	
ATGC-01	7/24/1990		MANGANESE, TOTAL (UG/L AS MN)	400	µg/L	
ATGC-01	9/11/1990		MANGANESE, TOTAL (UG/L AS MN)	1392	µg/L	
ATGC-01	10/30/1990		MANGANESE, TOTAL (UG/L AS MN)	206	µg/L	
ATGC-01	12/20/1990		MANGANESE, TOTAL (UG/L AS MN)	1150	µg/L	
ATGC-01	1/30/1991		MANGANESE, TOTAL (UG/L AS MN)	1281	µg/L	
ATGC-01	3/7/1991		MANGANESE, TOTAL (UG/L AS MN)	1511	µg/L	
ATGC-01	4/9/1991		MANGANESE, TOTAL (UG/L AS MN)	1565	µg/L	
ATGC-01	5/13/1991		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	6/11/1991		MANGANESE, TOTAL (UG/L AS MN)	390	µg/L	
ATGC-01	7/18/1991		MANGANESE, TOTAL (UG/L AS MN)	295	µg/L	
ATGC-01	9/30/1991		MANGANESE, TOTAL (UG/L AS MN)	151	µg/L	
ATGC-01	11/7/1991		MANGANESE, TOTAL (UG/L AS MN)	86	µg/L	
ATGC-01	12/9/1991		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	1/21/1992		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	2/25/1992		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	3/26/1992		MANGANESE, TOTAL (UG/L AS MN)	960	µg/L	
ATGC-01	4/28/1992		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	6/25/1992		MANGANESE, TOTAL (UG/L AS MN)	2100	µg/L	
ATGC-01	8/10/1992		MANGANESE, TOTAL (UG/L AS MN)	480	µg/L	
ATGC-01	9/2/1992		MANGANESE, TOTAL (UG/L AS MN)	680	µg/L	
ATGC-01	10/6/1992		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	12/1/1992		MANGANESE, TOTAL (UG/L AS MN)	1700	µg/L	
ATGC-01	1/5/1993		MANGANESE, TOTAL (UG/L AS MN)	620	µg/L	
ATGC-01	2/10/1993		MANGANESE, TOTAL (UG/L AS MN)	1700	µg/L	
ATGC-01	3/18/1993		MANGANESE, TOTAL (UG/L AS MN)	1700	µg/L	
ATGC-01	4/22/1993		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	6/8/1993		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	7/13/1993		MANGANESE, TOTAL (UG/L AS MN)	230	µg/L	
ATGC-01	9/16/1993		MANGANESE, TOTAL (UG/L AS MN)	21000	µg/L	
ATGC-01	11/15/1993		MANGANESE, TOTAL (UG/L AS MN)	570	µg/L	
ATGC-01	12/14/1993		MANGANESE, TOTAL (UG/L AS MN)	1900	µg/L	
ATGC-01	1/13/1994		MANGANESE, TOTAL (UG/L AS MN)	1500	µg/L	
ATGC-01	2/22/1994		MANGANESE, TOTAL (UG/L AS MN)	1300	µg/L	
ATGC-01	4/20/1994		MANGANESE, TOTAL (UG/L AS MN)	1300	µg/L	
ATGC-01	5/17/1994		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	6/22/1994		MANGANESE, TOTAL (UG/L AS MN)	1200	µg/L	
ATGC-01	8/11/1994		MANGANESE, TOTAL (UG/L AS MN)	750	µg/L	
ATGC-01	9/22/1994		MANGANESE, TOTAL (UG/L AS MN)	260	µg/L	
ATGC-01	11/1/1994		MANGANESE, TOTAL (UG/L AS MN)	85	µg/L	
ATGC-01	12/19/1994		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	1/24/1995		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	2/28/1995		MANGANESE, TOTAL (UG/L AS MN)	950	µg/L	
ATGC-01	4/19/1995		MANGANESE, TOTAL (UG/L AS MN)	560	µg/L	
ATGC-01	5/23/1995		MANGANESE, TOTAL (UG/L AS MN)	1500	µg/L	
ATGC-01	7/3/1995		MANGANESE, TOTAL (UG/L AS MN)	1300	µg/L	
ATGC-01	8/10/1995		MANGANESE, TOTAL (UG/L AS MN)	790	µg/L	
ATGC-01	9/7/1995		MANGANESE, TOTAL (UG/L AS MN)	100	µg/L	
ATGC-01	10/16/1995		MANGANESE, TOTAL (UG/L AS MN)	250	µg/L	
ATGC-01	11/21/1995		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	1/2/1996		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	2/8/1996		MANGANESE, TOTAL (UG/L AS MN)	1200	µg/L	
ATGC-01	4/15/1996		MANGANESE, TOTAL (UG/L AS MN)	550	µg/L	
ATGC-01	5/23/1996		MANGANESE, TOTAL (UG/L AS MN)	1500	µg/L	
ATGC-01	6/13/1996		MANGANESE, TOTAL (UG/L AS MN)	1600	µg/L	
ATGC-01	8/15/1996		MANGANESE, TOTAL (UG/L AS MN)	300	µg/L	
ATGC-01	9/30/1996		MANGANESE, TOTAL (UG/L AS MN)	1700	µg/L	
ATGC-01	11/4/1996		MANGANESE, TOTAL (UG/L AS MN)	270	µg/L	
ATGC-01	12/19/1996		MANGANESE, TOTAL (UG/L AS MN)	1500	µg/L	
ATGC-01	1/30/1997		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	3/6/1997		MANGANESE, TOTAL (UG/L AS MN)	1200	µg/L	
ATGC-01	4/17/1997		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	6/4/1997		MANGANESE, TOTAL (UG/L AS MN)	1300	µg/L	
ATGC-01	7/11/1997		MANGANESE, TOTAL (UG/L AS MN)	540	µg/L	
ATGC-01	8/18/1997		MANGANESE, TOTAL (UG/L AS MN)	420	µg/L	
ATGC-01	9/25/1997		MANGANESE, TOTAL (UG/L AS MN)	160	µg/L	
ATGC-01	11/10/1997		MANGANESE, TOTAL (UG/L AS MN)	53	µg/L	
ATGC-01	12/17/1997		MANGANESE, TOTAL (UG/L AS MN)	370	µg/L	
ATGC-01	1/22/1998		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	2/25/1998		MANGANESE, TOTAL (UG/L AS MN)	810	µg/L	
ATGC-01	4/15/1998		MANGANESE, TOTAL (UG/L AS MN)	460	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	5/20/1998		MANGANESE, TOTAL (UG/L AS MN)	510	µg/L	
ATGC-01	6/18/1998		MANGANESE, TOTAL (UG/L AS MN)	940	µg/L	
ATGC-01	7/29/1998		MANGANESE, TOTAL (UG/L AS MN)	170	µg/L	
ATGC-01	9/16/1998		MANGANESE, TOTAL (UG/L AS MN)	81	µg/L	
ATGC-01	10/22/1998		MANGANESE, TOTAL (UG/L AS MN)	65	µg/L	
ATGC-01	11/23/1998		MANGANESE, TOTAL (UG/L AS MN)	34	µg/L	
ATGC-01	1/28/1999		MANGANESE, TOTAL (UG/L AS MN)	1300	µg/L	
ATGC-01	2/17/1999		MANGANESE, TOTAL (UG/L AS MN)	1200	µg/L	
ATGC-01	3/29/1999		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	5/7/1999		MANGANESE, TOTAL (UG/L AS MN)	970	µg/L	
ATGC-01	7/6/1999		MANGANESE, TOTAL (UG/L AS MN)	510	µg/L	
ATGC-01	8/17/1999		MANGANESE, TOTAL (UG/L AS MN)	210	µg/L	
ATGC-01	9/23/1999		MANGANESE, TOTAL (UG/L AS MN)	140	µg/L	
ATGC-01	11/4/1999		MANGANESE, TOTAL (UG/L AS MN)	210	µg/L	
ATGC-01	12/17/1999		MANGANESE, TOTAL (UG/L AS MN)	500	µg/L	
ATGC-01	1/26/2000		MANGANESE, TOTAL (UG/L AS MN)	1600	µg/L	
ATGC-01	3/1/2000		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	4/19/2000		MANGANESE, TOTAL (UG/L AS MN)	490	µg/L	
ATGC-01	5/24/2000		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	6/22/2000		MANGANESE, TOTAL (UG/L AS MN)	1400	µg/L	
ATGC-01	8/16/2000		MANGANESE, TOTAL (UG/L AS MN)	260	µg/L	
ATGC-01	10/2/2000		MANGANESE, TOTAL (UG/L AS MN)	130	µg/L	
ATGC-01	11/15/2000		MANGANESE, TOTAL (UG/L AS MN)	440	µg/L	
ATGC-01	1/10/2001		MANGANESE, TOTAL (UG/L AS MN)	1500	µg/L	
ATGC-01	4/19/2001		MANGANESE, TOTAL (UG/L AS MN)	880	µg/L	
ATGC-01	7/26/2001		MANGANESE, TOTAL (UG/L AS MN)	26000	µg/L	
ATGC-01	9/4/2001		MANGANESE, TOTAL (UG/L AS MN)	170	µg/L	
ATGC-01	11/1/2001		MANGANESE, TOTAL (UG/L AS MN)	820	µg/L	
ATGC-01	1/17/2002		MANGANESE, TOTAL (UG/L AS MN)	1800	µg/L	
ATGC-01	2/21/2002		MANGANESE, TOTAL (UG/L AS MN)	850	µg/L	
ATGC-01	3/20/2002		MANGANESE, TOTAL (UG/L AS MN)	550	µg/L	
ATGC-01	4/24/2002		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	6/4/2002		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	7/15/2002		MANGANESE, TOTAL (UG/L AS MN)	370	µg/L	
ATGC-01	8/19/2002		MANGANESE, TOTAL (UG/L AS MN)	140	µg/L	
ATGC-01	1/30/2003		MANGANESE, TOTAL (UG/L AS MN)	1100	µg/L	
ATGC-01	3/5/2003		MANGANESE, TOTAL (UG/L AS MN)	880	µg/L	
ATGC-01	3/26/2003		MANGANESE, TOTAL (UG/L AS MN)	760	µg/L	
ATGC-01	5/6/2003		MANGANESE, TOTAL (UG/L AS MN)	760	µg/L	
ATGC-01	6/18/2003		MANGANESE, TOTAL (UG/L AS MN)	490	µg/L	
ATGC-01	8/7/2003		MANGANESE, TOTAL (UG/L AS MN)	210	µg/L	
ATGC-01	9/4/2003		MANGANESE, TOTAL (UG/L AS MN)	320	µg/L	
ATGC-01	10/15/2003		MANGANESE, TOTAL (UG/L AS MN)	110	µg/L	
ATGC-01	11/18/2003		MANGANESE, TOTAL (UG/L AS MN)	37	µg/L	
ATGC-01	1/14/2004		MANGANESE, TOTAL (UG/L AS MN)	820	µg/L	
ATGC-01	2/19/2004		MANGANESE, TOTAL (UG/L AS MN)	820	µg/L	
ATGC-01	4/14/2004		MANGANESE, TOTAL (UG/L AS MN)	440	µg/L	
ATGC-01	5/12/2004		MANGANESE, TOTAL (UG/L AS MN)	460	µg/L	
ATGC-01	6/9/2004		MANGANESE, TOTAL (UG/L AS MN)	220	µg/L	
ATGC-01	8/11/2004		MANGANESE, TOTAL (UG/L AS MN)	140	µg/L	
ATGC-01	9/8/2004		MANGANESE, TOTAL (UG/L AS MN)	180	µg/L	
ATGC-01	10/27/2004		MANGANESE, TOTAL (UG/L AS MN)	400	µg/L	
ATGC-01	12/20/2004		MANGANESE, TOTAL (UG/L AS MN)	800	µg/L	
ATGC-01	1/27/2005		MANGANESE, TOTAL (UG/L AS MN)	1200	µg/L	
ATGC-01	2/24/2005		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	4/13/2005		MANGANESE, TOTAL (UG/L AS MN)	800	µg/L	
ATGC-01	5/23/2005		MANGANESE, TOTAL (UG/L AS MN)	340	µg/L	
ATGC-01	6/29/2005		MANGANESE, TOTAL (UG/L AS MN)	600	µg/L	
ATGC-01	7/20/2005		MANGANESE, TOTAL (UG/L AS MN)	250	µg/L	
ATGC-01	9/15/2005		MANGANESE, TOTAL (UG/L AS MN)	280	µg/L	
ATGC-01	10/31/2005		MANGANESE, TOTAL (UG/L AS MN)	140	µg/L	
ATGC-01	12/6/2005		MANGANESE, TOTAL (UG/L AS MN)	1000	µg/L	
ATGC-01	1/25/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	3/7/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/11/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/14/1990		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	6/14/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/24/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/11/1990		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	10/30/1990		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	12/20/1990		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/30/1991		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	3/7/1991		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/9/1991		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/13/1991		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	6/11/1991		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	7/18/1991		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/30/1991		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/7/1991		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	12/9/1991		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	1/21/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	2/25/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	3/26/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	4/28/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	6/25/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	8/10/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	9/2/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	10/6/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	12/1/1992		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	1/5/1993		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	2/10/1993		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	K
ATGC-01	3/18/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/22/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/8/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/13/1993		SILVER, DISSOLVED (UG/L AS AG)	5	µg/L	
ATGC-01	9/16/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/15/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	12/14/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/13/1994		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	2/22/1994		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/20/1994		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/17/1994		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/22/1994		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/11/1994		SILVER, DISSOLVED (UG/L AS AG)	17	µg/L	
ATGC-01	11/1/1994		SILVER, DISSOLVED (UG/L AS AG)	16	µg/L	
ATGC-01	12/19/1994		SILVER, DISSOLVED (UG/L AS AG)	11	µg/L	
ATGC-01	1/24/1995		SILVER, DISSOLVED (UG/L AS AG)	8	µg/L	
ATGC-01	2/28/1995		SILVER, DISSOLVED (UG/L AS AG)	4	µg/L	
ATGC-01	4/19/1995		SILVER, DISSOLVED (UG/L AS AG)	13	µg/L	
ATGC-01	5/23/1995		SILVER, DISSOLVED (UG/L AS AG)	7	µg/L	
ATGC-01	7/3/1995		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/10/1995		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/7/1995		SILVER, DISSOLVED (UG/L AS AG)	13	µg/L	
ATGC-01	10/16/1995		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/21/1995		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/2/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	2/8/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/15/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/23/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/13/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/15/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/30/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/4/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	12/19/1996		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/30/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	3/6/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/17/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/4/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/11/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/18/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/25/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/10/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	12/17/1997		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/22/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	2/25/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/15/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/20/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/18/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/29/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/16/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	10/22/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/23/1998		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/28/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	2/17/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	3/29/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/7/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/6/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/17/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/23/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/4/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	12/17/1999		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/26/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	3/1/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/19/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	5/24/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/22/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/16/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	10/2/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/15/2000		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/10/2001		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/19/2001		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	7/26/2001		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	9/4/2001		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	11/1/2001		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/17/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	2/21/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	3/20/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	4/24/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	6/4/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	7/15/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	8/19/2002		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-01	1/30/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	3/5/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	3/26/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	5/6/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	6/18/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	8/7/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	9/4/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	10/15/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	11/18/2003		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	1/14/2004		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	
ATGC-01	2/19/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	4/14/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	5/12/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	6/9/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	8/11/2004		SILVER, DISSOLVED (UG/L AS AG)	3.6	µg/L	
ATGC-01	9/8/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	10/27/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	12/20/2004		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	1/27/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	2/24/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	4/13/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	5/23/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	6/29/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	7/20/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	9/15/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	10/31/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	12/6/2005		SILVER, DISSOLVED (UG/L AS AG)		µg/L	ND
ATGC-01	1/25/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/7/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/11/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/14/1990		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	6/14/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/24/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/11/1990		SILVER, TOTAL (UG/L AS AG)	7	µg/L	
ATGC-01	10/30/1990		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	12/20/1990		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/30/1991		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/7/1991		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/9/1991		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/13/1991		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	6/11/1991		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	7/18/1991		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/30/1991		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/7/1991		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	12/9/1991		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	1/21/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	2/25/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	3/26/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	4/28/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	6/25/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	8/10/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	9/2/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	10/6/1992		SILVER, TOTAL (UG/L AS AG)	6	µg/L	
ATGC-01	12/1/1992		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	1/5/1993		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	2/10/1993		SILVER, TOTAL (UG/L AS AG)	5	µg/L	K
ATGC-01	3/18/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	4/22/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	6/8/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/13/1993		SILVER, TOTAL (UG/L AS AG)	5	µg/L	
ATGC-01	9/16/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/15/1993		SILVER, TOTAL (UG/L AS AG)	4	µg/L	
ATGC-01	12/14/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/13/1994		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	2/22/1994		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/20/1994		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/17/1994		SILVER, TOTAL (UG/L AS AG)	4	µg/L	
ATGC-01	6/22/1994		SILVER, TOTAL (UG/L AS AG)	5	µg/L	
ATGC-01	8/11/1994		SILVER, TOTAL (UG/L AS AG)	17	µg/L	
ATGC-01	9/22/1994		SILVER, TOTAL (UG/L AS AG)	17	µg/L	
ATGC-01	11/1/1994		SILVER, TOTAL (UG/L AS AG)	17	µg/L	
ATGC-01	12/19/1994		SILVER, TOTAL (UG/L AS AG)	11	µg/L	
ATGC-01	1/24/1995		SILVER, TOTAL (UG/L AS AG)	9	µg/L	
ATGC-01	2/28/1995		SILVER, TOTAL (UG/L AS AG)	5	µg/L	
ATGC-01	4/19/1995		SILVER, TOTAL (UG/L AS AG)	13	µg/L	
ATGC-01	5/23/1995		SILVER, TOTAL (UG/L AS AG)	7	µg/L	
ATGC-01	7/3/1995		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	8/10/1995		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/7/1995		SILVER, TOTAL (UG/L AS AG)	11	µg/L	
ATGC-01	10/16/1995		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/21/1995		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/2/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	2/8/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/15/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/23/1996		SILVER, TOTAL (UG/L AS AG)	4	µg/L	
ATGC-01	6/13/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	8/15/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/30/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/4/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	12/19/1996		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	1/30/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/6/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/17/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	6/4/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/11/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	8/18/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/25/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/10/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	12/17/1997		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/22/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	2/25/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/15/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/20/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	6/18/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/29/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/16/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	10/22/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/23/1998		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/28/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	2/17/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/29/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/7/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/6/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	8/17/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/23/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/4/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	12/17/1999		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/26/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/1/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/19/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	5/24/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	6/22/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	8/16/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	10/2/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/15/2000		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/10/2001		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	4/19/2001		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	7/26/2001		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	9/4/2001		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	11/1/2001		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/17/2002		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	2/21/2002		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	3/20/2002		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	4/24/2002		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	6/4/2002		SILVER, TOTAL (UG/L AS AG)	7	µg/L	
ATGC-01	7/15/2002		SILVER, TOTAL (UG/L AS AG)	6	µg/L	
ATGC-01	8/19/2002		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGC-01	1/30/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	3/5/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	3/26/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	5/6/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	6/18/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	8/7/2003		SILVER, TOTAL (UG/L AS AG)	6	µg/L	
ATGC-01	9/4/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	10/15/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	11/18/2003		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	1/14/2004		SILVER, TOTAL (UG/L AS AG)	3	µg/L	
ATGC-01	2/19/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	4/14/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	5/12/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	6/9/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	8/11/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	9/8/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	10/27/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	12/20/2004		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	1/27/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	2/24/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	4/13/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	5/23/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	6/29/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	7/20/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	9/15/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	10/31/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	12/6/2005		SILVER, TOTAL (UG/L AS AG)		µg/L	ND
ATGC-01	1/25/1990		SULFATE, TOTAL (MG/L AS SO4)	1380	mg/L	
ATGC-01	3/7/1990		SULFATE, TOTAL (MG/L AS SO4)	1440	mg/L	
ATGC-01	4/11/1990		SULFATE, TOTAL (MG/L AS SO4)	424	mg/L	
ATGC-01	5/14/1990		SULFATE, TOTAL (MG/L AS SO4)	537	mg/L	
ATGC-01	6/14/1990		SULFATE, TOTAL (MG/L AS SO4)	1725	mg/L	
ATGC-01	7/24/1990		SULFATE, TOTAL (MG/L AS SO4)	1939	mg/L	
ATGC-01	9/11/1990		SULFATE, TOTAL (MG/L AS SO4)	276	mg/L	
ATGC-01	10/30/1990		SULFATE, TOTAL (MG/L AS SO4)	2427	mg/L	
ATGC-01	12/20/1990		SULFATE, TOTAL (MG/L AS SO4)	1035	mg/L	
ATGC-01	1/30/1991		SULFATE, TOTAL (MG/L AS SO4)	610	mg/L	
ATGC-01	3/7/1991		SULFATE, TOTAL (MG/L AS SO4)	1330	mg/L	
ATGC-01	4/9/1991		SULFATE, TOTAL (MG/L AS SO4)	1020	mg/L	
ATGC-01	5/13/1991		SULFATE, TOTAL (MG/L AS SO4)	930	mg/L	
ATGC-01	6/11/1991		SULFATE, TOTAL (MG/L AS SO4)	2300	mg/L	
ATGC-01	7/18/1991		SULFATE, TOTAL (MG/L AS SO4)	2540	mg/L	
ATGC-01	9/30/1991		SULFATE, TOTAL (MG/L AS SO4)	2500	mg/L	
ATGC-01	11/7/1991		SULFATE, TOTAL (MG/L AS SO4)	2300	mg/L	
ATGC-01	12/9/1991		SULFATE, TOTAL (MG/L AS SO4)	950	mg/L	
ATGC-01	1/21/1992		SULFATE, TOTAL (MG/L AS SO4)	1280	mg/L	
ATGC-01	2/25/1992		SULFATE, TOTAL (MG/L AS SO4)	740	mg/L	
ATGC-01	3/26/1992		SULFATE, TOTAL (MG/L AS SO4)	608	mg/L	
ATGC-01	4/28/1992		SULFATE, TOTAL (MG/L AS SO4)	122	mg/L	
ATGC-01	6/25/1992		SULFATE, TOTAL (MG/L AS SO4)	1365	mg/L	
ATGC-01	8/10/1992		SULFATE, TOTAL (MG/L AS SO4)	2114	mg/L	
ATGC-01	9/2/1992		SULFATE, TOTAL (MG/L AS SO4)	655	mg/L	
ATGC-01	12/1/1992		SULFATE, TOTAL (MG/L AS SO4)	1032	mg/L	
ATGC-01	1/5/1993		SULFATE, TOTAL (MG/L AS SO4)	175	mg/L	
ATGC-01	2/10/1993		SULFATE, TOTAL (MG/L AS SO4)	1530	mg/L	
ATGC-01	3/18/1993		SULFATE, TOTAL (MG/L AS SO4)	1400	mg/L	
ATGC-01	4/22/1993		SULFATE, TOTAL (MG/L AS SO4)	1240	mg/L	
ATGC-01	6/8/1993		SULFATE, TOTAL (MG/L AS SO4)	1790	mg/L	
ATGC-01	7/13/1993		SULFATE, TOTAL (MG/L AS SO4)	2200	mg/L	
ATGC-01	9/16/1993		SULFATE, TOTAL (MG/L AS SO4)	1440	mg/L	
ATGC-01	11/15/1993		SULFATE, TOTAL (MG/L AS SO4)	167	mg/L	
ATGC-01	12/14/1993		SULFATE, TOTAL (MG/L AS SO4)	1762	mg/L	
ATGC-01	1/13/1994		SULFATE, TOTAL (MG/L AS SO4)	770	mg/L	
ATGC-01	2/22/1994		SULFATE, TOTAL (MG/L AS SO4)	700	mg/L	
ATGC-01	4/20/1994		SULFATE, TOTAL (MG/L AS SO4)	1210	mg/L	
ATGC-01	5/17/1994		SULFATE, TOTAL (MG/L AS SO4)	1710	mg/L	
ATGC-01	6/22/1994		SULFATE, TOTAL (MG/L AS SO4)	2300	mg/L	
ATGC-01	8/11/1994		SULFATE, TOTAL (MG/L AS SO4)	3000	mg/L	
ATGC-01	9/22/1994		SULFATE, TOTAL (MG/L AS SO4)	2700	mg/L	
ATGC-01	11/1/1994		SULFATE, TOTAL (MG/L AS SO4)	2600	mg/L	
ATGC-01	12/19/1994		SULFATE, TOTAL (MG/L AS SO4)	1330	mg/L	
ATGC-01	1/24/1995		SULFATE, TOTAL (MG/L AS SO4)	97	mg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-01	2/28/1995		SULFATE, TOTAL (MG/L AS SO4)	450	mg/L	
ATGC-01	4/19/1995		SULFATE, TOTAL (MG/L AS SO4)	1760	mg/L	
ATGC-01	5/23/1995		SULFATE, TOTAL (MG/L AS SO4)	1040	mg/L	
ATGC-01	7/3/1995		SULFATE, TOTAL (MG/L AS SO4)	1080	mg/L	
ATGC-01	8/10/1995		SULFATE, TOTAL (MG/L AS SO4)	480	mg/L	
ATGC-01	9/7/1995		SULFATE, TOTAL (MG/L AS SO4)	195	mg/L	
ATGC-01	1/2/1996		SULFATE, TOTAL (MG/L AS SO4)	3040	mg/L	
ATGC-01	2/8/1996		SULFATE, TOTAL (MG/L AS SO4)	1960	mg/L	
ATGC-01	4/15/1996		SULFATE, TOTAL (MG/L AS SO4)	171	mg/L	
ATGC-01	5/23/1996		SULFATE, TOTAL (MG/L AS SO4)	1510	mg/L	
ATGC-01	6/13/1996		SULFATE, TOTAL (MG/L AS SO4)	1250	mg/L	
ATGC-01	11/4/1996		SULFATE, TOTAL (MG/L AS SO4)	1600	mg/L	
ATGC-01	12/19/1996		SULFATE, TOTAL (MG/L AS SO4)	1130	mg/L	
ATGC-01	1/30/1997		SULFATE, TOTAL (MG/L AS SO4)	823	mg/L	
ATGC-01	3/6/1997		SULFATE, TOTAL (MG/L AS SO4)	662	mg/L	
ATGC-01	4/17/1997		SULFATE, TOTAL (MG/L AS SO4)	872	mg/L	
ATGC-01	6/4/1997		SULFATE, TOTAL (MG/L AS SO4)	586	mg/L	
ATGC-01	7/11/1997		SULFATE, TOTAL (MG/L AS SO4)	2060	mg/L	
ATGC-01	8/18/1997		SULFATE, TOTAL (MG/L AS SO4)	1600	mg/L	
ATGC-01	9/25/1997		SULFATE, TOTAL (MG/L AS SO4)	1490	mg/L	
ATGC-01	11/10/1997		SULFATE, TOTAL (MG/L AS SO4)	1890	mg/L	
ATGC-01	12/17/1997		SULFATE, TOTAL (MG/L AS SO4)	1670	mg/L	
ATGC-01	1/22/1998		SULFATE, TOTAL (MG/L AS SO4)	545	mg/L	
ATGC-01	2/25/1998		SULFATE, TOTAL (MG/L AS SO4)	982	mg/L	
ATGC-01	5/20/1998		SULFATE, TOTAL (MG/L AS SO4)	1200	mg/L	
ATGC-01	6/18/1998		SULFATE, TOTAL (MG/L AS SO4)	1050	mg/L	
ATGC-01	7/29/1998		SULFATE, TOTAL (MG/L AS SO4)	1350	mg/L	
ATGC-01	9/16/1998		SULFATE, TOTAL (MG/L AS SO4)	1250	mg/L	
ATGC-01	10/22/1998		SULFATE, TOTAL (MG/L AS SO4)	1770	mg/L	
ATGC-01	11/23/1998		SULFATE, TOTAL (MG/L AS SO4)	1938	mg/L	
ATGC-01	1/28/1999		SULFATE, TOTAL (MG/L AS SO4)	1064	mg/L	
ATGC-01	2/17/1999		SULFATE, TOTAL (MG/L AS SO4)	1280	mg/L	
ATGC-01	3/29/1999		SULFATE, TOTAL (MG/L AS SO4)	626	mg/L	
ATGC-01	7/6/1999		SULFATE, TOTAL (MG/L AS SO4)	1660	mg/L	
ATGC-01	8/17/1999		SULFATE, TOTAL (MG/L AS SO4)	2005	mg/L	
ATGC-01	9/23/1999		SULFATE, TOTAL (MG/L AS SO4)	2240	mg/L	
ATGC-01	11/4/1999		SULFATE, TOTAL (MG/L AS SO4)	2400	mg/L	
ATGC-01	12/17/1999		SULFATE, TOTAL (MG/L AS SO4)	1110	mg/L	
ATGC-01	1/26/2000		SULFATE, TOTAL (MG/L AS SO4)	2600	mg/L	
ATGC-01	4/19/2000		SULFATE, TOTAL (MG/L AS SO4)	1300	mg/L	
ATGC-01	5/24/2000		SULFATE, TOTAL (MG/L AS SO4)	213	mg/L	
ATGC-01	6/22/2000		SULFATE, TOTAL (MG/L AS SO4)	563	mg/L	
ATGC-01	8/16/2000		SULFATE, TOTAL (MG/L AS SO4)	1690	mg/L	
ATGC-01	11/15/2000		SULFATE, TOTAL (MG/L AS SO4)	1320	mg/L	
ATGC-01	1/10/2001		SULFATE, TOTAL (MG/L AS SO4)	912	mg/L	
ATGC-01	4/19/2001		SULFATE, TOTAL (MG/L AS SO4)	1270	mg/L	
ATGC-01	7/26/2001		SULFATE, TOTAL (MG/L AS SO4)	1490	mg/L	
ATGC-01	9/4/2001		SULFATE, TOTAL (MG/L AS SO4)	1490	mg/L	
ATGC-01	11/1/2001		SULFATE, TOTAL (MG/L AS SO4)	254	mg/L	
ATGC-01	1/17/2002		SULFATE, TOTAL (MG/L AS SO4)	1290	mg/L	
ATGC-01	2/21/2002		SULFATE, TOTAL (MG/L AS SO4)	417	mg/L	
ATGC-01	3/20/2002		SULFATE, TOTAL (MG/L AS SO4)	109	mg/L	
ATGC-01	4/24/2002		SULFATE, TOTAL (MG/L AS SO4)	675	mg/L	
ATGC-01	6/4/2002		SULFATE, TOTAL (MG/L AS SO4)	1050	mg/L	
ATGC-01	7/15/2002		SULFATE, TOTAL (MG/L AS SO4)	2130	mg/L	
ATGC-01	8/19/2002		SULFATE, TOTAL (MG/L AS SO4)	12.4	mg/L	
ATGC-01	5/12/2004		SULFATE, TOTAL (MG/L AS SO4)	876	mg/L	
ATGC-01	6/9/2004		SULFATE, TOTAL (MG/L AS SO4)	803	mg/L	
ATGC-01	8/11/2004		SULFATE, TOTAL (MG/L AS SO4)	957	mg/L	
ATGC-01	9/8/2004		SULFATE, TOTAL (MG/L AS SO4)	1720	mg/L	
ATGC-01	10/27/2004		SULFATE, TOTAL (MG/L AS SO4)	1510	mg/L	
ATGC-01	12/20/2004		SULFATE, TOTAL (MG/L AS SO4)	1120	mg/L	
ATGC-01	1/27/2005		SULFATE, TOTAL (MG/L AS SO4)	856	mg/L	
ATGC-01	2/24/2005		SULFATE, TOTAL (MG/L AS SO4)	1140	mg/L	
ATGC-01	4/13/2005		SULFATE, TOTAL (MG/L AS SO4)	829	mg/L	
ATGC-01	5/23/2005		SULFATE, TOTAL (MG/L AS SO4)	1040	mg/L	
ATGC-01	6/29/2005		SULFATE, TOTAL (MG/L AS SO4)	2460	mg/L	
ATGC-01	7/20/2005		SULFATE, TOTAL (MG/L AS SO4)	1360	mg/L	
ATGC-01	9/15/2005		SULFATE, TOTAL (MG/L AS SO4)	2010	mg/L	
ATGC-01	10/31/2005		SULFATE, TOTAL (MG/L AS SO4)	1990	mg/L	
ATGC-01	12/6/2005		SULFATE, TOTAL (MG/L AS SO4)	300	mg/L	L
ATGC01	1/25/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	80	count/100ml	B
ATGC01	3/7/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	30	count/100ml	B
ATGC01	4/11/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2100	count/100ml	
ATGC01	5/14/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	1300	count/100ml	B
ATGC01	6/14/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	900	count/100ml	B

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC01	7/24/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	K
ATGC01	9/11/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	260	count/100ml	
ATGC01	10/30/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	K
ATGC01	12/20/1990		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	50	count/100ml	B
ATGC01	1/30/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	K
ATGC01	3/7/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	180	count/100ml	B
ATGC01	4/9/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	480	count/100ml	
ATGC01	5/13/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2200	count/100ml	
ATGC01	6/11/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	K
ATGC01	7/18/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	K
ATGC01	9/30/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	140	count/100ml	B
ATGC01	11/7/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	120	count/100ml	B
ATGC01	12/9/1991		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	140	count/100ml	B
ATGC01	1/21/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	20	count/100ml	B
ATGC01	2/25/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	110	count/100ml	B
ATGC01	3/26/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	200	count/100ml	B
ATGC01	4/28/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	20	count/100ml	B
ATGC01	6/25/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2900	count/100ml	
ATGC01	8/10/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	700	count/100ml	B
ATGC01	9/2/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	28000	count/100ml	
ATGC01	10/6/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	150	count/100ml	B
ATGC01	12/1/1992		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	460	count/100ml	
ATGC01	1/5/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2100	count/100ml	
ATGC01	2/10/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	B
ATGC01	3/18/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	19	count/100ml	B
ATGC01	6/8/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	215	count/100ml	
ATGC01	7/13/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	225	count/100ml	
ATGC01	11/15/1993		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2400	count/100ml	
ATGC01	1/13/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	375	count/100ml	
ATGC01	2/22/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	210	count/100ml	
ATGC01	4/20/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	112	count/100ml	
ATGC01	5/17/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	280	count/100ml	
ATGC01	6/22/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	152	count/100ml	B
ATGC01	8/11/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	171	count/100ml	B
ATGC01	9/22/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	270	count/100ml	
ATGC01	11/1/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	54	count/100ml	
ATGC01	12/19/1994		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	60	count/100ml	
ATGC01	1/24/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	26	count/100ml	B
ATGC01	2/28/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	690	count/100ml	
ATGC01	4/19/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	60	count/100ml	
ATGC01	5/23/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	100	count/100ml	B
ATGC01	7/3/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	152	count/100ml	B
ATGC01	8/10/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	13600	count/100ml	B
ATGC01	9/7/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	168	count/100ml	B
ATGC01	10/16/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	102	count/100ml	
ATGC01	11/21/1995		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	28	count/100ml	B
ATGC01	1/2/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	42	count/100ml	
ATGC01	2/8/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	76	count/100ml	
ATGC01	4/15/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	52	count/100ml	
ATGC01	5/23/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	62	count/100ml	
ATGC01	6/13/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	180	count/100ml	B
ATGC01	8/15/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	1630	count/100ml	B
ATGC01	9/30/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	14	count/100ml	B
ATGC01	11/4/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	11	count/100ml	B
ATGC01	12/19/1996		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	16	count/100ml	B
ATGC01	1/30/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	15	count/100ml	B
ATGC01	3/6/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	174	count/100ml	B
ATGC01	4/17/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	34	count/100ml	B
ATGC01	6/4/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	145	count/100ml	
ATGC01	7/11/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	840	count/100ml	B
ATGC01	8/18/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	710	count/100ml	B
ATGC01	9/25/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	51	count/100ml	
ATGC01	11/10/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	22	count/100ml	B
ATGC01	12/17/1997		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	8	count/100ml	B
ATGC01	1/22/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	10	count/100ml	B
ATGC01	2/25/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	18	count/100ml	B
ATGC01	4/15/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	156	count/100ml	B
ATGC01	5/20/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	74	count/100ml	
ATGC01	6/18/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	460	count/100ml	
ATGC01	7/29/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	780	count/100ml	
ATGC01	9/16/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	661	count/100ml	B
ATGC01	10/22/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	14	count/100ml	B
ATGC01	11/23/1998		FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	2	count/100ml	B
ATGC-02	7/7/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2071		C
ATGC-02	7/7/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2071	mg/L	C
ATGC-02	9/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2181		C

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-02	9/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2181	mg/L	C
ATGC-02	12/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1545		C
ATGC-02	12/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1545	mg/L	C
ATGC-02	7/7/1993		MANGANESE, DISSOLVED (UG/L AS MN)	530		
ATGC-02	9/13/1993		MANGANESE, DISSOLVED (UG/L AS MN)	150		
ATGC-02	12/15/1993		MANGANESE, DISSOLVED (UG/L AS MN)	2100		
ATGC-02	7/7/1993		MANGANESE, TOTAL (UG/L AS MN)	560		
ATGC-02	9/13/1993		MANGANESE, TOTAL (UG/L AS MN)	160		
ATGC-02	12/15/1993		MANGANESE, TOTAL (UG/L AS MN)	2100		
ATGC-02	7/7/1993		SILVER, DISSOLVED (UG/L AS AG)	7	µg/L	
ATGC-02	9/13/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-02	12/15/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGC-02	7/7/1993		SILVER, TOTAL (UG/L AS AG)	6	µg/L	
ATGC-02	9/13/1993		SILVER, TOTAL (UG/L AS AG)	13	µg/L	
ATGC-02	7/7/1993		SULFATE, TOTAL (MG/L AS SO4)	2070	mg/L	
ATGC-02	9/13/1993		SULFATE, TOTAL (MG/L AS SO4)	1710	mg/L	
ATGC-02	12/15/1993		SULFATE, TOTAL (MG/L AS SO4)	1842	mg/L	
ATGC-11	7/16/2008		Chloride, Total	9.71	mg/l	
ATGC-11	8/8/2008		Chloride, Total	12.1	mg/l	
ATGC-11	9/22/2008		Chloride, Total	11.2	mg/l	
ATGC-11	7/16/2008		Copper, Total	6.28	ug/l	J
ATGC-11	8/8/2008		Copper, Total	5.73	ug/l	J
ATGC-11	9/22/2008		Copper, Total	6.09	ug/l	J
ATGC-11	7/16/2008		Hardness, Ca + Mg, Total	2030000	ug/l	
ATGC-11	8/8/2008		Hardness, Ca + Mg, Total	1440000	ug/l	
ATGC-11	9/22/2008		Hardness, Ca + Mg, Total	2080000	ug/l	
ATGC-11	7/16/2008		Manganese, Total	69.2	ug/l	
ATGC-11	8/8/2008		Manganese, Total	189	ug/l	
ATGC-11	9/22/2008		Manganese, Total	87.5	ug/l	
ATGC-11	7/16/2008		Nickel, Total	2.77	ug/l	J
ATGC-11	8/8/2008		Nickel, Total	3.09	ug/l	J
ATGC-11	9/22/2008		Nickel, Total	3.17	ug/l	J
ATGC-11	7/16/2008		Silver, Total	ND	ug/l	J7,ND
ATGC-11	8/8/2008		Silver, Total	ND	ug/l	ND
ATGC-11	9/22/2008		Silver, Total	3.83	ug/l	
ATGC-11	7/16/2008		Sulfate, Total	150	mg/l	L
ATGC-11	8/8/2008		Sulfate, Total	200	mg/l	L
ATGC-11	9/22/2008		Sulfate, Total	2110	mg/l	J4
ATGC-11	7/16/2008		Zinc, Total	2.62	ug/l	J
ATGC-11	8/8/2008		Zinc, Total	5.04	ug/l	J
ATGC-11	9/22/2008		Zinc, Total	2.06	ug/l	J
ATGC-11	6/7/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2232		C
ATGC-11	9/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2307		C
ATGC-11	12/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	2054		C
ATGC-11	6/7/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1800		
ATGC-11	9/13/1993		MANGANESE, DISSOLVED (UG/L AS MN)	860		
ATGC-11	12/15/1993		MANGANESE, DISSOLVED (UG/L AS MN)	2200		
ATGC-11	6/7/1993		MANGANESE, TOTAL (UG/L AS MN)	1800		
ATGC-11	9/13/1993		MANGANESE, TOTAL (UG/L AS MN)	880		
ATGC-11	12/15/1993		MANGANESE, TOTAL (UG/L AS MN)	2300		
ATGC-11	6/7/1993		SULFATE, TOTAL (MG/L AS SO4)	2160	mg/L	
ATGC-11	9/13/1993		SULFATE, TOTAL (MG/L AS SO4)	27	mg/L	
ATGC-11	12/15/1993		SULFATE, TOTAL (MG/L AS SO4)	2542	mg/L	
ATGC-13	7/17/2008		Chloride, Total	9.76	mg/l	
ATGC-13	8/8/2008		Chloride, Total	10.4	mg/l	
ATGC-13	9/22/2008		Chloride, Total	11.7	mg/l	
ATGC-13	7/17/2008		Copper, Total	5.63	ug/l	J
ATGC-13	8/8/2008		Copper, Total	5.7	ug/l	J
ATGC-13	9/22/2008		Copper, Total	5.91	ug/l	J
ATGC-13	7/17/2008		Hardness, Ca + Mg, Total	1990000	ug/l	
ATGC-13	8/8/2008		Hardness, Ca + Mg, Total	1640000	ug/l	
ATGC-13	9/22/2008		Hardness, Ca + Mg, Total	1940000	ug/l	
ATGC-13	7/17/2008		Manganese, Total	212	ug/l	
ATGC-13	8/8/2008		Manganese, Total	292	ug/l	
ATGC-13	9/22/2008		Manganese, Total	62.5	ug/l	
ATGC-13	7/17/2008		Nickel, Total	3.12	ug/l	J
ATGC-13	8/8/2008		Nickel, Total	3.94	ug/l	J
ATGC-13	9/22/2008		Nickel, Total	2.2	ug/l	J
ATGC-13	7/17/2008		Silver, Total	ND	ug/l	J7,ND
ATGC-13	8/8/2008		Silver, Total	ND	ug/l	ND
ATGC-13	9/22/2008		Silver, Total	3.22	ug/l	
ATGC-13	7/17/2008		Sulfate, Total	150	mg/l	L
ATGC-13	8/8/2008		Sulfate, Total	200	mg/l	L
ATGC-13	9/22/2008		Sulfate, Total	1730	mg/l	J4
ATGC-13	7/17/2008		Zinc, Total	3.74	ug/l	J
ATGC-13	8/8/2008		Zinc, Total	4.38	ug/l	J

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGC-13	9/22/2008		Zinc, Total	1.8	ug/l	J
ATGC-15	7/16/2008		Chloride, Total	9.83	mg/l	
ATGC-15	8/8/2008		Chloride, Total	11	mg/l	
ATGC-15	9/22/2008		Chloride, Total	11.4	mg/l	
ATGC-15	7/16/2008		Copper, Total	5.8	ug/l	J
ATGC-15	8/8/2008		Copper, Total	6.44	ug/l	J
ATGC-15	9/22/2008		Copper, Total	6.16	ug/l	J
ATGC-15	7/16/2008		Hardness, Ca + Mg, Total	1860000	ug/l	
ATGC-15	8/8/2008		Hardness, Ca + Mg, Total	1580000	ug/l	
ATGC-15	9/22/2008		Hardness, Ca + Mg, Total	1890000	ug/l	
ATGC-15	7/16/2008		Manganese, Total	275	ug/l	
ATGC-15	8/8/2008		Manganese, Total	202	ug/l	
ATGC-15	9/22/2008		Manganese, Total	77.4	ug/l	
ATGC-15	7/16/2008		Nickel, Total	2.31	ug/l	J
ATGC-15	8/8/2008		Nickel, Total	2.52	ug/l	J
ATGC-15	9/22/2008		Nickel, Total	1.18	ug/l	J
ATGC-15	7/16/2008		Silver, Total	ND	ug/l	J7,ND
ATGC-15	8/8/2008		Silver, Total	ND	ug/l	ND
ATGC-15	9/22/2008		Silver, Total	3.34	ug/l	
ATGC-15	7/16/2008		Sulfate, Total	150	mg/l	L
ATGC-15	8/8/2008		Sulfate, Total	200	mg/l	L
ATGC-15	9/22/2008		Sulfate, Total	1950	mg/l	J4
ATGC-15	7/16/2008		Zinc, Total	2.63	ug/l	J
ATGC-15	8/8/2008		Zinc, Total	3.25	ug/l	J
ATGC-15	9/22/2008		Zinc, Total	1.31	ug/l	J
ATGH-09	7/16/2008		Chloride, Total	23.3	mg/l	
ATGH-09	8/8/2008		Chloride, Total	24.1	mg/l	
ATGH-09	9/22/2008		Chloride, Total	18.5	mg/l	
ATGH-09	7/16/2008		Copper, Total	5.74	ug/l	J
ATGH-09	8/8/2008		Copper, Total	6.55	ug/l	J
ATGH-09	9/22/2008		Copper, Total	6.3	ug/l	J
ATGH-09	7/16/2008		Hardness, Ca + Mg, Total	823000	ug/l	
ATGH-09	8/8/2008		Hardness, Ca + Mg, Total	810000	ug/l	L
ATGH-09	9/22/2008		Hardness, Ca + Mg, Total	1250000	ug/l	
ATGH-09	7/16/2008		Manganese, Total	304	ug/l	
ATGH-09	8/8/2008		Manganese, Total	702	ug/l	
ATGH-09	9/22/2008		Manganese, Total	162	ug/l	
ATGH-09	7/16/2008		Nickel, Total	1.6	ug/l	J
ATGH-09	8/8/2008		Nickel, Total	49.9	ug/l	
ATGH-09	9/22/2008		Nickel, Total	2.52	ug/l	J
ATGH-09	7/16/2008		Silver, Total	ND	ug/l	J7,ND
ATGH-09	8/8/2008		Silver, Total	ND	ug/l	ND
ATGH-09	9/22/2008		Silver, Total	2.01	ug/l	J
ATGH-09	7/16/2008		Sulfate, Total	150	mg/l	L
ATGH-09	8/8/2008		Sulfate, Total	200	mg/l	L
ATGH-09	9/22/2008		Sulfate, Total	1470	mg/l	J3,J4
ATGH-09	7/16/2008		Zinc, Total	6.21	ug/l	J
ATGH-09	8/8/2008		Zinc, Total	27.9	ug/l	
ATGH-09	9/22/2008		Zinc, Total	1.01	ug/l	J
ATGH-09	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	849		C
ATGH-09	9/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1117		C
ATGH-09	12/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	603		C
ATGH-09	6/17/1993		MANGANESE, DISSOLVED (UG/L AS MN)	550		
ATGH-09	9/13/1993		MANGANESE, DISSOLVED (UG/L AS MN)	250		
ATGH-09	12/15/1993		MANGANESE, DISSOLVED (UG/L AS MN)	1500		
ATGH-09	6/17/1993		MANGANESE, TOTAL (UG/L AS MN)	710		
ATGH-09	9/13/1993		MANGANESE, TOTAL (UG/L AS MN)	340		
ATGH-09	12/15/1993		MANGANESE, TOTAL (UG/L AS MN)	1500		
ATGH-09	6/17/1993		SULFATE, TOTAL (MG/L AS SO4)	1310	mg/L	
ATGH-09	9/13/1993		SULFATE, TOTAL (MG/L AS SO4)	3220	mg/L	
ATGH-09	12/15/1993		SULFATE, TOTAL (MG/L AS SO4)	953	mg/L	
ATGH-10	7/16/2008		Chloride, Total	27	mg/l	
ATGH-10	8/8/2008		Chloride, Total	30.6	mg/l	
ATGH-10	9/22/2008		Chloride, Total	15.9	mg/l	
ATGH-10	7/16/2008		Copper, Total	7	ug/l	J
ATGH-10	8/8/2008		Copper, Total	9.49	ug/l	J
ATGH-10	9/22/2008		Copper, Total	6.58	ug/l	J
ATGH-10	7/16/2008		Hardness, Ca + Mg, Total	1510000	ug/l	
ATGH-10	8/8/2008		Hardness, Ca + Mg, Total	1500000	ug/l	
ATGH-10	9/22/2008		Hardness, Ca + Mg, Total	1620000	ug/l	
ATGH-10	7/16/2008		Manganese, Total	380	ug/l	
ATGH-10	8/8/2008		Manganese, Total	2660	ug/l	
ATGH-10	9/22/2008		Manganese, Total	129	ug/l	
ATGH-10	7/16/2008		Nickel, Total	2.26	ug/l	J
ATGH-10	8/8/2008		Nickel, Total	243	ug/l	
ATGH-10	9/22/2008		Nickel, Total	2.64	ug/l	J

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGH-10	7/16/2008		Silver, Total	ND	ug/l	J7,ND
ATGH-10	8/8/2008		Silver, Total	ND	ug/l	ND
ATGH-10	9/22/2008		Silver, Total	2.87	ug/l	J
ATGH-10	7/16/2008		Sulfate, Total	150	mg/l	L
ATGH-10	8/8/2008		Sulfate, Total	200	mg/l	L
ATGH-10	9/22/2008		Sulfate, Total	2410	mg/l	J4
ATGH-10	7/16/2008		Zinc, Total	4.25	ug/l	J
ATGH-10	8/8/2008		Zinc, Total	402	ug/l	
ATGH-10	9/22/2008		Zinc, Total	1.15	ug/l	J
ATGH-10	7/8/1993		HARDNESS, TOTAL (MG/L AS CACO3)	571	mg/L	C
ATGH-10	9/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	1711	mg/L	C
ATGH-10	12/15/1993		HARDNESS, TOTAL (MG/L AS CACO3)	516	mg/L	C
ATGH-10	7/8/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGH-10	9/13/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGH-10	12/15/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGH-10	7/8/1993		SILVER, TOTAL (UG/L AS AG)	4	µg/L	
ATGH-10	9/13/1993		SILVER, TOTAL (UG/L AS AG)	14	µg/L	
ATGH-10	12/15/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGH-10	7/8/1993		SULFATE, TOTAL (MG/L AS SO4)	770	mg/L	
ATGH-10	9/13/1993		SULFATE, TOTAL (MG/L AS SO4)	260	mg/L	
ATGH-10	12/15/1993		SULFATE, TOTAL (MG/L AS SO4)	641	mg/L	
ATGM-01	7/16/2008		Chloride, Total	36.4	mg/l	
ATGM-01	8/8/2008		Chloride, Total	7.44	mg/l	
ATGM-01	9/22/2008		Chloride, Total	22.1	mg/l	
ATGM-01	7/16/2008		Copper, Dissolved	2.6	ug/l	J
ATGM-01	8/8/2008		Copper, Dissolved	3.23	ug/l	J
ATGM-01	9/22/2008		Copper, Dissolved	3.74	ug/l	J
ATGM-01	7/16/2008		Copper, Total	2.85	ug/l	J
ATGM-01	8/8/2008		Copper, Total	6.51	ug/l	J
ATGM-01	9/22/2008		Copper, Total	3.65	ug/l	J
ATGM-01	7/16/2008		Hardness, Ca + Mg, Dissolved	172000	ug/l	
ATGM-01	8/8/2008		Hardness, Ca + Mg, Dissolved	96200	ug/l	
ATGM-01	9/22/2008		Hardness, Ca + Mg, Dissolved	212000	ug/l	
ATGM-01	7/16/2008		Hardness, Ca + Mg, Total	169000	ug/l	
ATGM-01	8/8/2008		Hardness, Ca + Mg, Total	100000	ug/l	
ATGM-01	9/22/2008		Hardness, Ca + Mg, Total	207000	ug/l	
ATGM-01	7/16/2008		Manganese, Dissolved	762	ug/l	
ATGM-01	8/8/2008		Manganese, Dissolved	555	ug/l	
ATGM-01	9/22/2008		Manganese, Dissolved	466	ug/l	
ATGM-01	7/16/2008		Manganese, Total	750	ug/l	
ATGM-01	8/8/2008		Manganese, Total	253	ug/l	
ATGM-01	9/22/2008		Manganese, Total	412	ug/l	
ATGM-01	7/16/2008		Nickel, Dissolved	3.8	ug/l	J
ATGM-01	8/8/2008		Nickel, Dissolved	5.49	ug/l	
ATGM-01	9/22/2008		Nickel, Dissolved	3.44	ug/l	J
ATGM-01	7/16/2008		Nickel, Total	3.78	ug/l	J
ATGM-01	8/8/2008		Nickel, Total	4.1	ug/l	J
ATGM-01	9/22/2008		Nickel, Total	3.18	ug/l	J
ATGM-01	7/16/2008		Silver, Dissolved	ND	ug/l	J7,ND
ATGM-01	8/8/2008		Silver, Dissolved	ND	ug/l	ND
ATGM-01	9/22/2008		Silver, Dissolved	ND	ug/l	ND
ATGM-01	7/16/2008		Silver, Total	ND	ug/l	J7,ND
ATGM-01	8/8/2008		Silver, Total	ND	ug/l	ND
ATGM-01	9/22/2008		Silver, Total	ND	ug/l	ND
ATGM-01	7/16/2008		Sulfate, Total	150	mg/l	L
ATGM-01	8/8/2008		Sulfate, Total	74.9	mg/l	
ATGM-01	9/22/2008		Sulfate, Total	148	mg/l	
ATGM-01	7/16/2008		Zinc, Dissolved	10.4	ug/l	J
ATGM-01	8/8/2008		Zinc, Dissolved	10.4	ug/l	J
ATGM-01	9/22/2008		Zinc, Dissolved	2.58	ug/l	J
ATGM-01	7/16/2008		Zinc, Total	6.2	ug/l	J
ATGM-01	8/8/2008		Zinc, Total	13.3	ug/l	J
ATGM-01	9/22/2008		Zinc, Total	1.87	ug/l	J
ATGM01	6/17/1993		COPPER, DISSOLVED (UG/L AS CU)	190	µg/L	
ATGM01	9/28/1993		COPPER, DISSOLVED (UG/L AS CU)	160	µg/L	
ATGM01	12/13/1993		COPPER, DISSOLVED (UG/L AS CU)	46	µg/L	
ATGM01	6/17/1993		COPPER, TOTAL (UG/L AS CU)	190	µg/L	
ATGM01	9/28/1993		COPPER, TOTAL (UG/L AS CU)	160	µg/L	
ATGM01	12/13/1993		COPPER, TOTAL (UG/L AS CU)	47	µg/L	
ATGM01	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	626	mg/L	C
ATGM01	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	626	mg/L	C
ATGM01	9/28/1993		HARDNESS, TOTAL (MG/L AS CACO3)	489	mg/L	C
ATGM01	9/28/1993		HARDNESS, TOTAL (MG/L AS CACO3)	489	mg/L	C
ATGM01	12/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	564	mg/L	C
ATGM01	12/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	564	mg/L	C
ATGM01	6/17/1993		NICKEL, DISSOLVED (UG/L AS NI)	440	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
ATGM01	9/28/1993		NICKEL, DISSOLVED (UG/L AS NI)	390	µg/L	
ATGM01	12/13/1993		NICKEL, DISSOLVED (UG/L AS NI)	410	µg/L	
ATGM01	6/17/1993		NICKEL, TOTAL (UG/L AS NI)	460	µg/L	
ATGM01	9/28/1993		NICKEL, TOTAL (UG/L AS NI)	400	µg/L	
ATGM01	12/13/1993		NICKEL, TOTAL (UG/L AS NI)	410	µg/L	
ATGM01	6/17/1993		PH (STANDARD UNITS)	2.34	Standard Units	
ATGM01	9/28/1993		PH (STANDARD UNITS)	2.5	Standard Units	
ATGM01	12/13/1993		PH (STANDARD UNITS)	3.08	Standard Units	
ATGM-01	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	626		C
ATGM-01	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	626	mg/L	C
ATGM-01	6/17/1993		HARDNESS, TOTAL (MG/L AS CACO3)	626	mg/L	C
ATGM-01	9/28/1993		HARDNESS, TOTAL (MG/L AS CACO3)	489		C
ATGM-01	9/28/1993		HARDNESS, TOTAL (MG/L AS CACO3)	489	mg/L	C
ATGM-01	9/28/1993		HARDNESS, TOTAL (MG/L AS CACO3)	489	mg/L	
ATGM-01	12/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	564		C
ATGM-01	12/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	564	mg/L	C
ATGM-01	12/13/1993		HARDNESS, TOTAL (MG/L AS CACO3)	564	mg/L	
ATGM-01	6/17/1993		MANGANESE, DISSOLVED (UG/L AS MN)	12000		
ATGM-01	9/28/1993		MANGANESE, DISSOLVED (UG/L AS MN)	7500		
ATGM-01	12/13/1993		MANGANESE, DISSOLVED (UG/L AS MN)	9600		
ATGM-01	6/17/1993		MANGANESE, TOTAL (UG/L AS MN)	12000		
ATGM-01	9/28/1993		MANGANESE, TOTAL (UG/L AS MN)	7700		
ATGM-01	12/13/1993		MANGANESE, TOTAL (UG/L AS MN)	9600		
ATGM-01	6/17/1993		SILVER, DISSOLVED (UG/L AS AG)	8	µg/L	
ATGM-01	9/28/1993		SILVER, DISSOLVED (UG/L AS AG)	3	µg/L	K
ATGM-01	12/13/1993		SILVER, DISSOLVED (UG/L AS AG)	11	µg/L	
ATGM-01	6/17/1993		SILVER, TOTAL (UG/L AS AG)	9	µg/L	
ATGM-01	9/28/1993		SILVER, TOTAL (UG/L AS AG)	3	µg/L	K
ATGM-01	12/13/1993		SILVER, TOTAL (UG/L AS AG)	10	µg/L	
ATGM-01	6/17/1993		SULFATE, TOTAL (MG/L AS SO4)	1580	mg/L	
ATGM-01	9/28/1993		SULFATE, TOTAL (MG/L AS SO4)	1045	mg/L	
ATGM-01	12/13/1993		SULFATE, TOTAL (MG/L AS SO4)	1034	mg/L	
ATGM-01	6/17/1993		ZINC, DISSOLVED (UG/L AS ZN)	7400	µg/L	
ATGM-01	9/28/1993		ZINC, DISSOLVED (UG/L AS ZN)	7300	µg/L	
ATGM-01	12/13/1993		ZINC, DISSOLVED (UG/L AS ZN)	7200	µg/L	
ATGM-01	6/17/1993		ZINC, Total (UG/L AS ZN)	7400	µg/L	
ATGM-01	9/28/1993		ZINC, Total (UG/L AS ZN)	7000	µg/L	
ATGM-01	12/13/1993		ZINC, Total (UG/L AS ZN)	7200	µg/L	
RAI-1	04/03/2002	4	Chlorophyll (a+b+c)	350	ug/l	
RAI-1	06/10/2002	460	Chlorophyll (a+b+c)	460	ug/l	
RAI-1	07/15/2002	250	Chlorophyll (a+b+c)	250	ug/l	
RAI-1	08/08/2002	230	Chlorophyll (a+b+c)	230	ug/l	
RAI-1	10/08/2002	150	Chlorophyll (a+b+c)	150	ug/l	
RAI-1	04/03/2002	4	Chlorophyll a, corrected for pheophytin	35.3	ug/l	
RAI-1	06/10/2002	460	Chlorophyll a, corrected for pheophytin	57.3	ug/l	
RAI-1	07/15/2002	250	Chlorophyll a, corrected for pheophytin	178	ug/l	
RAI-1	08/08/2002	230	Chlorophyll a, corrected for pheophytin	63.9	ug/l	
RAI-1	10/08/2002	150	Chlorophyll a, corrected for pheophytin	139	ug/l	
RAI-1	04/03/2002	4	Chlorophyll a, uncorrected for pheophytin	37	ug/l	
RAI-1	06/10/2002	460	Chlorophyll a, uncorrected for pheophytin	57.4	ug/l	
RAI-1	07/15/2002	250	Chlorophyll a, uncorrected for pheophytin	176	ug/l	
RAI-1	08/08/2002	230	Chlorophyll a, uncorrected for pheophytin	68.3	ug/l	
RAI-1	10/08/2002	150	Chlorophyll a, uncorrected for pheophytin	144	ug/l	
RAI-1	7/13/1993	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	46.73	µg/L	
RAI-1	4/24/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	33.82	µg/L	
RAI-1	6/8/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	60.08	µg/L	
RAI-1	7/6/1995	6	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	45.924	µg/L	
RAI-1	8/10/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	73.234	µg/L	
RAI-1	10/10/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	40.05	µg/L	
RAI-1	7/13/1993	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	44.71	µg/L	
RAI-1	4/24/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	27.54	µg/L	
RAI-1	6/8/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	52.97	µg/L	
RAI-1	7/6/1995	6	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	48.937	µg/L	
RAI-1	8/10/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	76.282	µg/L	
RAI-1	10/10/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	42.894	µg/L	
RAI-1	04/03/2002	4	Chlorophyll-b	2.62	ug/l	
RAI-1	06/10/2002	460	Chlorophyll-b			
RAI-1	07/15/2002	250	Chlorophyll-b			
RAI-1	08/08/2002	230	Chlorophyll-b			
RAI-1	10/08/2002	150	Chlorophyll-b			
RAI-1	04/03/2002	4	Chlorophyll-c	7.45	ug/l	
RAI-1	06/10/2002	460	Chlorophyll-c	1.7	ug/l	
RAI-1	07/15/2002	250	Chlorophyll-c	7.75	ug/l	
RAI-1	08/08/2002	230	Chlorophyll-c	3.03	ug/l	
RAI-1	10/08/2002	150	Chlorophyll-c	13.6	ug/l	
RAI-1	7/13/1993	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	1.72	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-1	4/24/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	21.71	µg/L	
RAI-1	6/8/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	1.85	µg/L	
RAI-1	7/6/1995	6	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	4.1668	µg/L	
RAI-1	8/10/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	2.1932	µg/L	
RAI-1	10/10/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	4.1631	µg/L	
RAI-1	7/13/1993	23	COD, .025N K2CR2O7 MG/L	21	mg/L	
RAI-1	7/13/1993	1	COD, .025N K2CR2O7 MG/L	21	mg/L	
RAI-1	7/13/1993	1	DEPTH OF POND OR RESERVOIR IN FEET	25	Feet	
RAI-1	7/13/1993	23	DEPTH OF POND OR RESERVOIR IN FEET	25	Feet	
RAI-1	4/24/1995	25	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	4/24/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	4/24/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	6/8/1995	25	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	6/8/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	6/8/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	7/6/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	7/6/1995	25	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	7/6/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	27	Feet	
RAI-1	8/9/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	22	Feet	
RAI-1	8/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	26	Feet	
RAI-1	8/10/1995	24	DEPTH OF POND OR RESERVOIR IN FEET	26	Feet	
RAI-1	8/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	26	Feet	
RAI-1	10/10/1995	23	DEPTH OF POND OR RESERVOIR IN FEET	25	Feet	
RAI-1	10/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	25	Feet	
RAI-1	10/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	25	Feet	
RAI-1	04/03/2002	1	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	04/03/2002	1	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	06/10/2002	9	DEPTH OF POND OR RESERVOIR IN FEET	26	ft	
RAI-1	06/10/2002	9	DEPTH OF POND OR RESERVOIR IN FEET	26	ft	
RAI-1	07/15/2002	300	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	07/15/2002	300	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	08/08/2002	406	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	08/08/2002	406	DEPTH OF POND OR RESERVOIR IN FEET	24	ft	
RAI-1	10/08/2002	500	DEPTH OF POND OR RESERVOIR IN FEET	21	ft	
RAI-1	10/08/2002	500	DEPTH OF POND OR RESERVOIR IN FEET	21	ft	
RAI-1	04/03/2002	4	Depth of Sample	4	ft	
RAI-1	04/03/2002	1	Depth of Sample	1	ft	
RAI-1	04/03/2002	1	Depth of Sample	1	ft	
RAI-1	06/10/2002	9	Depth of Sample	1	ft	
RAI-1	06/10/2002	460	Depth of Sample	4	ft	
RAI-1	06/10/2002	9	Depth of Sample	24	ft	
RAI-1	07/15/2002	250	Depth of Sample	2	ft	
RAI-1	07/15/2002	300	Depth of Sample	22	ft	
RAI-1	07/15/2002	300	Depth of Sample	1	ft	
RAI-1	08/08/2002	500	Depth of Sample	24	ft	
RAI-1	08/08/2002	406	Depth of Sample	22	ft	
RAI-1	08/08/2002	406	Depth of Sample	1	ft	
RAI-1	08/08/2002	8	Depth of Sample	24	ft	
RAI-1	08/08/2002	230	Depth of Sample	3	ft	
RAI-1	10/08/2002	500	Depth of Sample	19	ft	
RAI-1	10/08/2002	500	Depth of Sample	1	ft	
RAI-1	10/08/2002	150	Depth of Sample	3	ft	
RAI-1	7/13/1993	2	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	10.5	mg/L	
RAI-1	7/13/1993	14	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	22	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	6	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.2	mg/L	
RAI-1	7/13/1993	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.3	mg/L	
RAI-1	7/13/1993	8	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.9	mg/L	
RAI-1	7/13/1993	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.8	mg/L	
RAI-1	7/13/1993	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1.1	mg/L	
RAI-1	7/13/1993	20	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	23	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	10.8	mg/L	
RAI-1	7/13/1993	24	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	10	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2.5	mg/L	
RAI-1	7/13/1993	12	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	16	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	18	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	4	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.7	mg/L	
RAI-1	7/13/1993	21	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	25	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	7/13/1993	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	10.7	mg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-1	7/13/1993	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	10	mg/L	
RAI-1	7/13/1993	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.2	mg/L	
RAI-1	4/24/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.1	mg/L	
RAI-1	4/24/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.1	mg/L	
RAI-1	4/24/1995	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.5	mg/L	
RAI-1	4/24/1995	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.6	mg/L	
RAI-1	4/24/1995	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.5	mg/L	
RAI-1	4/24/1995	23	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.2	mg/L	
RAI-1	4/24/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.9	mg/L	
RAI-1	4/24/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.7	mg/L	
RAI-1	4/24/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.2	mg/L	
RAI-1	4/24/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.8	mg/L	
RAI-1	4/24/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.7	mg/L	
RAI-1	4/24/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.1	mg/L	
RAI-1	4/24/1995	21	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.4	mg/L	
RAI-1	4/24/1995	25	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.4	mg/L	
RAI-1	5/8/1995	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	5/8/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.5	mg/L	
RAI-1	5/8/1995	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0	mg/L	
RAI-1	5/8/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.6	mg/L	
RAI-1	5/8/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.7	mg/L	
RAI-1	5/8/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2.2	mg/L	
RAI-1	5/8/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.7	mg/L	
RAI-1	5/8/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.9	mg/L	
RAI-1	5/8/1995	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	5/8/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.7	mg/L	
RAI-1	5/8/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.9	mg/L	
RAI-1	7/6/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.7	mg/L	
RAI-1	7/6/1995	21	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5	mg/L	
RAI-1	7/6/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2	mg/L	
RAI-1	7/6/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.9	mg/L	
RAI-1	7/6/1995	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	23	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	25	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5	mg/L	
RAI-1	7/6/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.8	mg/L	
RAI-1	7/6/1995	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	7/6/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.3	mg/L	
RAI-1	7/6/1995	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.3	mg/L	
RAI-1	8/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-1	8/10/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.5	mg/L	
RAI-1	8/10/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6	mg/L	
RAI-1	8/10/1995	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	23	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.2	mg/L	
RAI-1	8/10/1995	25	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	8/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.6	mg/L	
RAI-1	8/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.1	mg/L	
RAI-1	8/10/1995	21	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-1	10/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.4	mg/L	
RAI-1	10/10/1995	15	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.2	mg/L	
RAI-1	10/10/1995	21	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2	mg/L	
RAI-1	10/10/1995	23	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1	mg/L	
RAI-1	10/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.9	mg/L	
RAI-1	10/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.9	mg/L	
RAI-1	10/10/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.7	mg/L	
RAI-1	10/10/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.2	mg/L	
RAI-1	10/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.5	mg/L	
RAI-1	10/10/1995	17	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4	mg/L	
RAI-1	10/10/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6	mg/L	
RAI-1	10/10/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.4	mg/L	
RAI-1	10/10/1995	19	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2.9	mg/L	
RAI-1	4/24/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.007	mg/L	
RAI-1	4/24/1995	25	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.006	mg/L	
RAI-1	6/8/1995	25	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.15	mg/L	
RAI-1	6/8/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.017	mg/L	
RAI-1	7/6/1995	25	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.516	mg/L	
RAI-1	7/6/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.053	mg/L	
RAI-1	8/9/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.017	mg/L	
RAI-1	8/10/1995	24	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.858	mg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-1	8/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.013	mg/L	
RAI-1	10/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.024	mg/L	
RAI-1	10/10/1995	23	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.034	mg/L	
RAI-1	04/03/2002	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.018	mg/l	
RAI-1	04/03/2002	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.02	mg/l	
RAI-1	06/10/2002	9	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.014	mg/l	
RAI-1	06/10/2002	9	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.418	mg/l	
RAI-1	07/15/2002	300	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.979	mg/l	
RAI-1	07/15/2002	300	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.031	mg/l	
RAI-1	08/08/2002	406	PHOSPHORUS, DISSOLVED (MG/L AS P)	1.34	mg/l	
RAI-1	08/08/2002	406	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.125	mg/l	
RAI-1	10/08/2002	500	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.112	mg/l	
RAI-1	10/08/2002	500	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.132	mg/l	
RAI-1	7/13/1993	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.014	mg/L	
RAI-1	7/13/1993	23	PHOSPHORUS, TOTAL (MG/L AS P)	0.691	mg/L	
RAI-1	4/24/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.048	mg/L	
RAI-1	4/24/1995	25	PHOSPHORUS, TOTAL (MG/L AS P)	0.045	mg/L	
RAI-1	6/8/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.075	mg/L	
RAI-1	6/8/1995	25	PHOSPHORUS, TOTAL (MG/L AS P)	0.171	mg/L	
RAI-1	7/6/1995	25	PHOSPHORUS, TOTAL (MG/L AS P)	0.631	mg/L	
RAI-1	7/6/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.0829999	mg/L	
RAI-1	8/9/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.059	mg/L	
RAI-1	8/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.107	mg/L	
RAI-1	8/10/1995	24	PHOSPHORUS, TOTAL (MG/L AS P)	0.915	mg/L	
RAI-1	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.086	mg/L	
RAI-1	10/10/1995	23	PHOSPHORUS, TOTAL (MG/L AS P)	0.1	mg/L	
RAI-1	04/03/2002	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.077	mg/l	
RAI-1	04/03/2002	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.078	mg/l	
RAI-1	06/10/2002	9	PHOSPHORUS, TOTAL (MG/L AS P)	0.077	mg/l	
RAI-1	06/10/2002	9	PHOSPHORUS, TOTAL (MG/L AS P)	0.439	mg/l	
RAI-1	07/15/2002	300	PHOSPHORUS, TOTAL (MG/L AS P)	1.07	mg/l	
RAI-1	07/15/2002	300	PHOSPHORUS, TOTAL (MG/L AS P)	0.225	mg/l	
RAI-1	08/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	442	mg/kg	
RAI-1	08/08/2002	406	PHOSPHORUS, TOTAL (MG/L AS P)	1.4	mg/l	
RAI-1	08/08/2002	406	PHOSPHORUS, TOTAL (MG/L AS P)	0.263	mg/l	
RAI-1	10/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	0.27	mg/l	
RAI-1	10/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	0.31	mg/l	
RAI-1	7/13/1993	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	30.4	Deg. C	
RAI-1	7/13/1993	8	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.8	Deg. C	
RAI-1	7/13/1993	12	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.6	Deg. C	
RAI-1	7/13/1993	16	TEMPERATURE, WATER (DEGREES CENTIGRADE)	20.1	Deg. C	
RAI-1	7/13/1993	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	31.1	Deg. C	
RAI-1	7/13/1993	4	TEMPERATURE, WATER (DEGREES CENTIGRADE)	30.7	Deg. C	
RAI-1	7/13/1993	10	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29	Deg. C	
RAI-1	7/13/1993	22	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.3	Deg. C	
RAI-1	7/13/1993	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.6	Deg. C	
RAI-1	7/13/1993	14	TEMPERATURE, WATER (DEGREES CENTIGRADE)	22.5	Deg. C	
RAI-1	7/13/1993	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.3	Deg. C	
RAI-1	7/13/1993	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	31.2	Deg. C	
RAI-1	7/13/1993	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	31.3	Deg. C	
RAI-1	7/13/1993	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.9	Deg. C	
RAI-1	7/13/1993	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-1	7/13/1993	23	TEMPERATURE, WATER (DEGREES CENTIGRADE)	15.9	Deg. C	
RAI-1	7/13/1993	24	TEMPERATURE, WATER (DEGREES CENTIGRADE)	15.6	Deg. C	
RAI-1	7/13/1993	18	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.1	Deg. C	
RAI-1	7/13/1993	20	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17	Deg. C	
RAI-1	7/13/1993	25	TEMPERATURE, WATER (DEGREES CENTIGRADE)	15.5	Deg. C	
RAI-1	7/13/1993	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.5	Deg. C	
RAI-1	7/13/1993	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.1	Deg. C	
RAI-1	7/13/1993	21	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	7/13/1993	2	TEMPERATURE, WATER (DEGREES CENTIGRADE)	31.3	Deg. C	
RAI-1	7/13/1993	6	TEMPERATURE, WATER (DEGREES CENTIGRADE)	30.1	Deg. C	
RAI-1	7/13/1993	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.5	Deg. C	
RAI-1	4/24/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.5	Deg. C	
RAI-1	4/24/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.7	Deg. C	
RAI-1	4/24/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.2	Deg. C	
RAI-1	4/24/1995	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	4/24/1995	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	4/24/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.4	Deg. C	
RAI-1	4/24/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18	Deg. C	
RAI-1	4/24/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.7	Deg. C	
RAI-1	4/24/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.8	Deg. C	
RAI-1	4/24/1995	23	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.2	Deg. C	
RAI-1	4/24/1995	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	4/24/1995	21	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	4/24/1995	25	TEMPERATURE, WATER (DEGREES CENTIGRADE)	15.6	Deg. C	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-1	4/24/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.8	Deg. C	
RAI-1	5/8/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.2	Deg. C	
RAI-1	5/8/1995	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.4	Deg. C	
RAI-1	5/8/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.8	Deg. C	
RAI-1	5/8/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	23.7	Deg. C	
RAI-1	5/8/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	20.5	Deg. C	
RAI-1	5/8/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.3	Deg. C	
RAI-1	5/8/1995	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.3	Deg. C	
RAI-1	5/8/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.3	Deg. C	
RAI-1	5/8/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	26	Deg. C	
RAI-1	5/8/1995	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.3	Deg. C	
RAI-1	5/8/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.5	Deg. C	
RAI-1	7/6/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.8	Deg. C	
RAI-1	7/6/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.9	Deg. C	
RAI-1	7/6/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.9	Deg. C	
RAI-1	7/6/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.8	Deg. C	
RAI-1	7/6/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.6	Deg. C	
RAI-1	7/6/1995	23	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-1	7/6/1995	25	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.7	Deg. C	
RAI-1	7/6/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.1	Deg. C	
RAI-1	7/6/1995	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-1	7/6/1995	21	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.1	Deg. C	
RAI-1	7/6/1995	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.4	Deg. C	
RAI-1	7/6/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.9	Deg. C	
RAI-1	7/6/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.8	Deg. C	
RAI-1	7/6/1995	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.7	Deg. C	
RAI-1	8/10/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.7	Deg. C	
RAI-1	8/10/1995	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	26.2	Deg. C	
RAI-1	8/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.5	Deg. C	
RAI-1	8/10/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.7	Deg. C	
RAI-1	8/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.7	Deg. C	
RAI-1	8/10/1995	25	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.8	Deg. C	
RAI-1	8/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.8	Deg. C	
RAI-1	8/10/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.7	Deg. C	
RAI-1	8/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.5	Deg. C	
RAI-1	8/10/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.6	Deg. C	
RAI-1	8/10/1995	21	TEMPERATURE, WATER (DEGREES CENTIGRADE)	20.2	Deg. C	
RAI-1	8/10/1995	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.3	Deg. C	
RAI-1	8/10/1995	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	23.7	Deg. C	
RAI-1	8/10/1995	23	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.5	Deg. C	
RAI-1	10/10/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-1	10/10/1995	23	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.7	Deg. C	
RAI-1	10/10/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.2	Deg. C	
RAI-1	10/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.3	Deg. C	
RAI-1	10/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.1	Deg. C	
RAI-1	10/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.9	Deg. C	
RAI-1	10/10/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.2	Deg. C	
RAI-1	10/10/1995	15	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-1	10/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21	Deg. C	
RAI-1	10/10/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-1	10/10/1995	21	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.8	Deg. C	
RAI-1	10/10/1995	17	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-1	10/10/1995	19	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19	Deg. C	
RAI-2	04/03/2002	4	Chlorophyll (a+b+c)	388	ug/l	
RAI-2	06/10/2002	390	Chlorophyll (a+b+c)	390	ug/l	
RAI-2	07/15/2002	200	Chlorophyll (a+b+c)	200	ug/l	
RAI-2	08/08/2002	205	Chlorophyll (a+b+c)	205	ug/l	
RAI-2	10/08/2002	178	Chlorophyll (a+b+c)	178	ug/l	
RAI-2	04/03/2002	4	Chlorophyll a, corrected for pheophytin	39	ug/l	
RAI-2	06/10/2002	390	Chlorophyll a, corrected for pheophytin	86	ug/l	
RAI-2	07/15/2002	200	Chlorophyll a, corrected for pheophytin	175	ug/l	
RAI-2	08/08/2002	205	Chlorophyll a, corrected for pheophytin	60.9	ug/l	
RAI-2	10/08/2002	178	Chlorophyll a, corrected for pheophytin	161	ug/l	
RAI-2	04/03/2002	4	Chlorophyll a, uncorrected for pheophytin	40.3	ug/l	
RAI-2	06/10/2002	390	Chlorophyll a, uncorrected for pheophytin	82.7	ug/l	
RAI-2	07/15/2002	200	Chlorophyll a, uncorrected for pheophytin	171	ug/l	
RAI-2	08/08/2002	205	Chlorophyll a, uncorrected for pheophytin	63.3	ug/l	
RAI-2	10/08/2002	178	Chlorophyll a, uncorrected for pheophytin	156	ug/l	
RAI-2	4/24/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	32.42	µg/L	
RAI-2	6/8/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	35.24	µg/L	
RAI-2	7/6/1995	5	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	49.128	µg/L	
RAI-2	8/10/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	68.713	µg/L	
RAI-2	10/10/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	49.586	µg/L	
RAI-2	4/24/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	28.54	µg/L	
RAI-2	6/8/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	30.81	µg/L	
RAI-2	7/6/1995	5	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	50.346	µg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-2	8/10/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	73.938	µg/L	
RAI-2	10/10/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	53.644	µg/L	
RAI-2	04/03/2002	4	Chlorophyll-b			
RAI-2	06/10/2002	390	Chlorophyll-b			
RAI-2	07/15/2002	200	Chlorophyll-b			
RAI-2	08/08/2002	205	Chlorophyll-b			
RAI-2	10/08/2002	178	Chlorophyll-b			
RAI-2	04/03/2002	4	Chlorophyll-c	3.34	ug/l	
RAI-2	06/10/2002	390	Chlorophyll-c	6.57	ug/l	
RAI-2	07/15/2002	200	Chlorophyll-c	6.28	ug/l	
RAI-2	08/08/2002	205	Chlorophyll-c	3.55	ug/l	
RAI-2	10/08/2002	178	Chlorophyll-c	13.2	ug/l	
RAI-2	4/24/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	24.59	µg/L	
RAI-2	6/8/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	1.96	µg/L	
RAI-2	7/6/1995	5	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	7.8896	µg/L	
RAI-2	8/10/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	2.3978	µg/L	
RAI-2	10/10/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	7.125	µg/L	
RAI-2	4/24/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	15.5	Feet	
RAI-2	6/8/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	15	Feet	
RAI-2	7/6/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	15	Feet	
RAI-2	8/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	15	Feet	
RAI-2	10/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	14	Feet	
RAI-2	04/03/2002	1	DEPTH OF POND OR RESERVOIR IN FEET	15	ft	
RAI-2	06/10/2002	9	DEPTH OF POND OR RESERVOIR IN FEET	15	ft	
RAI-2	07/15/2002	300	DEPTH OF POND OR RESERVOIR IN FEET	14	ft	
RAI-2	08/08/2002	406	DEPTH OF POND OR RESERVOIR IN FEET	13	ft	
RAI-2	10/08/2002	500	DEPTH OF POND OR RESERVOIR IN FEET	13	ft	
RAI-2	04/03/2002	1	Depth of Sample	1	ft	
RAI-2	04/03/2002	4	Depth of Sample	4	ft	
RAI-2	06/10/2002	390	Depth of Sample	3	ft	
RAI-2	06/10/2002	9	Depth of Sample	1	ft	
RAI-2	07/15/2002	200	Depth of Sample	2	ft	
RAI-2	07/15/2002	300	Depth of Sample	1	ft	
RAI-2	08/08/2002	406	Depth of Sample	1	ft	
RAI-2	08/08/2002	205	Depth of Sample	3	ft	
RAI-2	10/08/2002	500	Depth of Sample	1	ft	
RAI-2	10/08/2002	178	Depth of Sample	3	ft	
RAI-2	4/24/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.2	mg/L	
RAI-2	4/24/1995	13.5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.4	mg/L	
RAI-2	4/24/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.3	mg/L	
RAI-2	4/24/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.3	mg/L	
RAI-2	4/24/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.4	mg/L	
RAI-2	4/24/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.8	mg/L	
RAI-2	4/24/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.5	mg/L	
RAI-2	4/24/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.4	mg/L	
RAI-2	4/24/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.1	mg/L	
RAI-2	5/8/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2.2	mg/L	
RAI-2	5/8/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1.2	mg/L	
RAI-2	5/8/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.2	mg/L	
RAI-2	5/8/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-2	5/8/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.3	mg/L	
RAI-2	5/8/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.1	mg/L	
RAI-2	5/8/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.6	mg/L	
RAI-2	5/8/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.1	mg/L	
RAI-2	7/6/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7	mg/L	
RAI-2	7/6/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.8	mg/L	
RAI-2	7/6/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.1	mg/L	
RAI-2	7/6/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.6	mg/L	
RAI-2	7/6/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.2	mg/L	
RAI-2	7/6/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.1	mg/L	
RAI-2	7/6/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6	mg/L	
RAI-2	7/6/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6	mg/L	
RAI-2	8/10/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1.2	mg/L	
RAI-2	8/10/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1.3	mg/L	
RAI-2	8/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.5	mg/L	
RAI-2	8/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.2	mg/L	
RAI-2	8/10/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.3	mg/L	
RAI-2	8/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.6	mg/L	
RAI-2	8/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.3	mg/L	
RAI-2	8/10/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.4	mg/L	
RAI-2	10/10/1995	11	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	4.9	mg/L	
RAI-2	10/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-2	10/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-2	10/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-2	10/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-2	10/10/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.7	mg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-2	10/10/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5	mg/L	
RAI-2	10/10/1995	13	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.2	mg/L	
RAI-2	4/24/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.006	mg/L	
RAI-2	6/8/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.021	mg/L	
RAI-2	7/6/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.028	mg/L	
RAI-2	8/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.016	mg/L	
RAI-2	10/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.022	mg/L	
RAI-2	04/03/2002	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.02	mg/l	
RAI-2	06/10/2002	9	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.014	mg/l	
RAI-2	07/15/2002	300	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.025	mg/l	
RAI-2	08/08/2002	406	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.128	mg/l	
RAI-2	10/08/2002	500	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.08	mg/l	
RAI-2	4/24/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.045	mg/L	
RAI-2	6/8/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.076	mg/L	
RAI-2	7/6/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.09	mg/L	
RAI-2	8/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.115	mg/L	
RAI-2	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.098	mg/L	
RAI-2	04/03/2002	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.089	mg/l	
RAI-2	06/10/2002	9	PHOSPHORUS, TOTAL (MG/L AS P)	0.128	mg/l	
RAI-2	07/15/2002	300	PHOSPHORUS, TOTAL (MG/L AS P)	0.205	mg/l	
RAI-2	08/08/2002	406	PHOSPHORUS, TOTAL (MG/L AS P)	0.258	mg/l	
RAI-2	10/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	0.263	mg/l	
RAI-2	4/24/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.8	Deg. C	
RAI-2	4/24/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.1	Deg. C	
RAI-2	4/24/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.3	Deg. C	
RAI-2	4/24/1995	13.5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16	Deg. C	
RAI-2	4/24/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.5	Deg. C	
RAI-2	4/24/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.8	Deg. C	
RAI-2	4/24/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.9	Deg. C	
RAI-2	4/24/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.5	Deg. C	
RAI-2	4/24/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.4	Deg. C	
RAI-2	5/8/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	23.8	Deg. C	
RAI-2	5/8/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.3	Deg. C	
RAI-2	5/8/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	23.4	Deg. C	
RAI-2	5/8/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-2	5/8/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.5	Deg. C	
RAI-2	5/8/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.5	Deg. C	
RAI-2	5/8/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.2	Deg. C	
RAI-2	5/8/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.9	Deg. C	
RAI-2	7/6/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.5	Deg. C	
RAI-2	7/6/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.9	Deg. C	
RAI-2	7/6/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.1	Deg. C	
RAI-2	7/6/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.2	Deg. C	
RAI-2	7/6/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.2	Deg. C	
RAI-2	7/6/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.2	Deg. C	
RAI-2	7/6/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.5	Deg. C	
RAI-2	7/6/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.4	Deg. C	
RAI-2	8/10/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.6	Deg. C	
RAI-2	8/10/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.8	Deg. C	
RAI-2	8/10/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.3	Deg. C	
RAI-2	8/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.2	Deg. C	
RAI-2	8/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.9	Deg. C	
RAI-2	8/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29	Deg. C	
RAI-2	8/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.9	Deg. C	
RAI-2	8/10/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	28.2	Deg. C	
RAI-2	10/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.1	Deg. C	
RAI-2	10/10/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.1	Deg. C	
RAI-2	10/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	22.2	Deg. C	
RAI-2	10/10/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.5	Deg. C	
RAI-2	10/10/1995	11	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.3	Deg. C	
RAI-2	10/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-2	10/10/1995	13	TEMPERATURE, WATER (DEGREES CENTIGRADE)	19.1	Deg. C	
RAI-2	10/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.9	Deg. C	
RAI-3	04/03/2002	3	Chlorophyll (a+b+c)	292	ug/l	
RAI-3	06/10/2002	250	Chlorophyll (a+b+c)	250	ug/l	
RAI-3	07/15/2002	258	Chlorophyll (a+b+c)	258	ug/l	
RAI-3	08/08/2002	162	Chlorophyll (a+b+c)	162	ug/l	
RAI-3	10/08/2002	150	Chlorophyll (a+b+c)	150	ug/l	
RAI-3	04/03/2002	3	Chlorophyll a, corrected for pheophytin	46.5	ug/l	
RAI-3	06/10/2002	250	Chlorophyll a, corrected for pheophytin	104	ug/l	
RAI-3	07/15/2002	258	Chlorophyll a, corrected for pheophytin	151	ug/l	
RAI-3	08/08/2002	162	Chlorophyll a, corrected for pheophytin	92.8	ug/l	
RAI-3	10/08/2002	150	Chlorophyll a, corrected for pheophytin	148	ug/l	
RAI-3	04/03/2002	3	Chlorophyll a, uncorrected for pheophytin	49	ug/l	
RAI-3	06/10/2002	250	Chlorophyll a, uncorrected for pheophytin	103	ug/l	
RAI-3	07/15/2002	258	Chlorophyll a, uncorrected for pheophytin	152	ug/l	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-3	08/08/2002	162	Chlorophyll a, uncorrected for pheophytin	98.5	ug/l	
RAI-3	10/08/2002	150	Chlorophyll a, uncorrected for pheophytin	150	ug/l	
RAI-3	4/24/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	36.24	µg/L	
RAI-3	6/8/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	44.06	µg/L	
RAI-3	7/6/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	7.476	µg/L	
RAI-3	8/10/1995	4	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	83.72	µg/L	
RAI-3	10/10/1995	3	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH.	82.325	µg/L	
RAI-3	4/24/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	29.05	µg/L	
RAI-3	6/8/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	44.91	µg/L	
RAI-3	7/6/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	6.7276	µg/L	
RAI-3	8/10/1995	4	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	82.203	µg/L	
RAI-3	10/10/1995	3	CHLOROPHYLL-A UG/L TRICHROMATIC UNCORRECTED	83.973	µg/L	
RAI-3	04/03/2002	3	Chlorophyll-b	2.72	ug/l	
RAI-3	06/10/2002	250	Chlorophyll-b			
RAI-3	07/15/2002	258	Chlorophyll-b			
RAI-3	08/08/2002	162	Chlorophyll-b			
RAI-3	10/08/2002	150	Chlorophyll-b			
RAI-3	04/03/2002	3	Chlorophyll-c	5.1	ug/l	
RAI-3	06/10/2002	250	Chlorophyll-c	6.72	ug/l	
RAI-3	07/15/2002	258	Chlorophyll-c	5.47	ug/l	
RAI-3	08/08/2002	162	Chlorophyll-c	4.88	ug/l	
RAI-3	10/08/2002	150	Chlorophyll-c	15.3	ug/l	
RAI-3	4/24/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	24.6	µg/L	
RAI-3	6/8/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	4.16	µg/L	
RAI-3	7/6/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	1.0972	µg/L	
RAI-3	8/10/1995	4	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	3.1881	µg/L	
RAI-3	10/10/1995	3	CHLOROPHYLL-C UG/L TRICHROMATIC UNCORRECTED	11.038	µg/L	
RAI-3	4/24/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	9	Feet	
RAI-3	4/24/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	9	Feet	
RAI-3	6/8/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	8.5	Feet	
RAI-3	6/8/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	8.5	Feet	
RAI-3	7/6/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	10	Feet	
RAI-3	7/6/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	10	Feet	
RAI-3	8/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	10	Feet	
RAI-3	8/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	10	Feet	
RAI-3	10/10/1995	1	DEPTH OF POND OR RESERVOIR IN FEET	7	Feet	
RAI-3	04/03/2002	1	DEPTH OF POND OR RESERVOIR IN FEET	8	ft	
RAI-3	06/10/2002	9	DEPTH OF POND OR RESERVOIR IN FEET	8	ft	
RAI-3	07/15/2002	300	DEPTH OF POND OR RESERVOIR IN FEET	7	ft	
RAI-3	08/08/2002	406	DEPTH OF POND OR RESERVOIR IN FEET	6	ft	
RAI-3	10/08/2002	500	DEPTH OF POND OR RESERVOIR IN FEET	6	ft	
RAI-3	04/03/2002	3	Depth of Sample	3	ft	
RAI-3	04/03/2002	1	Depth of Sample	1	ft	
RAI-3	06/10/2002	250	Depth of Sample	3	ft	
RAI-3	06/10/2002	9	Depth of Sample	1	ft	
RAI-3	07/15/2002	300	Depth of Sample	1	ft	
RAI-3	07/15/2002	258	Depth of Sample	2	ft	
RAI-3	08/08/2002	406	Depth of Sample	1	ft	
RAI-3	08/08/2002	500	Depth of Sample	6	ft	
RAI-3	08/08/2002	8	Depth of Sample	6	ft	
RAI-3	08/08/2002	162	Depth of Sample	2	ft	
RAI-3	10/08/2002	500	Depth of Sample	1	ft	
RAI-3	10/08/2002	150	Depth of Sample	2	ft	
RAI-3	4/24/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.3	mg/L	
RAI-3	4/24/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.1	mg/L	
RAI-3	4/24/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-3	4/24/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.1	mg/L	
RAI-3	4/24/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.2	mg/L	
RAI-3	5/8/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.5	mg/L	
RAI-3	5/8/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.6	mg/L	
RAI-3	5/8/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	5.6	mg/L	
RAI-3	5/8/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	1.7	mg/L	
RAI-3	5/8/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	0.4	mg/L	
RAI-3	7/6/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7	mg/L	
RAI-3	7/6/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.2	mg/L	
RAI-3	7/6/1995	8	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	6.8	mg/L	
RAI-3	7/6/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.4	mg/L	
RAI-3	7/6/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.2	mg/L	
RAI-3	7/6/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.3	mg/L	
RAI-3	8/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.8	mg/L	
RAI-3	8/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.7	mg/L	
RAI-3	8/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.9	mg/L	
RAI-3	8/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	8.4	mg/L	
RAI-3	8/10/1995	9	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	3.6	mg/L	
RAI-3	8/10/1995	7	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	7.3	mg/L	
RAI-3	10/10/1995	1	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	11.1	mg/L	

Station ID	Date	Sample Depth	Parameter	Result Value	Units	Remark Code
RAI-3	10/10/1995	5	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	10.6	mg/L	
RAI-3	10/10/1995	6	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	9.8	mg/L	
RAI-3	10/10/1995	3	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	11	mg/L	
RAI-3	10/10/1995	0	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	11.2	mg/L	
RAI-3	4/24/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.008	mg/L	
RAI-3	6/8/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.032	mg/L	
RAI-3	7/6/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.021	mg/L	
RAI-3	8/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.023	mg/L	
RAI-3	10/10/1995	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.024	mg/L	
RAI-3	04/03/2002	1	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.021	mg/l	
RAI-3	06/10/2002	9	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.014	mg/l	
RAI-3	07/15/2002	300	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.043	mg/l	
RAI-3	08/08/2002	406	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.185	mg/l	
RAI-3	10/08/2002	500	PHOSPHORUS, DISSOLVED (MG/L AS P)	0.059	mg/l	
RAI-3	4/24/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.051	mg/L	
RAI-3	6/8/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.104	mg/L	
RAI-3	7/6/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.0969999	mg/L	
RAI-3	8/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.063	mg/L	
RAI-3	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.127	mg/L	
RAI-3	04/03/2002	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.11	mg/l	
RAI-3	06/10/2002	9	PHOSPHORUS, TOTAL (MG/L AS P)	0.137	mg/l	
RAI-3	07/15/2002	300	PHOSPHORUS, TOTAL (MG/L AS P)	0.227	mg/l	
RAI-3	08/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	357	mg/kg	
RAI-3	08/08/2002	406	PHOSPHORUS, TOTAL (MG/L AS P)	0.357	mg/l	
RAI-3	10/08/2002	500	PHOSPHORUS, TOTAL (MG/L AS P)	0.234	mg/l	
RAI-3	4/24/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.3	Deg. C	
RAI-3	4/24/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	16.6	Deg. C	
RAI-3	4/24/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.3	Deg. C	
RAI-3	4/24/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	17.8	Deg. C	
RAI-3	4/24/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	18.3	Deg. C	
RAI-3	5/8/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	24.4	Deg. C	
RAI-3	5/8/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.5	Deg. C	
RAI-3	5/8/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	26.1	Deg. C	
RAI-3	5/8/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	23.4	Deg. C	
RAI-3	7/6/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	7/6/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	7/6/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	7/6/1995	8	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	7/6/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	7/6/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	25.3	Deg. C	
RAI-3	8/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	30.3	Deg. C	
RAI-3	8/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.6	Deg. C	
RAI-3	8/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	30.3	Deg. C	
RAI-3	8/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.9	Deg. C	
RAI-3	8/10/1995	7	TEMPERATURE, WATER (DEGREES CENTIGRADE)	29.5	Deg. C	
RAI-3	8/10/1995	9	TEMPERATURE, WATER (DEGREES CENTIGRADE)	27.1	Deg. C	
RAI-3	10/10/1995	3	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-3	10/10/1995	0	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-3	10/10/1995	1	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.5	Deg. C	
RAI-3	10/10/1995	5	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21.1	Deg. C	
RAI-3	10/10/1995	6	TEMPERATURE, WATER (DEGREES CENTIGRADE)	21	Deg. C	

Appendix D
Drainage Area Ratio Calculations

Surrogate Gage	Area (Sq.Mi)		Total NPDES Discharge in Watershed (CFS)
USGS 05597500 CRAB ORCHARD CREEK NEAR MARION, IL	31.70		0.00464

Watershed	Area (Sq.Mi)	Ratio (Surrogate Gage)	Total NPDES Discharge in Watershed (CFS)
Bankston Fork Segment ATGC-01	76.28	2.41	0
Bankston Fork Segment ATGC-02	39.21	1.24	0
Bankston Fork Segment ATGC-11	10.10	0.32	0
Brushy Creek Segment ATGH-09	21.76	0.69	0.1176
Brushy Creek Segment ATGH-10	16.59	0.52	0.1176
Harco Branch Segment ATGM-01	4.02	0.13	0

Appendix E
Manganese Load Duration Curve Calculations

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Mn (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	1/25/1990	2.876371	0.2396%	1717	26.64	15.51	Yes
ATGC-01	3/7/1990	5.282654	0.5027%	1407	40.09	28.49	Yes
ATGC-01	4/11/1990	736.3117	0.6061%	880	3,494.92	3,971.50	No
ATGC-01	5/14/1990	401.8382	2.2787%	772	1,673.25	2,167.43	No
ATGC-01	6/14/1990	14.66716	4.2802%	1393	110.20	79.11	Yes
ATGC-01	7/24/1990	0.036956	4.2802%	400	0.08	0.20	No
ATGC-01	9/11/1990	9.132709	6.3616%	1392	68.57	49.26	Yes
ATGC-01	10/30/1990	0.205396	6.7469%	206	0.23	1.11	No
ATGC-01	12/20/1990	74.58363	6.7938%	1150	462.63	402.29	Yes
ATGC-01	1/30/1991	113.0842	6.9301%	1281	781.35	609.95	Yes
ATGC-01	3/7/1991	28.86424	8.2315%	1511	235.24	155.69	Yes
ATGC-01	4/9/1991	28.86424	8.4618%	1565	243.65	155.69	Yes
ATGC-01	5/13/1991	20.68287	8.5416%	1000	111.56	111.56	No
ATGC-01	6/11/1991	4.560769	9.8525%	390	9.59	24.60	No
ATGC-01	7/18/1991	0.036956	10.5290%	295	0.06	0.20	No
ATGC-01	9/30/1991	0.001	11.0787%	151	0.00	0.01	No
ATGC-01	11/7/1991	0.001	11.5251%	86	0.00	0.01	No
ATGC-01	12/9/1991	19.47973	12.3661%	1400	147.10	105.07	Yes
ATGC-01	1/21/1992	20.44224	12.5822%	1400	154.37	110.26	Yes
ATGC-01	2/25/1992	26.45795	13.0192%	1100	156.98	142.71	Yes
ATGC-01	3/26/1992	57.73964	13.4890%	960	298.98	311.43	No
ATGC-01	4/28/1992	9.373337	13.4890%	1100	55.61	50.56	Yes
ATGC-01	6/25/1992	17.79533	14.5978%	2100	201.57	95.98	Yes
ATGC-01	8/10/1992	2.635742	14.9173%	480	6.82	14.22	No
ATGC-01	9/2/1992	14.42653	15.7489%	680	52.91	77.81	No
ATGC-01	10/6/1992	19.47973	15.7489%	1100	115.58	105.07	Yes
ATGC-01	12/1/1992	26.45795	16.2047%	1700	242.60	142.71	Yes
ATGC-01	1/5/1993	2695.027	17.6565%	620	9,012.55	14,536.37	No
ATGC-01	2/10/1993	22.12664	18.1921%	1700	202.89	119.35	Yes
ATGC-01	3/18/1993	31.27052	19.0519%	1700	286.73	168.67	Yes
ATGC-01	4/22/1993	48.11451	19.0519%	1400	363.33	259.52	Yes
ATGC-01	6/8/1993	11.53899	20.5037%	1100	68.46	62.24	Yes
ATGC-01	7/13/1993	4.560769	21.3118%	230	5.66	24.60	No
ATGC-01	9/16/1993	12.74213	22.1481%	21000	1,443.29	68.73	Yes
ATGC-01	11/15/1993	1821.546	22.1481%	570	5,600.26	9,825.01	No
ATGC-01	12/14/1993	50.52079	22.1481%	1900	517.75	272.50	Yes
ATGC-01	1/13/1994	60.14593	23.2240%	1500	486.62	324.41	Yes
ATGC-01	2/22/1994	221.3669	23.2240%	1300	1,552.20	1,194.00	Yes
ATGC-01	4/20/1994	14.1859	23.2240%	1300	99.47	76.52	Yes
ATGC-01	5/17/1994	6.485796	23.2240%	1100	38.48	34.98	Yes
ATGC-01	6/22/1994	2.298863	24.2577%	1200	14.88	12.40	Yes
ATGC-01	8/11/1994	0.001	24.2577%	750	0.00	0.01	No
ATGC-01	9/22/1994	0.001	25.3712%	260	0.00	0.01	No
ATGC-01	11/1/1994	1.191972	25.3712%	85	0.55	6.43	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Mn (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	12/19/1994	12.26088	25.3712%	1100	72.75	66.13	Yes
ATGC-01	1/24/1995	14.42653	25.3712%	1100	85.59	77.81	Yes
ATGC-01	2/28/1995	243.0235	25.3712%	950	1,245.27	1,310.81	No
ATGC-01	4/19/1995	8.89208	26.7290%	560	26.86	47.96	No
ATGC-01	5/23/1995	22.12664	26.7290%	1500	179.02	119.35	Yes
ATGC-01	7/3/1995	18.99847	26.7290%	1300	133.22	102.47	Yes
ATGC-01	8/10/1995	14.66716	26.7290%	790	62.50	79.11	No
ATGC-01	9/7/1995	0.001	28.1197%	100	0.00	0.01	No
ATGC-01	10/16/1995	0.001	30.2528%	250	0.00	0.01	No
ATGC-01	11/21/1995	0.638527	30.3514%	1000	3.44	3.44	No
ATGC-01	1/2/1996	33.6768	30.3514%	1000	181.65	181.65	No
ATGC-01	2/8/1996	19.72036	30.6944%	1200	127.64	106.37	Yes
ATGC-01	4/15/1996	28.86424	31.6576%	550	85.63	155.69	No
ATGC-01	5/23/1996	33.6768	31.8925%	1500	272.47	181.65	Yes
ATGC-01	6/13/1996	67.36478	31.8925%	1600	581.36	363.35	Yes
ATGC-01	8/15/1996	3.598256	32.4281%	300	5.82	19.41	No
ATGC-01	9/30/1996	0.734778	32.5879%	1700	6.74	3.96	Yes
ATGC-01	11/4/1996	0.662589	32.5879%	270	0.96	3.57	No
ATGC-01	12/19/1996	26.45795	33.3302%	1500	214.06	142.71	Yes
ATGC-01	1/30/1997	28.86424	34.2370%	1400	217.96	155.69	Yes
ATGC-01	3/6/1997	64.95849	34.8666%	1200	420.45	350.37	Yes
ATGC-01	4/17/1997	38.48937	36.9667%	1400	290.64	207.60	Yes
ATGC-01	6/4/1997	60.14593	36.9667%	1300	421.74	324.41	Yes
ATGC-01	7/11/1997	5.042026	37.0983%	540	14.69	27.20	No
ATGC-01	8/18/1997	0.855092	37.0983%	420	1.94	4.61	No
ATGC-01	9/25/1997	1.913857	37.6668%	160	1.65	10.32	No
ATGC-01	11/10/1997	1.312286	39.0669%	53	0.38	7.08	No
ATGC-01	12/17/1997	6.726425	39.2689%	370	13.42	36.28	No
ATGC-01	1/22/1998	22.36727	39.6072%	1100	132.71	120.64	Yes
ATGC-01	2/25/1998	33.6768	40.6737%	810	147.13	181.65	No
ATGC-01	4/15/1998	120.303	41.3691%	460	298.49	648.89	No
ATGC-01	5/20/1998	7.929567	42.8632%	510	21.81	42.77	No
ATGC-01	6/18/1998	36.08309	43.7136%	940	182.95	194.62	No
ATGC-01	7/29/1998	6.485796	44.0331%	170	5.95	34.98	No
ATGC-01	9/16/1998	0.470087	44.3291%	81	0.21	2.54	No
ATGC-01	10/22/1998	1.673229	44.3291%	65	0.59	9.03	No
ATGC-01	11/23/1998	4.560769	46.1192%	34	0.84	24.60	No
ATGC-01	1/28/1999	45.70822	46.8756%	1300	320.50	246.54	Yes
ATGC-01	2/17/1999	33.6768	48.2052%	1200	217.97	181.65	Yes
ATGC-01	3/29/1999	24.05167	48.6046%	1000	129.73	129.73	No
ATGC-01	5/7/1999	156.3973	48.6046%	970	818.26	843.57	No
ATGC-01	7/6/1999	1.143846	48.6046%	510	3.15	6.17	No
ATGC-01	8/17/1999	0.001	50.8786%	210	0.00	0.01	No
ATGC-01	9/23/1999	0.001	51.4518%	140	0.00	0.01	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Mn (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	11/4/1999	0.001	51.4518%	210	0.00	0.01	No
ATGC-01	12/17/1999	3.357627	51.4518%	500	9.06	18.11	No
ATGC-01	1/26/2000	1.721354	52.8143%	1600	14.86	9.28	Yes
ATGC-01	3/1/2000	36.08309	52.8143%	1000	194.62	194.62	No
ATGC-01	4/19/2000	7.44831	52.8143%	490	19.69	40.17	No
ATGC-01	5/24/2000	214.1481	52.8143%	1400	1,617.09	1,155.07	Yes
ATGC-01	6/22/2000	84.20876	53.9231%	1400	635.88	454.20	Yes
ATGC-01	8/16/2000	6.485796	55.1588%	260	9.10	34.98	No
ATGC-01	10/2/2000	0.001	56.0985%	130	0.00	0.01	No
ATGC-01	11/15/2000	10.81711	56.0985%	440	25.67	58.35	No
ATGC-01	1/10/2001	20.44224	56.9301%	1500	165.39	110.26	Yes
ATGC-01	4/19/2001	8.89208	57.7335%	880	42.21	47.96	No
ATGC-01	7/26/2001	0.710715	58.8235%	26000	99.67	3.83	Yes
ATGC-01	9/4/2001	1.360412	61.2056%	170	1.25	7.34	No
ATGC-01	11/1/2001	21.64538	62.5869%	820	95.74	116.75	No
ATGC-01	1/17/2002	31.27052	62.8641%	1800	303.60	168.67	Yes
ATGC-01	2/21/2002	218.9607	63.8884%	850	1,003.87	1,181.02	No
ATGC-01	3/20/2002	1713.263	64.1656%	550	5,082.53	9,240.96	No
ATGC-01	4/24/2002	103.459	64.3441%	1100	613.84	558.03	Yes
ATGC-01	6/4/2002	45.70822	65.8382%	1000	246.54	246.54	No
ATGC-01	7/15/2002	1.76948	66.8765%	370	3.53	9.54	No
ATGC-01	8/19/2002	0.734778	67.0269%	140	0.55	3.96	No
ATGC-01	1/30/2003	1.4326	67.7269%	1100	8.50	7.73	Yes
ATGC-01	3/5/2003	74.58363	68.8076%	880	354.01	402.29	No
ATGC-01	3/26/2003	163.6161	71.5749%	760	670.71	882.51	No
ATGC-01	5/6/2003	401.8382	72.6696%	760	1,647.24	2,167.43	No
ATGC-01	6/18/2003	96.24018	72.6696%	490	254.36	519.10	No
ATGC-01	8/7/2003	3.357627	72.9468%	210	3.80	18.11	No
ATGC-01	9/4/2003	4.079513	74.2905%	320	7.04	22.00	No
ATGC-01	10/15/2003	0.518212	74.4926%	110	0.31	2.80	No
ATGC-01	11/18/2003	40.89566	75.8034%	37	8.16	220.58	No
ATGC-01	1/14/2004	28.86424	76.3625%	820	127.66	155.69	No
ATGC-01	2/19/2004	36.08309	79.9991%	820	159.59	194.62	No
ATGC-01	4/14/2004	79.3962	82.4469%	440	188.43	428.25	No
ATGC-01	5/12/2004	9.613965	84.6457%	460	23.85	51.86	No
ATGC-01	6/9/2004	4.560769	84.6457%	220	5.41	24.60	No
ATGC-01	8/11/2004	3.116999	84.6457%	140	2.35	16.81	No
ATGC-01	9/8/2004	0.036956	85.5196%	180	0.04	0.20	No
ATGC-01	10/27/2004	86.61505	85.5196%	400	186.87	467.18	No
ATGC-01	12/20/2004	12.50151	85.5196%	800	53.94	67.43	No
ATGC-01	1/27/2005	16.83282	85.5196%	1200	108.95	90.79	Yes
ATGC-01	2/24/2005	26.45795	85.5196%	1000	142.71	142.71	No
ATGC-01	4/13/2005	153.991	85.5196%	800	664.47	830.59	No
ATGC-01	5/23/2005	5.042026	85.5196%	340	9.25	27.20	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Mn (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	6/29/2005	0.253521	85.5196%	600	0.82	1.37	No
ATGC-01	7/20/2005	1.986046	85.5196%	250	2.68	10.71	No
ATGC-01	9/15/2005	0.001	85.5196%	280	0.00	0.01	No
ATGC-01	10/31/2005	0.001	85.5196%	140	0.00	0.01	No
ATGC-01	12/6/2005	5.042026	85.5196%	1000	27.20	27.20	No
ATGC-02	7/7/1993	34.62505	14.5978%	560	104.59	186.76	No
ATGC-02	9/13/1993	0.860028	64.3441%	160	0.74	4.64	No
ATGC-02	12/15/1993	28.44098	16.6416%	2100	322.15	153.40	Yes
ATGC-02	7/16/2008	0.686874	66.9470%	275	1.02	3.70	No
ATGC-02	8/8/2008	0.78582	65.4247%	202	0.86	4.24	No
ATGC-02	9/22/2008	0.155045	79.5245%	77.4	0.06	0.84	No
ATGC-11	6/7/1993	1.782907	38.2541%	1800	17.31	9.62	Yes
ATGC-11	9/13/1993	0.221569	64.3441%	880	1.05	1.20	No
ATGC-11	12/15/1993	7.32725	16.6416%	2300	90.90	39.52	Yes
ATGC-11	7/16/2008	0.176959	66.9470%	69.2	0.07	0.95	No
ATGC-11	8/8/2008	0.202451	65.4247%	189	0.21	1.09	No
ATGC-11	9/22/2008	0.039944	79.5245%	87.5	0.02	0.22	No
ATGH-09	6/17/1993	2.929044	42.5860%	710	11.22	15.80	No
ATGH-09	9/13/1993	0.59496	64.3441%	340	1.09	3.21	No
ATGH-09	12/15/1993	15.9038	16.6416%	1500	128.67	85.78	Yes
ATGH-09	7/16/2008	0.498851	66.9470%	304	0.82	2.69	No
ATGH-09	8/8/2008	0.55377	65.4247%	702	2.10	2.99	No
ATGH-09	9/22/2008	0.203658	79.5245%	162	0.18	1.10	No
ATGM-01	6/17/1993	0.519864	42.5860%	12000	33.65	2.80	Yes
ATGM-01	9/28/1993	1.256114	29.3366%	7700	52.17	6.78	Yes
ATGM-01	12/13/1993	2.411266	19.0519%	9600	124.86	13.01	Yes
ATGM-01	7/16/2008	0.070497	66.9470%	750	0.29	0.38	No
ATGM-01	8/8/2008	0.080652	65.4247%	253	0.11	0.44	No
ATGM-01	9/22/2008	0.015913	79.5245%	412	0.04	0.09	No

Appendix F
Silver Load Duration Curve Calculations

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Silver (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	1/25/1990	2.876370629	57.7335%	3	0.05	0.08	No
ATGC-01	3/7/1990	5.282654477	50.8786%	3	0.09	0.14	No
ATGC-01	4/11/1990	736.3116877	2.2787%	3	11.91	19.86	No
ATGC-01	5/14/1990	401.8382327	4.2802%	5	10.84	10.84	No
ATGC-01	6/14/1990	14.66716149	36.9667%	3	0.24	0.40	No
ATGC-01	7/24/1990	0.036955687	84.6457%	3	0.00	0.00	No
ATGC-01	9/11/1990	9.132708635	44.0331%	7	0.34	0.25	Yes
ATGC-01	10/30/1990	0.205395557	82.4469%	5	0.01	0.01	No
ATGC-01	12/20/1990	74.58362932	13.4890%	3	1.21	2.01	No
ATGC-01	1/30/1991	113.0841709	10.5290%	3	1.83	3.05	No
ATGC-01	3/7/1991	28.86423619	25.3712%	3	0.47	0.78	No
ATGC-01	4/9/1991	28.86423619	25.3712%	3	0.47	0.78	No
ATGC-01	5/13/1991	20.68287111	31.6576%	5	0.56	0.56	No
ATGC-01	6/11/1991	4.560769323	52.8143%	5	0.12	0.12	No
ATGC-01	7/18/1991	0.036955687	84.6457%	3	0.00	0.00	No
ATGC-01	9/30/1991	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	11/7/1991	0.001	85.5196%	5	0.00	0.00	No
ATGC-01	12/9/1991	19.47972918	32.5879%	5	0.53	0.53	No
ATGC-01	1/21/1992	20.44224272	31.8925%	5	0.55	0.55	No
ATGC-01	2/25/1992	26.45795234	26.7290%	5	0.71	0.71	No
ATGC-01	3/26/1992	57.73964238	16.2047%	5	1.56	1.56	No
ATGC-01	4/28/1992	9.37333702	43.7136%	5	0.25	0.25	No
ATGC-01	6/25/1992	17.79533049	34.2370%	5	0.48	0.48	No
ATGC-01	8/10/1992	2.635742244	58.8235%	5	0.07	0.07	No
ATGC-01	9/2/1992	14.4265331	37.0983%	5	0.39	0.39	No
ATGC-01	10/6/1992	19.47972918	32.5879%	6	0.63	0.53	Yes
ATGC-01	12/1/1992	26.45795234	26.7290%	5	0.71	0.71	No
ATGC-01	1/5/1993	2695.02674	0.2396%	5	72.68	72.68	No
ATGC-01	2/10/1993	22.12664142	30.3514%	5	0.60	0.60	No
ATGC-01	3/18/1993	31.27052004	24.2577%	3	0.51	0.84	No
ATGC-01	4/22/1993	48.11450698	18.1921%	3	0.78	1.30	No
ATGC-01	6/8/1993	11.53899248	40.6737%	3	0.19	0.31	No
ATGC-01	7/13/1993	4.560769323	52.8143%	5	0.12	0.12	No
ATGC-01	9/16/1993	12.74213441	39.0669%	3	0.21	0.34	No
ATGC-01	11/15/1993	1821.545703	0.5027%	4	39.30	49.13	No
ATGC-01	12/14/1993	50.52079083	17.6565%	3	0.82	1.36	No
ATGC-01	1/13/1994	60.14592622	15.7489%	3	0.97	1.62	No
ATGC-01	2/22/1994	221.3669441	6.7469%	3	3.58	5.97	No
ATGC-01	4/20/1994	14.18590472	37.6668%	3	0.23	0.38	No
ATGC-01	5/17/1994	6.485796402	48.6046%	4	0.14	0.17	No
ATGC-01	6/22/1994	2.298862505	61.2056%	5	0.06	0.06	No
ATGC-01	8/11/1994	0.001	85.5196%	17	0.00	0.00	Yes
ATGC-01	9/22/1994	0.001	85.5196%	17	0.00	0.00	Yes
ATGC-01	11/1/1994	1.191971935	67.7269%	17	0.11	0.03	Yes
ATGC-01	12/19/1994	12.26087764	39.6072%	11	0.73	0.33	Yes
ATGC-01	1/24/1995	14.4265331	37.0983%	9	0.70	0.39	Yes
ATGC-01	2/28/1995	243.0234987	6.3616%	5	6.55	6.55	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Silver (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	4/19/1995	8.89208025	44.3291%	13	0.62	0.24	Yes
ATGC-01	5/23/1995	22.12664142	30.3514%	7	0.84	0.60	Yes
ATGC-01	7/3/1995	18.99847241	33.3302%	3	0.31	0.51	No
ATGC-01	8/10/1995	14.66716149	36.9667%	3	0.24	0.40	No
ATGC-01	9/7/1995	0.001	85.5196%	11	0.00	0.00	Yes
ATGC-01	10/16/1995	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	11/21/1995	0.638526649	74.4926%	3	0.01	0.02	No
ATGC-01	1/2/1996	33.67680389	23.2240%	3	0.54	0.91	No
ATGC-01	2/8/1996	19.72035757	32.4281%	3	0.32	0.53	No
ATGC-01	4/15/1996	28.86423619	25.3712%	3	0.47	0.78	No
ATGC-01	5/23/1996	33.67680389	23.2240%	4	0.73	0.91	No
ATGC-01	6/13/1996	67.36477777	14.5978%	3	1.09	1.82	No
ATGC-01	8/15/1996	3.598255783	55.1588%	3	0.06	0.10	No
ATGC-01	9/30/1996	0.734778003	72.6696%	3	0.01	0.02	No
ATGC-01	11/4/1996	0.662589488	74.2905%	3	0.01	0.02	No
ATGC-01	12/19/1996	26.45795234	26.7290%	3	0.43	0.71	No
ATGC-01	1/30/1997	28.86423619	25.3712%	3	0.47	0.78	No
ATGC-01	3/6/1997	64.95849392	14.9173%	3	1.05	1.75	No
ATGC-01	4/17/1997	38.48937159	21.3118%	3	0.62	1.04	No
ATGC-01	6/4/1997	60.14592622	15.7489%	3	0.97	1.62	No
ATGC-01	7/11/1997	5.042026092	51.4518%	3	0.08	0.14	No
ATGC-01	8/18/1997	0.855092196	71.5749%	3	0.01	0.02	No
ATGC-01	9/25/1997	1.913857089	62.8641%	3	0.03	0.05	No
ATGC-01	11/10/1997	1.312286127	67.0269%	3	0.02	0.04	No
ATGC-01	12/17/1997	6.726424786	48.2052%	3	0.11	0.18	No
ATGC-01	1/22/1998	22.3672698	30.2528%	3	0.36	0.60	No
ATGC-01	2/25/1998	33.67680389	23.2240%	3	0.54	0.91	No
ATGC-01	4/15/1998	120.3030224	9.8525%	3	1.95	3.24	No
ATGC-01	5/20/1998	7.929566711	46.1192%	3	0.13	0.21	No
ATGC-01	6/18/1998	36.08308774	22.1481%	3	0.58	0.97	No
ATGC-01	7/29/1998	6.485796402	48.6046%	3	0.10	0.17	No
ATGC-01	9/16/1998	0.47008678	76.3625%	3	0.01	0.01	No
ATGC-01	10/22/1998	1.673228704	64.3441%	3	0.03	0.05	No
ATGC-01	11/23/1998	4.560769323	52.8143%	3	0.07	0.12	No
ATGC-01	1/28/1999	45.70822313	19.0519%	3	0.74	1.23	No
ATGC-01	2/17/1999	33.67680389	23.2240%	3	0.54	0.91	No
ATGC-01	3/29/1999	24.0516685	28.1197%	3	0.39	0.65	No
ATGC-01	5/7/1999	156.3972802	8.4618%	3	2.53	4.22	No
ATGC-01	7/6/1999	1.143846258	68.8076%	3	0.02	0.03	No
ATGC-01	8/17/1999	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	9/23/1999	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	11/4/1999	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	12/17/1999	3.357627398	56.0985%	3	0.05	0.09	No
ATGC-01	1/26/2000	1.721354381	64.1656%	3	0.03	0.05	No
ATGC-01	3/1/2000	36.08308774	22.1481%	3	0.58	0.97	No
ATGC-01	4/19/2000	7.448309941	46.8756%	3	0.12	0.20	No
ATGC-01	5/24/2000	214.1480925	6.9301%	3	3.47	5.78	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Silver (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	6/22/2000	84.20876471	12.5822%	3	1.36	2.27	No
ATGC-01	8/16/2000	6.485796402	48.6046%	3	0.10	0.17	No
ATGC-01	10/2/2000	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	11/15/2000	10.81710733	41.3691%	3	0.18	0.29	No
ATGC-01	1/10/2001	20.44224272	31.8925%	3	0.33	0.55	No
ATGC-01	4/19/2001	8.89208025	44.3291%	3	0.14	0.24	No
ATGC-01	7/26/2001	0.710715165	72.9468%	3	0.01	0.02	No
ATGC-01	9/4/2001	1.360411804	66.8765%	3	0.02	0.04	No
ATGC-01	11/1/2001	21.64538465	30.6944%	3	0.35	0.58	No
ATGC-01	1/17/2002	31.27052004	24.2577%	3	0.51	0.84	No
ATGC-01	2/21/2002	218.9606602	6.7938%	3	3.54	5.91	No
ATGC-01	3/20/2002	1713.26293	0.6061%	3	27.72	46.20	No
ATGC-01	4/24/2002	103.4590355	11.0787%	3	1.67	2.79	No
ATGC-01	6/4/2002	45.70822313	19.0519%	7	1.73	1.23	Yes
ATGC-01	7/15/2002	1.769480058	63.8884%	6	0.06	0.05	Yes
ATGC-01	8/19/2002	0.734778003	72.6696%	3	0.01	0.02	No
ATGC-01	1/30/2003	1.43260032	65.8382%	3	0.02	0.04	No
ATGC-01	3/5/2003	74.58362932	13.4890%	3	1.21	2.01	No
ATGC-01	3/26/2003	163.6161317	8.2315%	3	2.65	4.41	No
ATGC-01	5/6/2003	401.8382327	4.2802%	3	6.50	10.84	No
ATGC-01	6/18/2003	96.24018395	11.5251%	3	1.56	2.60	No
ATGC-01	8/7/2003	3.357627398	56.0985%	6	0.11	0.09	Yes
ATGC-01	9/4/2003	4.079512553	53.9231%	3	0.07	0.11	No
ATGC-01	10/15/2003	0.518212457	75.8034%	3	0.01	0.01	No
ATGC-01	11/18/2003	40.89565544	20.5037%	3	0.66	1.10	No
ATGC-01	1/14/2004	28.86423619	25.3712%	3	0.47	0.78	No
ATGC-01	2/19/2004	36.08308774	22.1481%	3	0.58	0.97	No
ATGC-01	4/14/2004	79.39619701	13.0192%	3	1.28	2.14	No
ATGC-01	5/12/2004	9.613965405	42.8632%	3	0.16	0.26	No
ATGC-01	6/9/2004	4.560769323	52.8143%	2.9	0.07	0.12	No
ATGC-01	8/11/2004	3.116999014	56.9301%	3.6	0.06	0.08	No
ATGC-01	9/8/2004	0.036955687	84.6457%	3	0.00	0.00	No
ATGC-01	10/27/2004	86.61504856	12.3661%	3	1.40	2.34	No
ATGC-01	12/20/2004	12.50150602	39.2689%	3	0.20	0.34	No
ATGC-01	1/27/2005	16.83281695	34.8666%	3	0.27	0.45	No
ATGC-01	2/24/2005	26.45795234	26.7290%	3	0.43	0.71	No
ATGC-01	4/13/2005	153.9909963	8.5416%	3	2.49	4.15	No
ATGC-01	5/23/2005	5.042026092	51.4518%	3	0.08	0.14	No
ATGC-01	6/29/2005	0.253521234	79.9991%	3	0.00	0.01	No
ATGC-01	7/20/2005	1.986045605	62.5869%	3	0.03	0.05	No
ATGC-01	9/15/2005	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	10/31/2005	0.001	85.5196%	3	0.00	0.00	No
ATGC-01	12/6/2005	5.042026092	51.4518%	3	0.08	0.14	No
ATGC-02	7/7/1993	34.62504823	14.5978%	6	1.12	0.93	Yes
ATGC-02	9/13/1993	0.860028438	64.3441%	13	0.06	0.02	Yes
ATGC-02	12/15/1993	28.44097867	16.6416%	3	0.46	0.77	No
ATGC-02	9/22/2008	0.155044508	79.5245%	3.34	0.00	0.00	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Silver (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGH-10	12/15/1993	12.15229677	16.6416%	3	0.20	0.33	No
ATGH-10	7/8/1993	4.720679738	31.2582%	4	0.10	0.13	No
ATGH-10	9/13/1993	0.481517908	64.3441%	14	0.04	0.01	Yes
ATGH-10	8/8/2008	0.450116709	65.4247%	0.19	0.00	0.01	No
ATGH-10	7/16/2008	0.408248444	66.9470%	0.19	0.00	0.01	No
ATGH-10	9/22/2008	0.18320652	79.5245%	2.87	0.00	0.00	No
ATGM-01	12/13/1993	2.41126595	19.0519%	10	0.13	0.07	Yes
ATGM-01	9/28/1993	1.256114246	29.3366%	3	0.02	0.03	No
ATGM-01	6/17/1993	0.51986371	42.5860%	9	0.03	0.01	Yes
ATGM-01	8/12/2008	0.040031464	72.3877%	0.19	0.00	0.00	No
ATGM-01	7/17/2008	0.027337489	75.8034%	0.19	0.00	0.00	No
ATGM-01	9/25/2008	0.014643514	79.7266%	0.19	0.00	0.00	No

Appendix G
Sulfate Load Duration Curve Calculations

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Sulfate (mg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	1/25/1990	2.876	57.7%	1380	21,410.01	31,029.00	No
ATGC-01	3/7/1990	5.283	50.9%	1440	41,030.57	56,986.91	No
ATGC-01	4/11/1990	736.312	2.3%	424	1,683,916.07	8,470,812.72	No
ATGC-01	5/14/1990	401.838	4.3%	537	1,163,907.41	4,334,850.68	No
ATGC-01	6/14/1990	14.667	37.0%	1725	136,467.13	158,222.76	No
ATGC-01	7/24/1990	0.037	84.6%	1939	386.50	398.66	No
ATGC-01	9/11/1990	9.133	44.0%	276	13,595.70	98,519.57	No
ATGC-01	10/30/1990	0.205	82.4%	2427	2,688.77	2,215.72	Yes
ATGC-01	12/20/1990	74.584	13.5%	1035	416,367.43	804,574.75	No
ATGC-01	1/30/1991	113.084	10.5%	610	372,069.91	1,600,510.55	No
ATGC-01	3/7/1991	28.864	25.4%	1330	207,064.00	311,374.44	No
ATGC-01	4/9/1991	28.864	25.4%	1020	158,800.96	311,374.44	No
ATGC-01	5/13/1991	20.683	31.7%	930	103,749.66	223,117.54	No
ATGC-01	6/11/1991	4.561	52.8%	2300	56,579.46	49,199.53	Yes
ATGC-01	7/18/1991	0.037	84.6%	2540	506.30	398.66	Yes
ATGC-01	9/30/1991	0.000	85.5%	2500	-	-	Yes
ATGC-01	11/7/1991	0.000	85.5%	2300	-	-	Yes
ATGC-01	12/9/1991	19.480	32.6%	950	99,815.83	210,138.58	No
ATGC-01	1/21/1992	20.442	31.9%	1280	141,133.92	220,521.75	No
ATGC-01	2/25/1992	26.458	26.7%	740	105,604.11	285,416.53	No
ATGC-01	3/26/1992	57.740	16.2%	608	189,352.29	622,869.37	No
ATGC-01	4/28/1992	9.373	43.7%	122	6,168.04	101,115.36	No
ATGC-01	6/25/1992	17.795	34.2%	1365	131,018.19	191,968.05	No
ATGC-01	8/10/1992	2.636	58.8%	2114	30,053.90	28,433.21	Yes
ATGC-01	9/2/1992	14.427	37.1%	655	50,967.83	155,626.97	No
ATGC-01	12/1/1992	26.458	26.7%	1032	147,274.93	285,416.53	No
ATGC-01	1/5/1993	2695.027	0.2%	175	2,543,864.76	13,199,024.01	No
ATGC-01	2/10/1993	22.127	30.4%	1530	182,599.60	238,692.29	No
ATGC-01	3/18/1993	31.271	24.3%	1400	236,132.64	337,332.35	No
ATGC-01	4/22/1993	48.115	18.2%	1240	321,803.39	519,037.73	No
ATGC-01	6/8/1993	11.539	40.7%	1790	111,407.34	124,477.48	No
ATGC-01	7/13/1993	4.561	52.8%	2200	54,119.49	49,199.53	Yes
ATGC-01	9/16/1993	12.742	39.1%	1440	98,968.63	137,456.43	No
ATGC-01	11/15/1993	1821.546	0.5%	167	1,640,776.53	8,821,875.73	No
ATGC-01	12/14/1993	50.521	17.7%	1762	480,141.16	544,995.64	No
ATGC-01	1/13/1994	60.146	15.7%	770	249,798.50	648,827.28	No
ATGC-01	2/22/1994	221.367	6.7%	700	835,802.57	2,388,007.34	No
ATGC-01	4/20/1994	14.186	37.7%	1210	92,583.86	153,031.18	No
ATGC-01	5/17/1994	6.486	48.6%	1710	59,820.81	69,965.86	No
ATGC-01	6/22/1994	2.299	61.2%	2300	28,518.96	24,799.10	Yes
ATGC-01	8/11/1994	0.000	85.5%	3000	-	-	Yes
ATGC-01	9/22/1994	0.000	85.5%	2700	-	-	Yes
ATGC-01	11/1/1994	1.192	67.7%	2600	16,716.00	12,858.46	Yes
ATGC-01	12/19/1994	12.261	39.6%	1330	87,956.13	132,264.85	No
ATGC-01	1/24/1995	14.427	37.1%	97	7,547.91	155,626.97	No
ATGC-01	2/28/1995	243.023	6.4%	450	589,866.42	2,621,628.54	No
ATGC-01	4/19/1995	8.892	44.3%	1760	84,412.92	95,923.77	No
ATGC-01	5/23/1995	22.127	30.4%	1040	124,119.99	238,692.29	No
ATGC-01	7/3/1995	18.998	33.3%	1080	110,671.38	204,947.00	No
ATGC-01	8/10/1995	14.667	37.0%	480	37,973.46	137,250.33	No
ATGC-01	9/7/1995	0.000	85.5%	195	-	-	Yes
ATGC-01	1/2/1996	33.677	23.2%	3040	552,201.20	363,290.26	Yes
ATGC-01	2/8/1996	19.720	32.4%	1960	208,479.69	212,734.38	No
ATGC-01	4/15/1996	28.864	25.4%	171	26,622.51	262,550.93	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Sulfate (mg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	5/23/1996	33.677	23.2%	1510	274,284.15	363,290.26	No
ATGC-01	6/13/1996	67.365	14.6%	1250	454,188.14	726,701.02	No
ATGC-01	11/4/1996	0.663	74.3%	1600	5,718.17	7,147.72	No
ATGC-01	12/19/1996	26.458	26.7%	1130	161,260.34	285,416.53	No
ATGC-01	1/30/1997	28.864	25.4%	823	128,130.58	311,374.44	No
ATGC-01	3/6/1997	64.958	14.9%	662	231,945.97	700,743.11	No
ATGC-01	4/17/1997	38.489	21.3%	872	181,029.85	415,206.08	No
ATGC-01	6/4/1997	60.146	15.7%	586	190,106.39	753,483.13	No
ATGC-01	7/11/1997	5.042	51.5%	2060	56,022.85	54,391.12	Yes
ATGC-01	8/18/1997	0.855	71.6%	1600	7,379.48	9,224.35	No
ATGC-01	9/25/1997	1.914	62.9%	1490	15,381.14	20,645.83	No
ATGC-01	11/10/1997	1.312	67.0%	1890	13,377.75	14,156.35	No
ATGC-01	12/17/1997	6.726	48.2%	1670	60,588.98	72,561.65	No
ATGC-01	1/22/1998	22.367	30.3%	545	65,751.00	241,288.08	No
ATGC-01	2/25/1998	33.677	23.2%	982	178,375.52	363,290.26	No
ATGC-01	5/20/1998	7.930	46.1%	1200	51,324.37	85,540.61	No
ATGC-01	6/18/1998	36.083	22.1%	1050	204,355.29	389,248.17	No
ATGC-01	7/29/1998	6.486	48.6%	1350	47,226.96	69,965.86	No
ATGC-01	9/16/1998	0.470	76.4%	1250	3,169.43	5,071.09	No
ATGC-01	10/22/1998	1.673	64.3%	1770	15,974.29	18,050.04	No
ATGC-01	11/23/1998	4.561	52.8%	1938	47,674.35	49,199.53	No
ATGC-01	1/28/1999	45.708	19.1%	1064	262,318.46	493,079.82	No
ATGC-01	2/17/1999	33.677	23.2%	1280	232,505.77	363,290.26	No
ATGC-01	3/29/1999	24.052	28.1%	626	81,210.55	64,877.63	Yes
ATGC-01	7/6/1999	1.144	68.8%	1660	10,241.62	12,339.30	No
ATGC-01	8/17/1999	0.000	85.5%	2005	-	-	Yes
ATGC-01	9/23/1999	0.000	85.5%	2240	-	-	Yes
ATGC-01	11/4/1999	0.000	85.5%	2400	-	-	Yes
ATGC-01	12/17/1999	3.358	56.1%	1110	20,102.42	36,220.58	No
ATGC-01	1/26/2000	1.721	64.2%	2600	24,139.96	18,569.20	Yes
ATGC-01	4/19/2000	7.448	46.9%	1300	52,226.87	80,349.03	No
ATGC-01	5/24/2000	214.148	6.9%	213	246,029.23	1,958,993.30	No
ATGC-01	6/22/2000	84.209	12.6%	563	255,716.40	908,406.40	No
ATGC-01	8/16/2000	6.486	48.6%	1690	59,121.15	69,965.86	No
ATGC-01	11/15/2000	10.817	41.4%	1320	77,015.47	116,690.10	No
ATGC-01	1/10/2001	20.442	31.9%	912	100,557.92	220,521.75	No
ATGC-01	4/19/2001	8.892	44.3%	1270	60,911.60	95,923.77	No
ATGC-01	7/26/2001	0.711	72.9%	1490	5,711.82	1,917.10	Yes
ATGC-01	9/4/2001	1.360	66.9%	1490	10,933.26	14,675.51	No
ATGC-01	11/1/2001	21.645	30.7%	254	29,654.59	233,500.70	No
ATGC-01	1/17/2002	31.271	24.3%	1290	217,579.37	337,332.35	No
ATGC-01	2/21/2002	218.961	6.8%	417	492,487.31	2,362,049.43	No
ATGC-01	3/20/2002	1713.263	0.6%	109	1,007,264.22	4,621,402.18	No
ATGC-01	4/24/2002	103.459	11.1%	675	376,673.52	1,116,069.69	No
ATGC-01	6/4/2002	45.708	19.1%	1050	258,866.90	493,079.82	No
ATGC-01	7/15/2002	1.769	63.9%	2130	20,329.10	19,088.36	Yes
ATGC-01	8/19/2002	0.735	72.7%	12.4	49.14	7,926.46	No
ATGC-01	5/12/2004	9.614	42.9%	876	45,425.48	103,711.15	No
ATGC-01	6/9/2004	4.561	52.8%	803	19,753.61	49,199.53	No
ATGC-01	8/11/2004	3.117	56.9%	957	16,089.46	33,624.79	No
ATGC-01	9/8/2004	0.037	84.6%	1720	342.85	398.66	No
ATGC-01	10/27/2004	86.615	12.4%	1510	705,445.05	934,364.31	No
ATGC-01	12/20/2004	12.502	39.3%	1120	75,521.96	134,860.64	No
ATGC-01	1/27/2005	16.833	34.9%	856	77,718.33	181,584.88	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Total Sulfate (mg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGC-01	2/24/2005	26.458	26.7%	1140	162,687.42	285,416.53	No
ATGC-01	4/13/2005	153.991	8.5%	829	688,561.52	1,661,185.82	No
ATGC-01	5/23/2005	5.042	51.5%	1040	28,283.38	54,391.12	No
ATGC-01	6/29/2005	0.254	80.0%	2460	3,363.89	2,734.87	Yes
ATGC-01	7/20/2005	1.986	62.6%	1360	14,568.71	21,424.57	No
ATGC-01	9/15/2005	0.000	85.5%	2010	-	-	Yes
ATGC-01	10/31/2005	0.000	85.5%	1990	-	-	Yes
ATGC-01	12/6/2005	5.042	51.5%	300	8,158.67	54,391.12	No
ATGC-02	12/15/1993	28.441	16.6%	1842	282,570.65	306,808.53	No
ATGC-02	9/13/1993	0.860	64.3%	1710	7,932.35	9,277.60	No
ATGC-02	8/8/2008	0.786	65.4%	200	847.71	8,477.07	No
ATGC-02	7/16/2008	0.687	66.9%	150	555.73	7,409.69	No
ATGC-02	9/22/2008	0.155	79.5%	1950	1,630.74	1,672.55	No
ATGC-11	12/15/1993	7.327	16.6%	2542	100,463.76	79,043.08	Yes
ATGC-11	6/7/1993	1.783	38.3%	2160	20,771.86	19,233.20	Yes
ATGC-11	9/13/1993	0.222	64.3%	27	32.27	597.55	No
ATGC-11	8/8/2008	0.202	65.4%	200	218.39	2,183.95	No
ATGC-11	7/16/2008	0.177	66.9%	150	143.17	1,908.96	No
ATGC-11	9/22/2008	0.040	79.5%	2110	454.60	430.90	Yes
ATGH-09	12/15/1993	15.904	16.6%	953	81,749.82	171,563.11	No
ATGH-09	6/17/1993	2.929	42.6%	1310	20,696.17	31,597.21	No
ATGH-09	9/13/1993	0.595	64.3%	3220	10,333.24	6,418.16	Yes
ATGH-09	8/8/2008	0.554	65.4%	200	597.38	5,973.83	No
ATGH-09	7/16/2008	0.499	66.9%	150	403.60	5,381.38	No
ATGH-09	9/22/2008	0.204	79.5%	1470	1,614.77	2,196.97	No
ATGH-10	12/15/1993	12.152	16.6%	641	42,015.48	131,093.53	No
ATGH-10	7/8/1993	4.721	31.3%	770	19,605.96	50,924.58	No
ATGH-10	9/13/1993	0.482	64.3%	260	675.27	5,194.40	No
ATGH-10	8/8/2008	0.450	65.4%	200	485.57	4,855.66	No
ATGH-10	7/16/2008	0.408	66.9%	150	330.30	4,404.00	No
ATGH-10	9/22/2008	0.183	79.5%	2410	2,381.50	1,976.35	Yes
ATGM-01	12/13/1993	2.411	19.1%	1034	13,448.03	26,011.66	No
ATGM-01	9/28/1993	1.256	29.3%	1045	7,080.08	14,529.34	No
ATGM-01	6/17/1993	0.520	42.6%	1580	4,430.36	5,608.06	No
ATGM-01	8/8/2008	0.081	65.4%	74.9	32.58	217.51	No
ATGM-01	7/16/2008	0.070	66.9%	150	57.04	534.55	No
ATGM-01	9/22/2008	0.016	79.5%	148	12.70	131.25	No

Appendix H
Zinc, Copper, and Nickel Load Duration Curve Calculations

Station	DATE	Flow (CFS)	Flow Exceedence %	Parameter	Result (µg/L)	Actual Load (lb/day)	Allowable Load (lb/day)	Exceedence
ATGM-01	12/13/1993	2.4113	19.05%	Copper, Dissolved	46	0.60	1.129	No
ATGM-01	9/28/1993	1.2561	29.34%	Copper, Dissolved	160	1.08	0.514	Yes
ATGM-01	6/17/1993	0.5199	42.59%	Copper, Dissolved	190	0.53	0.269	Yes
ATGM-01	8/8/2008	0.0807	65.42%	Copper, Dissolved	3.23	0.0014	0.007	No
ATGM-01	7/16/2008	0.0705	66.95%	Copper, Dissolved	2.6	0.0010	0.011	No
ATGM-01	9/22/2008	0.0159	79.52%	Copper, Dissolved	3.74	0.0003	0.003	No
ATGM-01	12/13/1993	2.4113	19.05%	Nickel, Dissolved	410	5.33	1.071	Yes
ATGM-01	9/28/1993	1.2561	29.34%	Nickel, Dissolved	390	2.64	0.558	Yes
ATGM-01	6/17/1993	0.5199	42.59%	Nickel, Dissolved	440	1.23	0.231	Yes
ATGM-01	8/8/2008	0.0807	65.42%	Nickel, Dissolved	5.49	0.0024	0.036	No
ATGM-01	7/16/2008	0.0705	66.95%	Nickel, Dissolved	3.8	0.0014	0.031	No
ATGM-01	9/22/2008	0.0159	79.52%	Nickel, Dissolved	3.44	0.0003	0.007	No
ATGM-01	12/13/1993	2.4113	19.05%	Zinc, Dissolved	7200	93.64	1.554	Yes
ATGM-01	9/28/1993	1.2561	29.34%	Zinc, Dissolved	7300	49.46	0.810	Yes
ATGM-01	6/17/1993	0.5199	42.59%	Zinc, Dissolved	7400	20.75	0.335	Yes
ATGM-01	8/8/2008	0.0807	65.42%	Zinc, Dissolved	10.4	0.0045	0.052	No
ATGM-01	7/16/2008	0.0705	66.95%	Zinc, Dissolved	10.4	0.0040	0.045	No
ATGM-01	9/22/2008	0.0159	79.52%	Zinc, Dissolved	2.58	0.0002	0.010	No

Appendix I
Fecal Coliform Load Duration Curve Calculations

Station	DATE	Flow (CFS)	Flow Exceedence %	Fecal Coliform (cfu/100ml)	Actual Load (Mil Col/day)	Allowable Load (Mil Col/day)	Exceedence
ATGC-01	5/6/2003	401.838	2.00%	580	5702140.1	1966255.2	Yes
ATGC-01	5/14/1990	401.838	2.00%	1300	12780658.8	1966255.2	Yes
ATGC-01	5/24/2000	214.148	3.33%	4450	23314862.5	1047859.0	Yes
ATGC-01	6/18/2003	96.240	5.56%	74	174239.6	470917.8	No
ATGC-01	10/27/2004	86.615	5.92%	460	974787.2	423820.5	Yes
ATGC-01	6/22/2000	84.209	6.03%	2200	4532508.4	412046.2	Yes
ATGC-01	6/13/1996	67.365	6.95%	180	296663.4	329626.0	No
ATGC-01	6/4/1997	60.146	7.44%	145	213369.8	294303.1	No
ATGC-01	6/4/2002	45.708	8.69%	58	64860.6	223657.3	No
ATGC-01	6/18/1998	36.083	9.86%	460	406088.0	176560.0	Yes
ATGC-01	5/23/1996	33.677	10.31%	62	51083.6	164785.7	No
ATGC-01	5/23/2001	28.864	11.16%	166	117226.8	141237.1	No
ATGC-01	5/23/1995	22.127	13.16%	100	54134.5	108269.0	No
ATGC-01	5/13/1991	20.683	13.78%	2200	1113248.7	101204.4	Yes
ATGC-01	10/6/1992	19.480	14.22%	150	71488.0	95317.3	No
ATGC-01	7/3/1995	18.998	14.58%	152	70651.4	92962.4	No
ATGC-01	6/25/1992	17.795	15.24%	2900	1262591.2	87075.3	Yes
ATGC-01	6/14/1990	14.667	17.02%	900	322958.9	71768.6	Yes
ATGC-01	8/10/1995	14.667	17.02%	13600	4880268.2	71768.6	Yes
ATGC-01	9/2/1992	14.427	17.14%	28000	9882770.6	70591.2	Yes
ATGC-01	6/8/1993	11.539	19.37%	215	60696.7	56462.0	Yes
ATGC-01	5/12/2004	9.614	21.25%	60	14112.8	47042.6	No
ATGC-01	9/11/1990	9.133	21.99%	260	58094.1	44687.7	Yes
ATGC-01	5/20/1998	7.930	23.69%	74	14356.2	38800.6	No
ATGC-01	5/17/1994	6.486	26.13%	280	44430.4	31736.0	Yes
ATGC-01	7/29/1998	6.486	26.13%	780	123770.4	31736.0	Yes
ATGC-01	8/16/2000	6.486	26.13%	37	5871.2	31736.0	No
ATGC-01	5/23/2005	5.042	29.01%	40	4934.3	24671.4	No
ATGC-01	7/11/1997	5.042	29.01%	840	103619.9	24671.4	Yes
ATGC-01	6/11/1991	4.561	30.43%	10	1115.8	22316.5	No
ATGC-01	6/9/2004	4.561	30.43%	64	7141.3	22316.5	No
ATGC-01	7/13/1993	4.561	30.43%	225	25106.1	22316.5	Yes
ATGC-01	9/4/2003	4.080	31.77%	290	28944.4	19961.7	Yes
ATGC-01	8/15/1996	3.598	33.42%	1630	143495.6	17606.8	Yes
ATGC-01	9/13/2000	3.598	33.42%	3	264.1	17606.8	No
ATGC-01	8/7/2003	3.358	34.55%	48	3943.1	16429.4	No
ATGC-01	8/11/2004	3.117	35.64%	108	8236.1	15252.0	No
ATGC-01	8/10/1992	2.636	38.20%	700	45139.8	12897.1	Yes
ATGC-01	6/22/1994	2.299	41.26%	152	8549.0	11248.7	No
ATGC-01	7/20/2005	1.986	43.31%	145	7045.6	9718.0	No
ATGC-01	9/25/1997	1.914	43.77%	51	2388.0	9364.8	No
ATGC-01	10/22/1998	1.673	45.78%	14	573.1	8187.4	No
ATGC-01	9/4/2001	1.360	49.35%	72	2396.4	6656.7	No
ATGC-01	8/18/1997	0.855	55.88%	710	14853.6	4184.1	Yes
ATGC-01	8/19/2002	0.735	57.71%	307	5518.9	3595.4	Yes
ATGC-01	9/30/1996	0.735	57.71%	14	251.7	3595.4	No
ATGC-01	7/26/2001	0.711	58.21%	410	7129.2	3477.6	Yes
ATGC-01	6/14/2001	0.590	61.09%	60	866.7	2888.9	No

Station	DATE	Flow (CFS)	Flow Exceedence %	Fecal Coliform (cfu/100ml)	Actual Load (Mil Col/day)	Allowable Load (Mil Col/day)	Exceedence
ATGC-01	10/15/2003	0.518	62.50%	68	862.1	2535.7	No
ATGC-01	10/2/2002	0.494	63.02%	72	870.5	2418.0	No
ATGC-01	9/16/1998	0.470	63.48%	661	7602.2	2300.2	Yes
ATGC-01	6/29/2005	0.254	69.23%	86	533.4	1240.5	No
ATGC-01	10/30/1990	0.205	72.77%	10	50.3	1005.0	No
ATGC-01	7/24/1990	0.037	76.32%	10	9.0	180.8	No
ATGC-01	7/18/1991	0.037	76.32%	10	9.0	180.8	No
ATGC-01	9/8/2004	0.037	76.32%	90	81.4	180.8	No
ATGC-01	8/11/1994	0.000	77.78%	171	0.0	0.0	Yes
ATGC-01	9/30/1991	0.000	77.78%	140	0.0	0.0	Yes
ATGC-01	9/7/1995	0.000	77.78%	168	0.0	0.0	Yes
ATGC-01	9/22/1994	0.000	77.78%	270	0.0	0.0	No
ATGC-01	9/15/2005	0.000	77.78%	270	0.0	0.0	No
ATGC-01	10/31/2005	0.000	77.78%	28	0.0	0.0	Yes
ATGC-01	10/16/1995	0.000	77.78%	102	0.0	0.0	Yes
ATGC-01	10/2/2000	0.000	77.78%	165	0.0	0.0	Yes

Appendix J
BATHTUB Model Files

Harrisburg Land Use Summary

Land Cover Category	Area (Acres)	Percentage
Rural Grassland	1070.459083	26.59%
Soybeans	820.240279	20.37%
Upland	607.004512	15.08%
Corn	438.38415	10.89%
Floodplain Forest	351.769438	8.74%
Surface Water	299.168292	7.43%
Other Small Grains & Hay	101.532486	2.52%
Winter Wheat/Soybeans	81.720487	2.03%
Winter Wheat	54.225962	1.35%
Partial Canopy/Savannah Upland	52.05103	1.29%
Low/Medium Density	46.678315	1.16%
Other Agriculture	32.869151	0.82%
High Density	18.70054	0.46%
Coniferous	18.302397	0.45%
Shallow Water	15.531172	0.39%
Shallow Marsh/Wet Meadow	13.374132	0.33%
Deep Marsh	2.244206	0.06%
Swamp	1.511087	0.04%
Total	**4025.8**	100.00%

Note: Calculated from GIS

Global Inputs

Title: Harrisburg Reservoir
Notes:

	Historic Data	Units	Model Input	Model units
Averaging Period:	NA		1	yr
Precipitation	38.4	inches	0.97536	meters
Evaporation	36.1	inches	0.91694	meters
Increase in Storage	NA	NA		meters
Atmospheric Loads	NA	NS		

	inches to meters
Conversions:	0.0254

Note: Data extracted from Stage 1 report

Segment Inputs

Total Lake Segments	3		CONVERSIONS	ft to m
				0.3048
Segment Name:	Segment 1: RAI-3			
Outflow Segment:	Segment 2: RAI-2			
	Historic Data	Units	Model Input	Model units
MORPHOMETRY				
Surface Area	**0.286**	km	**0.286**	km2
Mean Depth	**8.4**	ft	**2.55**	meters
Length	**0.9600**	km	**0.9600**	km
Mixed Layer Depth	6.1	ft	1.86	m
Hypolimnetic Depth	7	ft	2.13	m
OBSERVED WQ				
Non-Algal Turbidity			1	1/m
Total Phosphorus	0.0920	mg/L	**92**	ug/L or ppb
Internal Load	NA	NA		mg/m2-day
Segment Name:	Segment 2: RAI-2			
Outflow Segment:	Segment 3: RAI-1			
	Historic Data	Units	Model Input	Model units
MORPHOMETRY				
Surface Area	**0.433**	km2	**0.433**	km2
Mean Depth	**14.5**	ft	**4.40**	meters
Length	**1.4000**	km	**1.4000**	km
Mixed Layer Depth	8.25	ft	2.51	m
Hypolimnetic Depth	12.7	ft	3.87	m
OBSERVED WQ				
Non-Algal Turbidity			1	1/m
Total Phosphorus	0.0860	mg/L	**86**	ug/L or ppb
Internal Load	NA	NA		mg/m2-day
Segment Name:	Segment 3: RAI-1			
Outflow Segment:	Out of Reservoir			
	Historic Data	Units	Model Input	Model units
MORPHOMETRY				
Surface Area	**0.232**	km2	**0.232**	km2
Mean Depth	**25.2**	ft	**7.69**	m
Length	**0.8300**	km	**0.8300**	km
Mixed Layer Depth	9.42	ft	2.87	m
Hypolimnetic Depth	16.166	ft	4.93	m
OBSERVED WQ				
Non-Algal Turbidity			1	1/m
Total Phosphorus	0.0700	mg/L	**70.0**	ug/L or ppb
Internal Load	NA	NA		mg/m2-day

Segment 1: RHH-3
Segment 2: RHH-2
Segment 3: RHH-1

Lake	Section	Area (ac)	SqMiles	sqKm
Harrisburg Res	RAI-3	70.6653	0.110415	0.285974
Harrisburg Res	RAI-2	107.082	0.167316	0.433347
Harrisburg Res	RAI-1	57.3644	0.089632	0.232147
		235.1117		

Tributary Inputs

Data may need to be generated from Unit Area Loads sheet if no trib concentration data are available
Flow data may need to be calculated if no gage data exists - use surrogate gage tab

Number of Tributaries **3**
Total area of the watershed = **4027.0** acres
Total annual estimated flow in the watershed = **5.43713024** mil m^3/yr

Tributary Name:	Overland Flow -3					
Segment:	Segment 1: RAI-3					
Tributary Type:						
	Historic Data	Units	Model Input	Model units	Notes	
Total Watershed Area	**3225.5**	acres	**13.053**	km2		*from GIS*
Flow Rate	**4.876868991**	cfs	**4.35504443**	million meters3/yr		*from 'Surrogate Gage Calculation"*
TP Conc	0.1635	mg/L	163.46	ug/L		

Tributary Name:	Overland Flow -2					
Segment:	Segment 2: RAI-2					
Tributary Type:						
	Historic Data	Units	Model Input	Model units	Notes	
Total Watershed Area	**589.3**	acres	**2.385**	km2		*from GIS*
Flow Rate	**0.89101124**	cfs	**0.79567312**	million meters3/yr		*from 'Surrogate Gage Calculation"*
TP Conc	0.1635	mg/L	163.46	ug/L		

Tributary Name:	Overland Flow -1					
Segment:	Segment 3: RAI-1					
Tributary Type:						
	Historic Data	Units	Model Input	Model units	Notes	
Total Watershed Area	**212.1**	acres	**0.858**	km2		*from GIS*
Flow Rate	**0.32073086**	cfs	**0.28641269**	million meters3/yr		*from 'Surrogate Gage Calculation"*
TP Conc	0.1635	mg/L	163.46	ug/L		

Lake	Section	Acres	sqKm	million meters3/yr	
Harrisburg Shed	RAI-3	3225.54	13.0532959	4.355044434	80%
Harrisburg Shed	RAI-2	589.31097	2.38485663	0.795673115	15%
Harrisburg Shed	RAI-1	212.13	0.85845956	0.286412686	5%
TOTAL		**4027.0**	**16.3**	**5.437130235**	

Unit Conversions:

1 acre= 0.004046856 square kilometer
1cfs = 0.893000087 mil m^3/yr

CDM	Client:	Illinois EPA	Job No.	Computed By:
	Project:	TMDL Harrisburg Reservoir Watershed	Dated Checked:	Date:
	Calculations:	**Total Phosphorus Loads**	Checked By:	Page No.

References:
1. "Illinois EPA Total Maximum Daily Load Middle Fork Saline Watersheds" prepared by CDM dated 2008
2. USEPA PLOAD Version 3.0 User's Manual dated January 2001
3. USGS Fact Sheet FS-195-97: "Unit-Area Loads of Suspended Sediment, Suspended Solid, And Total Phosphorus From Small Watersheds in Wisconsin" prepared by Corsi, Graczik, Owens, and Bannerman

Methodology:
Harrisburg Reservoir Watershed is predominantly rural grassland.
Therefore, the export coefficient method described on Page 3 of Reference 2 is used to calculate median total phosphorus loads.
The minimum and maximum phosphorus loads are calculated using the procedure described in "Estimating Loads" section of Reference 3.

1. Calculate Median Total Phosphorus Load
Assumptions:

Export coefficients per land use (lb/ac/yr) are given in Appendix IV of Reference 2. The export coeffients for the Wisconsin area located in Appendix IV are most appropriate for the Harrisburg Reservoir watershed due to similar climate characteristics. The land use distribution for Harrisburg Reservoir watershed is given on page 5-7 of Reference 1. Export coeficients were assumed for the Harrisburg Reservoir Land Use categories that are not listed in the Wisconsin categories. Assumed values are indicated with bold and italics.

Saganashkee Slough Lake Watershed Information		**Total Phosphorus Export Coefficients**		**Phosphorus Loads**			
Land Use	Area	High*	Low*	High	Low		
	acres	lb/ac/yr	lb/ac/yr	lb/yr	lb/yr	Source Categories	
Barren & Exposed Land	0	**0.16**	**0.16**	0.0	0.0	open lands	0.0
Coniferous	18	**0.13**	**0.08**	2.4	1.5	woodland (FL) - forest	
Corn	438	0.92	0.92	403.3	403.3	95% ag	403.3
Deep Marsh	2.2	**0.22**	***0.08***	0.5	0.2	wetland (FL)) - forest	0.3
Floodplain Forest	352	**0.13**	***0.08***	45.7	28.1	woodland (FL) - forest	36.9
High Density	19	**2.05**	1.00	38.3	18.7	Commercial (FL) - High Density	28.5
Low/Medium Density	47	0.52	0.04	24.3	1.9	Medium - Low density	13.1
Other Agriculture	33	0.92	0.92	30.2	30.2	95% ag	30.2
Other Small Grains & Hay	102	0.92	0.92	93.4	93.4	95% ag	93.4
Partial Canopy/Savannah Upland	52	0.13	0.08	6.8	4.2	woodland (FL) - forest	5.5
Rural Grassland	1,070	0.5	**0.16**	535.2	171.3	50% ag - open lands (FL)	353.3
Seasonally/Temporarily Flood	0	**0.22**	***0.08***	0.0	0.0	wetland (FL)) - forest	0.0
Shallow Marsh/Wet Meadow	13	**0.22**	***0.08***	2.9	1.1	wetland (FL)) - forest	2.0
Shallow Water	16	**0.22**	***0.08***	3.4	1.2	wetland (FL)) - forest	2.3
Soybeans	820	0.92	0.92	754.6	754.6	95% ag	754.6
Surface Water	299	**0.22**	***0.08***	65.8	23.9	wetland (FL)) - forest	44.9
Swamp	1.5	**0.22**	***0.08***	0.3	0.1	wetland (FL)) - forest	
Upland	607	**0.13**	0.08	78.9	48.6	woodland (FL) - forest	63.7
Urban Open Space	0	**0.16**	0.03	0.0	0.0	open lands (FL) - parks	0.0
Winter Wheat	54	0.92	0.92	49.9	49.9	95% ag	49.9
Winter Wheat/Soybeans	82	0.92	0.92	75.2	75.2	95% ag	75.2
TOTAL	**4,026**			**2,211**	**1,707**		1959.3

*Export coefficient valuus listed in Appendix IV are MEDIAN values. The ranges for each land use are assumed.
Bold: No category for this land use in Wisconsin unit area loads. Use Florida unit area loads
Bold Italic: No category for this land use in Appendix IV. Use forest land use value.

Results:

The export coefficient values lised in Appendix IV of Reference 2 are median values. Therefore, the range calculated with this method is a range for the median, rather than a range between the minimum and maximum loads. The results show that the Harrisburg Reservoir watershed median Phosphorus load ranges between **1,707-2,211** lb/yr.

BJB
4/13/2009
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Trib Name	Trib Area (acres)	Percent of Total	Trib Flow (mil m^3/yr)	Trib load (lbs/yr)	Trib Concentration(ug/L)
Direct Flow 3 (RAI-3)	3226	80.1%	4.3550	1569.38	163.46
Direct Flow 2 (RAI-2)	589	14.6%	0.7957	286.73	163.46
Direct Flow 1 (RAI-1)	212	5.3%	0.2864	103.21	163.46
	4027	1.00	5.4371	1959.32	490

5.367994279 lbs/day

Unit Conversions:

1 cu m = 1000 liters
I pound = 453.59237 grams or 10^6 ug
(1 lb/yr) **/** (1 mil m^3/yr) = 0.45359237 ug/L

Median phosphorous load in the watershed = 1959.327171 lb/yr
Total average annual estimated flow in the watershed = 5.437130235 mil m^3/yr

BATHTUB Calibration Output

Calibration factors	Total P
Segment 1	0.64
Segment 2	0.135
Segment 3	0.52

Loadings	Observed	Predicted	Observed	Predicted
Segment 1: RAI-3	92.0	92.3	0.000	0.14
Segment 2 : RAI-2	85.5	85.4	0.000	0.15
Segment 3: RAI-1	69.7	69.8	0.000	0.19
Area-Wtd Mean	83.6	83.7	0.000	0.15

Harrisburg Reservoir Existing

File: **C:\Documents and Settings\bennettbj\My Documents\BATHTUB\bath\Harrisburg_Existing_v2_Decay.btb**

Overall Water & Nutrient Balances

Overall Water Balance — **Averaging Period = 1.00 years**

Trb	Type	Seg	Name	Area km^2	Flow hm^3/yr	Variance $(hm3/yr)^2$	CV -	Runoff m/yr
1	1	1	RAI-3 Watershed	13.1	4.4	0.00E+00	0.00	0.33
2	1	2	RAI-2 Watershed	2.4	0.8	0.00E+00	0.00	0.33
3	1	3	RAI-1 Watershed	0.9	0.3	0.00E+00	0.00	0.33
PRECIPITATION				1.0	0.9	0.00E+00	0.00	0.98
TRIBUTARY INFLOW				16.3	5.4	0.00E+00	0.00	0.33
***TOTAL INFLOW				17.2	6.4	0.00E+00	0.00	0.37
ADVECTIVE OUTFLOW				17.2	5.5	0.00E+00	0.00	0.32
***TOTAL OUTFLOW				17.2	5.5	0.00E+00	0.00	0.32
***EVAPORATION					0.9	0.00E+00	0.00	

Overall Mass Balance Based Upon — **Predicted** — **Outflow & Reservoir Concentrations**

Component: **TOTAL P**

Trb	Type	Seg	Name	Load kg/yr	%Total	Load Variance $(kg/yr)^2$	%Total	CV	Conc mg/m^3	Export $kg/km^2/yr$
1	1	1	RAI-3 Watershed	711.9	77.6%	0.00E+00		0.00	163.5	54.5
2	1	2	RAI-2 Watershed	130.1	14.2%	0.00E+00		0.00	163.5	54.5
3	1	3	RAI-1 Watershed	46.8	5.1%	0.00E+00		0.00	163.5	54.6
PRECIPITATION				28.5	3.1%	2.03E+02	100.0%	0.50	30.8	30.0
TRIBUTARY INFLOW				888.7	96.9%	0.00E+00		0.00	163.5	54.5
***TOTAL INFLOW				917.3	100.0%	2.03E+02	100.0%	0.02	144.1	53.2
ADVECTIVE OUTFLOW				383.4	41.8%	5.38E+03		0.19	69.8	22.2
***TOTAL OUTFLOW				383.4	41.8%	5.38E+03		0.19	69.8	22.2
***RETENTION				533.9	58.2%	5.47E+03		0.14		

Overflow Rate (m/yr)	5.8	Nutrient Resid. Time (yrs)	0.4030
Hydraulic Resid. Time (yrs)	0.8045	Turnover Ratio	2.5
Reservoir Conc (mg/m3)	84	Retention Coef.	0.582

Harrisburg Reservoir Existing
File: C:\Documents and Settings\bennettbj\My Documents\BATHTUB\bath\Harrisburg_TMDL_v2_Decay.btb

Overall Water & Nutrient Balances

Overall Water Balance — **Averaging Period = 1.00 years**

Trb	Type	Seg	Name	Area km^2	Flow hm^3/yr	Variance $(hm3/yr)^2$	CV -	Runoff m/yr
1	1	1	RAI-3 Wat	13.1	4.4	0.00E+00	0.00	0.33
2	1	2	RAI-2 Wat	2.4	0.8	0.00E+00	0.00	0.33
3	1	3	RAI-1 Wat	0.9	0.3	0.00E+00	0.00	0.33
PRECIPITATION				1.0	0.9	0.00E+00	0.00	0.98
TRIBUTARY INFLOW				16.3	5.4	0.00E+00	0.00	0.33
***TOTAL INFLOW				17.2	6.4	0.00E+00	0.00	0.37
ADVECTIVE OUTFLOW				17.2	5.5	0.00E+00	0.00	0.32
***TOTAL OUTFLOW				17.2	5.5	0.00E+00	0.00	0.32
***EVAPORATION					0.9	0.00E+00	0.00	

Overall Mass Balance Based Upon — **Predicted** — **Outflow & Reservoir Concentrations**
Component: — **TOTAL P**

Trb	Type	Seg	Name	Load kg/yr	%Total	Load Variance $(kg/yr)^2$	%Total	CV	Conc mg/m^3	Export $kg/km^2/yr$
1	1	1	RAI-3 Wat	270.0	61.4%	0.00E+00		0.00	62.0	20.7
2	1	2	RAI-2 Wat	94.7	21.5%	0.00E+00		0.00	119.0	39.7
3	1	3	RAI-1 Wat	46.8	10.6%	0.00E+00		0.00	163.5	54.6
PRECIPITATION				28.5	6.5%	2.03E+02	100.0%	0.50	30.8	30.0
TRIBUTARY INFLOW				411.5	93.5%	0.00E+00		0.00	75.7	25.3
***TOTAL INFLOW				440.0	100.0%	2.03E+02	100.0%	0.03	69.1	25.5
ADVECTIVE OUTFLOW				249.1	56.6%	1.36E+03		0.15	45.3	14.4
***TOTAL OUTFLOW				249.1	56.6%	1.36E+03		0.15	45.3	14.4
***RETENTION				191.0	43.4%	1.40E+03		0.20		

Overflow Rate (m/yr)	5.8	Nutrient Resid. Time (yrs)	0.4898
Hydraulic Resid. Time (yrs)	0.8045	Turnover Ratio	2.0
Reservoir Conc (mg/m3)	49	Retention Coef.	0.434

Appendix K
Responsiveness Summary

Responsiveness Summary

This responsiveness summary responds to substantive questions and comments received during the public comment period from May 12, 2009 through June 11, 2009 postmarked, including those from the August 10, 2010 public meeting discussed below.

What is a TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. The Middle Fork Saline River Watershed TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to the impaired water bodies and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and regulations thereunder.

Background

The watershed targeted for TMDL development is Middle Fork Saline River Watershed and encompasses five counties with Williamson County covering 28,929 acres (18 %) percent of the watershed, Saline County 119,182 acres (74 %), Franklin County 7586 acres (5 %), Hamilton County 3567 acres (2 %) and Gallatin County 1298 acres (1 %) The watershed encompasses an area of approximately 160,562 acres). Land use in the watershed is predominately agriculture. The Clean Water Act and USEPA regulations require that states develop TMDLs for waters on the Section 303(d) List. Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards therefore a TMDL was developed for Oxygen, Fecal Coliform, Manganese, pH, Iron, Copper, Nickel, Silver, Sulfates, Zinc. The Illinois EPA contracted with Camp Dresser and McKee to prepare a TMDL report for the Middle Fork Saline River Watershed.

Public Meetings

Public meetings were held in the City of Harrisburg on May 12, 2009 and August 10, 2010. The Illinois EPA provided public notices for the meeting by placing display ads in the Harrisburg Daily Register. These notices gave the date, time, location, and purpose of the meeting. They also provided references to obtain additional information about this specific site, the TMDL Program and other related issues. Approximately 92 individuals and organizations were also sent the public notices by first class mail. The draft TMDL Report was available for review at the Harrisburg City Hall and Saline County and Williamson County Soil and Water Conservation District offices, and also on the Agency's web page at http://www.epa.state.il.us/water/tmdl .

A public meeting started at 6:00 p.m. on Tuesday, August 10, 2010. It was attended by approximately 6 persons and concluded at 7:45 p.m. with the meeting record remaining open until midnight, August 24, 2010.

Questions and Comments

There were no questions or comments from the meetings.