CORRECTIVE ACTION PLAN

FOR THE

TVA KINGSTON FOSSIL PLANT ASH RELEASE

Prepared By:

Tennessee Valley Authority

March 2, 2009

I certify under penalty of law, including but not limited to penalties for perjury, that the information contained in this document and on any attachment is true, accurate and complete to the best of my knowledge, information and belief. I am fully aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for intentional violation.

Warren P. Behlau

STATE OF TENNESSEE)
) SS
COUNTY OF ROANE)

Personally appeared before me, Gary Godfrey, a Notary Public At Large, State of Tennessee, Warren P. Behlau, personally known to me, and says that the facts herein stated are true, and acknowledged that he executed the same.

Sworn to and subscribed before me this 27th day of February, 2009.

Gary Godfrey
Notary Public

GARY GODFREY STATE OF TENNESSEE NOTARY PUBLIC HAMILTON COUNTY

MY COMMISSION EXPIRES DEC. 26, 2011

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ACRONYMS LIST

AAMP	AMBIENT AIR MONITORING PLAN
AECOM	AECOM TECHNOLOGY CORPORATION
AM	ACTION MEMORANDUM
ARARS	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
BTEX	BENZENE, TOLUENE, ETHYL BENZENE, AND XYLENE
CAP	CORRECTIVE ACTION PLAN
CERCLA	COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980
CRM	CLINCH RIVER MILE
DOE	DEPARTMENT OF ENERGY
DQO	DATA QUALITY OBJECTIVE
EA	ENVIRONMENTAL ASSESSMENT
EE / CA	ENGINEERING EVALUATION / COST ANALYSIS
EIS	ENVIRONMENTAL IMPACT STATEMENT
EMHS	EMERGENCY MANAGEMENT AND HOMELAND SECURITY
EPA	ENVIRONMENTAL PROTECTION AGENCY
ERM	EMORY RIVER MILE
IH	INDUSTRIAL HYGIENE
JSA	JOB SAFETY ANALYSIS
KIF	KINGSTON FOSSIL PLANT
KWTP	KINGSTON WATER TREATMENT PLANT
MCL	MAXIMUM CONTAMINANT LEVEL
MSDS	MATERIAL SAFETY DATA SHEETS
MSL	MEAN SEA LEVEL
NEPA	NATIONAL ENVIRONMENTAL POLICY ACT
NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
ORNL	OAK RIDGE NATIONAL LABORATORY
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
PCB	POLYCHLORINATED BIPHENYL
PELS	PERMISSIBLE EXPOSURE LIMITS
PM10	PARTICULATE MATTER < 10 MICRONS
PM2.5	PARTICULATE MATTER < 2.5 MICRONS
PPE	PERSONAL PROTECTIVE EQUIPMENT
PRG	PRELIMINARY REMEDIATION GOALS
ROD	RECORD OF DECISION
RWTP	ROCKWOOD WATER TREATMENT PLANT
SAP	SAMPLING AND ANALYSIS PLAN
SHARE	SAFETY HAZARD ASSESSMENT REPORT AND EVALUATION
SHPO	STATE HISTORIC PRESERVATION OFFICER
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
TAL	TARGET ANALYTE LIST
TCLP	TOXICITY CHARACTERISTIC LEACHING PROCEDURE
TDEC	TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
TDOT	TENNESSEE DEPARTMENT OF TRANSPORTATION
TRM	TENNESSEE RIVER MILE

TVA	TENNESSEE VALLEY AUTHORITY
TWRA	TENNESSEE WILDLIFE RESOURCES AGENCY
U.S. FWS	U.S. FISH AND WILDLIFE SERVICE
USCG	U.S. COAST GUARD

EXECUTIVE SUMMARY

On Monday, December 22, 2008, a dike containing the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF) dredge cells failed, releasing about 5.4 million cubic yards of fly ash and bottom ash into adjacent waterways and over land. TVA responded immediately. A number of emergency response actions and sampling activities as well as community outreach programs were initiated without delay. Subsequently, the Tennessee Department of Environment and Conservation (TDEC) issued a Commissioner's Order, Case No. OGC09-0001 requiring action be taken as necessary to respond to the emergency under Tennessee Code Annotated § 69-3-109(B)(1), the Water Quality Control Act. As part of this Order, TVA is required to prepare and submit a Corrective Action Plan (CAP) within 45 days of receipt of the order. This document is the CAP.

The Order directs that the CAP shall include the following elements:

A. A plan for the comprehensive assessment of soil, surface water, and groundwater; remediation of affected media; and, restoration of all natural resources damaged as a result of the coal ash release;

B. A plan for monitoring the air and water in the area during the cleanup process;

C. A plan to ensure that public and private water supplies are protected from contamination and that alternative water supplies are provided if contamination is detected;

D. A plan addressing both the short term and long term management of coal ash at the Kingston Plant, including remediation and stabilization of the failed ash waste cells, proper management of the recovered ash, and a revised closure plan for the Class II ash disposal facility; and,

E. A plan to address any health or safety hazards posed by the ash to workers and the public.

TVA's objectives for the recovery effort are:

- Maintaining the health and safety of the public and response personnel;
- Involving the public, affected property owners, and other agencies in the formulation of response activities;
- Restoring impacted natural and public resources expeditiously; and
- Making things as good, if not better than they were before.

In addition to the Order, two statutory programs provide helpful processes and guidance for formulation of the CAP: (1) the National Environmental Policy Act (NEPA) and (2) the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). NEPA requires that environmental considerations be incorporated into agency decision making. TVA, other agencies, and key stakeholders are familiar with the NEPA process and using this process would provide a framework for the effort that may be comfortable for many people. CERCLA and its methodologies can be used to formulate and test a CAP to ensure that it appropriately restores the impacted area and that the public and the environment are protected in the short-

and long-term. Both NEPA and CERCLA require analyses of potentially impacted resources, the formulation of alternatives to restore those resources, and appropriately protect public health and the environment, and involvement of the public and other agencies in doing this. TVA reviewed both the NEPA and CERCLA processes in the formulation of this CAP for the approval of TDEC and the U.S. Environmental Protection Agency (EPA).

Figure ES.1 illustrates the actions and plans that will be taken and developed for the various components of this CAP. There are numerous actions that have already been identified that need to be performed, and it is likely that more will be identified as recovery progresses. Changes in methods and plan components that are identified as the cleanup progresses would be captured in subsequent plans to the CAP.

Another important aspect of TVA's proposed approach is the formation of an Interagency Team that will consist of personnel from involved and interested federal, state, and local agencies. Members of this team would be involved in all steps of the cleanup effort and could individually serve as a sounding board for proposed activities and technical and scientific resources to help inform the effort. For this Interagency Team, members tentatively identified include TDEC, EPA, the Tennessee Department of Public Health, the Tennessee Wildlife Resources Agency, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Roane County, TVA and possibly others.

Finally, TVA intends to develop a Community Involvement Plan that would provide a structured process enabling public review and input. It would also explain the opportunities that will be provided to the public to involve itself in this effort. This plan will be released for agency and public comment. At a minimum, it will consist of identified opportunities for public comment and meetings on components of the plan as they are formulated, associated analyses, and environmental reviews. It will also include a publicly accessible and usable administrative record that will include all monitoring results, analyses, public comments, and the plans themselves. TVA is already providing such information at its public internet site and it intends to continue to do so.

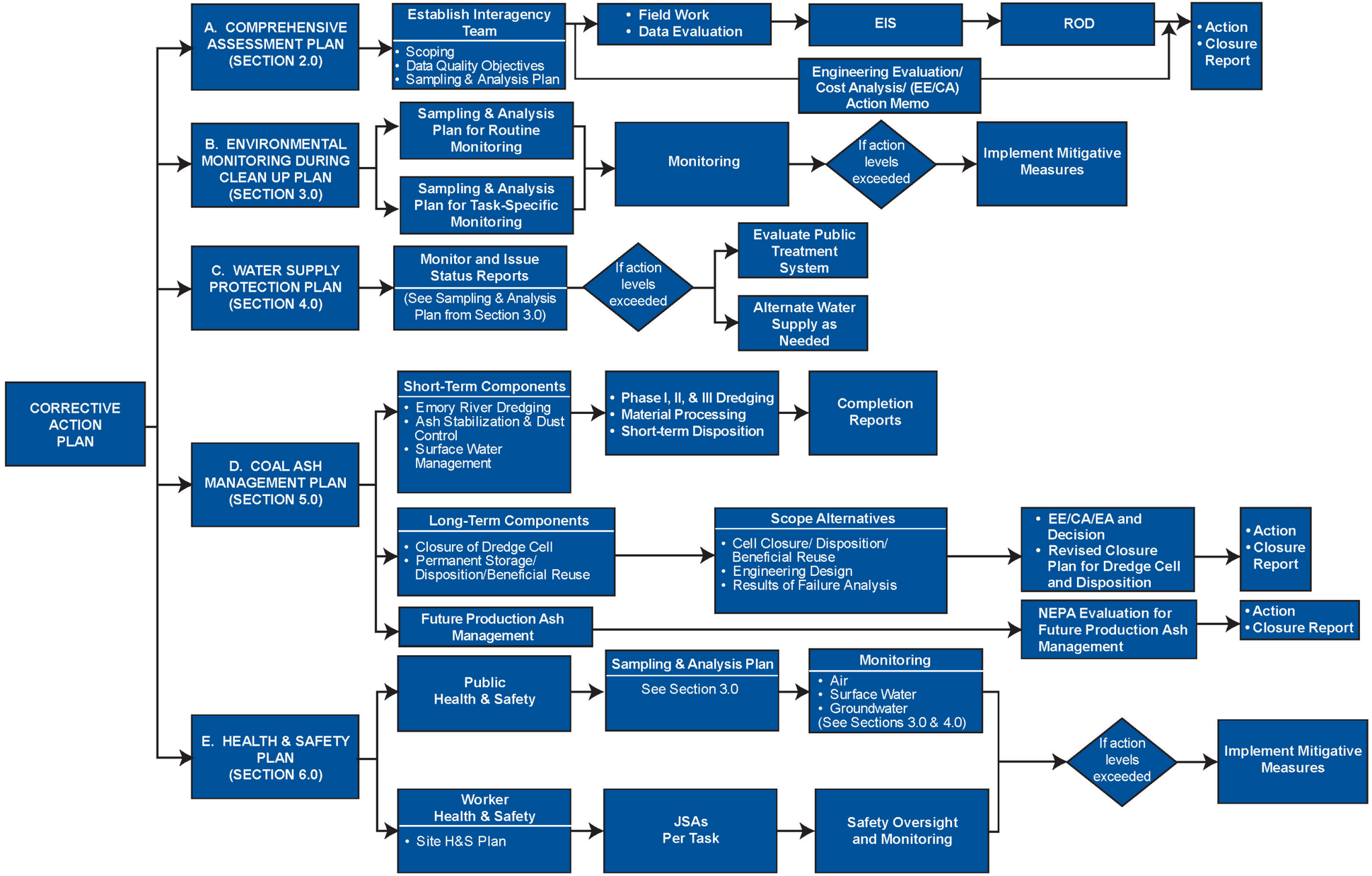


Figure ES.1. Components of the Corrective Action Plan and Proposed Implementation Steps

1.0 INTRODUCTION

On Monday, December 22, 2008, a dike containing the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF) dredge cells failed, releasing about 5.4 million cubic yards (cy) of fly ash and bottom ash into adjacent waterways and over land. Subsequently, the Tennessee Department of Environment and Conservation (TDEC) issued a Commissioner's Order, Case No. OGC09-0001 requiring action be taken as necessary to respond to the emergency under Tennessee Code Annotated § 69-3-109(B)(1), the Water Quality Control Act. As part of this Order, TVA is required to prepare and submit a Corrective Action Plan (CAP) within 45 days of receipt of the order. This document is the CAP.

The CAP includes the following elements in response to the Commissioner's Order:

A. A plan for the comprehensive assessment of soil, surface water, and groundwater; remediation of impacted media; and, restoration of all natural resources damaged as a result of the coal ash release;

B. A plan for monitoring the air and water in the area during the cleanup process;

C. A plan to ensure that public and private water supplies are protected from contamination and that alternative water supplies are provided if contamination is detected;

D. A plan addressing both the short term and long term management of coal ash at the Kingston Plant, including remediation and stabilization of the failed ash waste cells, proper management of the recovered ash, and a revised closure plan for the Class II ash disposal facility; and,

E. A plan to address any health or safety hazards posed by the ash to workers and the public.

Plans previously submitted for the short-term work underway are referenced.

Sections 1.1 and 1.2 provide background information and summarize TVA's initial response actions. Section 1.3 outlines the organization of the CAP.

TVA's objectives for the recovery effort are:

- Maintaining the health and safety of the public and response personnel;
- Involving the public, affected property owners, and other agencies in the formulation of response activities;
- Restoring impacted natural and public resources expeditiously; and
- Making things as good, if not better than they were before.

1.1 BACKGROUND

1.1.1 SITE SETTING

KIF is located on the Emory River close to the confluence of the Clinch and Tennessee rivers near Kingston, Tennessee. Construction of the plant began in 1951 and was completed in 1955. Kingston generates 10 billion kilowatt-hours of electric power each year, enough to supply the needs of about 670,000 homes in the Tennessee Valley. The plant consumes approximately 14,000 tons of coal per day when operating at full power.

The Emory River at the KIF site is impounded by Watts Bar Dam. The normal summer and winter pool levels of Watts Bar Reservoir in the vicinity of KIF are 741 and 735 feet mean sea level (msl), respectively. The Emory River originates on the Cumberland Plateau and its inflows to Watts Bar Reservoir are not regulated. Flows in the nearby Clinch River arm of Watts Bar Reservoir are regulated by Melton Hill Dam.

Fly ash is a product of burning pulverized coal in generation plants such as KIF. KIF produces about 1,000 tons or approximately 1,200 cy of fly ash per day when operating at full power. Fly ash is a fine powdery material that is removed from the plant's exhaust stream by electrostatic precipitators. The collected fly ash is then sluiced in a water-based slurry to a wet ash pond for settling. The ash was then dredged from the settling pond and piped to long-term storage ponds also known as dredge cells. The three KIF dredge cells covered about 84 acres and stored about 9.4 million cy of both fly and bottom ash in mid-December 2008.

1.1.2 SUMMARY OF RELEASE

On Monday, December 22, 2008, a dike containing the KIF dredge cells failed, releasing about 5.4 million cy of fly ash and bottom ash. Ash was released from about 60 acres of the 84-acre dredge cell complex. The spilled material now covers about 300 acres of adjacent parts of the Emory River, including most of Swan Pond Embayment, and reservoir shorelands. Most of this property is owned by TVA. Figure 1.1 illustrates the area prior to the dike failure, and Figure 1.2 shows the area on December 30, 2008, after the dike failure. No injuries occurred, but about 40 residences were directly affected by ash deposits or water surge. Three houses were severely damaged and are now uninhabitable. Swan Pond Road, Swan Pond Circle, and portions of the rail line serving KIF were covered with ash. Water, electrical, and gas services to the adjacent area were interrupted.

1.2 SUMMARY OF RESPONSE ACTIONS PERFORMED

TVA responded immediately when the ash was released. A number of emergency response actions and sampling activities as well as community outreach programs were initiated promptly. This section discusses the response actions and community outreach programs. A later section describes the sampling completed to date and the results of this sampling.

Figure 1.1. Kingston Fossil Plant Prior to the Ash Spill

Figure 1.2. Kingston Fossil Plant After the December 22, 2008 Ash Spill

1.2.1 EMERGENCY RESPONSE ACTIONS

TVA and Roane County Office of Emergency Management and Homeland Security (EMHS) responded immediately upon notice of the release. The National Response Center was notified by TVA of the release. TVA activated an Incident Command System response organization to manage the recovery project. Members of the Unified Command included TVA, U.S. Environmental Protection Agency (EPA) Region 4, TDEC, Roane County EMHS, Tennessee Emergency Management Agency, and Tennessee Department of Health. The U.S. Coast Guard, U.S. Fish and Wildlife Service (U.S. FWS), and the U.S. Army Corps of Engineers were also informed of the release. In addition, TVA staff also contacted the office of the State Historic Preservation Officer (SHPO) and federally recognized tribes and informed them that there may have been impacts to known cultural resources.

1.2.2 COMMUNITY OUTREACH

Immediately after the incident, TVA provided hotel rooms, meals, transportation, and other support to impacted residents to ensure that their immediate needs were met. TVA established community outreach teams made up of plant employees and TVA retirees to work with homeowners in the affected areas. TVA activated a phone number (800-257-2675) for property owners to call for assessments of property damages. An Outreach Center (phone number 865-632-1700) was opened at 509 North Kentucky Street in Kingston and a general information number established; 865-717-4006. TVA has held a public meeting to provide information and answer questions about the ash spill; attended three local government meetings; conducted three Unified Command technical briefings in the local area; provided testimony to a U.S. Senate committee; and provided senior management representatives as guests on local radio and television programs. In addition, over 50 Federal, State, and local officials have visited the site to gain a better understanding. Information in the form of Material Safety Data Sheets (MSDSs) and handouts was made available to local residents to help make them aware of potential hazards and actions they could take to minimize risk. TVA established a dedicated website, www.tva.gov/kingston, and provided frequent updated information on the incident including links to other agency web sites.

Sampling data collected by TVA, TDEC, and EPA and associated summary reports are provided on their respective web sites.

1.2.3 ROADWAY AND RAILWAY CLEANUP

Shortly after the ash spill, TVA began removing ash from the railroad and Swan Pond Road. Ash was moved from the roadways by heavy equipment and placed back on site at KIF until final disposition of the reclaimed ash is determined. All of the ash has been removed from Swan Pond Road and Swan Pond Circle. Because of the presence of heavy equipment, these roads remain closed to the public. There is currently no estimate for when the roads will reopen for public use. Ash has been removed from the railroad, and the damaged 3,000-foot portion of the railroad was rebuilt along the original alignment. The railroad was reopened to rail traffic on January 5, 2009. Water and gas utilities were restored on December 28, 2008, and electricity was restored on December 24, 2008.

1.2.4 ASH DUST CONTROL

The undisturbed portion of the ash cell and existing dike walls have been treated with a water-soluble vinyl acrylic emulsion, a nontoxic liquid dust suppression agent that TVA has previously used at KIF and other fossil plants. In an attempt to establish a temporary vegetative cover, the

exposed spilled ash was seeded using a helicopter by first spreading a mixture of grass seed and fertilizer, followed by straw. The grass seed consisted of a mixture of winter rye (25 pounds per acre) and 12-24-24 fertilizer (400 pounds per acre). Approximately 213 acres have been seeded in this manner. Efforts were made to avoid drift of the seed/fertilizer mixture and straw into the reservoir. Areas that could not be easily accessed by air were treated using an amphibious vehicle. Portions of these areas were also treated with an erosion control mulch, which was applied using a truck mounted sprayer or a sled mounted sprayer towed by an amphibious vehicle.

Dust at active work areas along Swan Pond Road and elsewhere on the site is being controlled by spraying with water, a method that has been used at KIF for years in the ash pond area. Vehicle wheels and equipment that have been exposed to the ash are being washed as they leave the construction area. The road is also being sprayed with water or cleaned with a vacuum sweeper to control fugitive dust. To reduce dusting during freezing conditions, TVA applied a calcium chloride solution along portions of the gravel covered roads that are being used by construction equipment. Long-term stabilization and dust control methods will be addressed in the restoration and remediation plan currently being developed. A 24-hr contact was provided to the public to report any observed airborne dust activity.

1.2.5 STABILIZATION OF FAILED ASH CELLS

A fall safety zone has been established next to high-walls. This zone is established as a minimum distance of 1.5 times the exposed heights of the highwall. This value provides a safe working zone for equipment operators and on-ground personnel. A rock buttress has been designed to be placed at the toe of the constructed fill slope to 1) further improve the factor of safety against instability by providing additional weight and frictional resistance to sliding forces that may develop during construction of the fill slope and 2) to serve as a “counter-balance”, increasing the factor of safety against rotational failure. A 100-ft clear zone is being left between the fall safety zone and Swan Pond Road to provide additional protection.

Dike C forms the perimeter embankment for the ash pond and final settling pond structures (Figure 1.3). Dike C is bounded by the Emory River and plant intake channels to the east and the former dredge cell structure to the west. Dike D is the embankment structure which physically delineates the western boundary of the ash pond from the adjacent dredge cell area. Immediately following the incident, engineering teams visually assessed the conditions of the two dikes. The area of highest concern was the northern limits of Dike D at the intersection of Dike C. The observed conditions included indications of strain along Dike D in the form of tension or compression cracks in both the longitudinal and transverse directions as well as a steep scarp line formed on the western side of Dike D which developed during the dredge cell incident.

Immediate action items included a formal monitoring program to assess additional distress, seepage, or other changed conditions. In addition, a clay soil cap was constructed over the area of concern to reduce the potential for surface water infiltration associated with rainfall events. A geotechnical instrumentation program was implemented including installation of slope inclinometers and piezometers. A Dike D buttress mitigation plan was executed which consisted of zoned embankment construction along the Dike D scarp line. The operational ash pond pool was also lowered roughly 2 feet.

TVA retained AECOM Technology Corporation (AECOM) in early January 2009 to conduct an independent analysis to determine the root cause of the Kingston dike failure. As of mid-February, AECOM had 21 staff working at the KIF site and in Chattanooga, with five active drill

Figure 1.3. Weir and Dike Locations

rigs deployed to perform testing of the failed dredge cell area. Further laboratory and analytical work will also be performed at the AECOM facilities. AECOM is coordinating its work with TDEC and its consultants as work progresses. The completion date of the study is anticipated to be early summer of 2009.

1.2.6 ASH MIGRATION MANAGEMENT

The spilled ash has filled most of the Swan Pond Embayment to the north of the former ash pond area and an adjacent stretch of the Emory River. The Emory River, although reopened as of February 4, 2009, was closed to all boats not associated with the emergency response and restoration effort between Emory River Mile (ERM) 0 and ERM4, and the area was patrolled by U.S. Coast Guard (USCG) and TVA Police marine units. To prevent downstream migration of ash and dike material, TVA is constructing two temporary rock structures (Figure 1.3).

Weir #1, completed on January 5, 2009, is built across the Emory River, just north of the existing intake skimmer wall. This underwater weir is about 615 feet long. The top of most of this weir is at elevation 730 feet, 11 and 5 feet below the normal summer and winter reservoir pool elevations, respectively. A 50-foot section of the weir has a top elevation of 728 feet.

Dike #2 extends across the Swan Pond Embayment a short distance upstream of its mouth. Based on preliminary plans, the weir would be about 1,750 feet long. The top elevation of most of the weir is at 752.0 feet; a 300-foot-wide spillway section has a top elevation of 745.0 feet. When complete, this weir will minimize the movement of ash from the embayment into the Emory River. As of the end of February, 95% of the dike has been built. Completion will occur after an embayment drainage and settling pond system is designed and approved (described in Section 5.1.4).

Diversion berms will be constructed across the Swan Pond Embayment just upstream of the spilled ash. The purpose of these diversion berms will be to intercept surface flows in this drainage for conveyance directly to the river to prevent that water from running across the spilled ash, as discussed below.

TVA is managing the inflows into Swan Pond Embayment through the development of a series of ditches and piping. This action will preclude further movement of ash from surface water flow in the embayment and will help facilitate recovery of the area in the future.

TVA is managing the flows of the Clinch and Tennessee Rivers in the Kingston area by controlling the releases from Melton Hill, Fort Loudoun, and Watts Bar dams. This flow management is designed to minimize the downstream movement of spilled ash and to prevent backflow of potential ash-containing water from the Clinch River into the lower Tennessee River. This backflow could occur if the flow in the Tennessee River is less than that in the Clinch and Emory rivers. The City of Kingston municipal water supply intake is located on the Tennessee River about 0.5 miles upstream from its confluence with the Clinch River.

1.2.7 CENOSPHERE CONTAINMENT AND REMOVAL

TVA has been managing cenospheres (inert floating ash residue) by containing them with floating booms and then collecting them with vacuum trucks (often on a barge), backhoes, and hand tools. The collected cenospheres are then transported by truck to a holding area in the vicinity of the remaining KIF ash ponds. As of February 23, 2009, approximately 2,607,000 gallons of cenosphere liquid had been removed. Cenospheres are used in various materials and are marketable.

1.3 ORGANIZATION OF THE CAP

The CAP is organized to match the requirements of the Commissioner's Order with the addition of an Introduction Section (Section 1.0) and a path forward discussion in Section 7.0 to illustrate what activities and plans will be generated from the CAP.

The TVA response to this incident has resulted in development of prioritized actions to address near-term concerns first (e.g., removal of ash from the main channel of the Emory River). In fact, several plans have already been submitted to TDEC, EPA, and other agencies for review. Accordingly, the near term plans discussed in this CAP are more fully developed and more detail is available. Where a plan has already been submitted under separate cover, that plan is referenced.

The plans for longer-term actions are more conceptual and they will be developed further as additional data or information are collected and input from other agencies and the public is obtained.

Section 2.0 is the Plan for Comprehensive Assessment to respond to Subsection A of Section 5 in the Order: a plan for the comprehensive assessment of soil, surface water, and groundwater; remediation of impacted media; and, restoration of all natural resources damaged as a result of the coal ash release. Section 2.0 provides a summary of the initial assessment of the post-release impacts to human health and the environment. It also proposes an approach for making final remediation decisions on the released ash and impacted media.

Section 3.0 is the Plan for Environmental Monitoring During Cleanup which responds to Subsection B of Section 5 of the Order: a plan for monitoring the air and water in the area during the cleanup process.

Section 4.0 of this CAP is the Plan to Protect Water Supplies which responds to Subsection C of Section 5 of the Order: a plan to ensure that public and private water supplies are protected from contamination and that alternative water supplies are provided if contamination is detected.

Section 5.0 is the Plan for Management of the Coal Ash which addresses Subsection D of Section 5 of the Order: a plan addressing both the short term and long term management of coal ash at the Kingston Plant, including remediation and stabilization of the failed ash waste cells, proper management of the recovered ash, and a revised closure plan for the Class II ash disposal facility. Section 5.0 addresses both the short-term management and recovery of released coal ash in order to open navigation channels or to restore surface water drainage as well as the long-term management of the ash disposal facility that was breached. A discussion of future ash production management is included in this section.

Finally, Section 6.0 is the Health and Safety Plan to respond to Subsection E of Section 5 of the Order: a plan to address any health or safety hazards posed by the ash to workers and the public.

Figure ES-1 illustrates the activities and plans that will be generated from the various components of this CAP. There are numerous activities that have already been identified that need to be conducted and it is likely that more will be identified as recovery progresses. To best use the resources from the various agencies and to ensure timely input into the decision making processes from the agencies, TVA is proposing to implement an Interagency Team. Close involvement by other federal and state agencies/entities is critical to the success of

implementing this CAP. Depending on the work underway and the schedule urgency, the Interagency Team will meet routinely and will review all relevant information as it is generated.

The Interagency Team will scope the decisions to be made including what additional information may be needed. Individuals on the Interagency Team will review information as it becomes available and help identify necessary modifications to data collection activities and technical work. Because of the significant involvement from the agencies in scoping and implementing the work, the reviews of resultant actions and plans should occur more quickly. TVA will also develop and implement a Community Involvement Plan to provide the opportunity for the public to review and provide input into actions that affect their community because of the recovery and remediation efforts.

2.0 PLAN FOR COMPREHENSIVE ASSESSMENT

The plan for a Comprehensive Assessment includes a review of the data and information collected to date about the potentially impacted media (Section 2.1) and an approach for completion of the evaluation of impacts to the media as well as making a final environmental decision (Section 2.2). A final section (Section 2.3) provides a discussion on reports generated by this plan and potential schedule implications.

2.1 INITIAL ASSESSMENT OF POST- RELEASE IMPACTS

As stated earlier in the CAP, on Monday, December 22, 2008, a dike providing containment around a coal ash storage area (a dredge cell) at the TVA KIF, failed. The retention wall failure allowed about 60 acres of the 84-acre containment area to be displaced. The resultant release of an estimated 5.4 million cy of ash now covers about 300 acres beyond the ash storage area, impacting the river, shoreline, roads, and property including serious impacts to three residences.

Because of the location of the failed portion of the dike (the northern side of the dredge cell area) the dislodged coal ash slurry flowed primarily to the adjacent northwest, north, and northeast areas, filling to varying extents the Swan Pond Embayment, Lakeshore Slough, and the Emory River, respectively. The released coal ash was either visible or submerged below the receiving water surface. Estimated volumes of the released ash account for the 5.4 million cy as follows: (1) west of the Dike #2 (Figure 1.3) in the western embayments (primarily Swan Pond Embayment) and sloughs -- 2.1 million cy, (2) east of the Dike #2 in the main river channel (Emory River) -- 1.9 million cy occurring above and below the water surface, (3) upstream in the main river channel -- 0.5 million cy below the water surface, and (4) down stream in the main river channel -- 0.6 million cy below the water surface. Further sampling investigations have shown small thicknesses of the ash in the Emory River, upstream of the major ash spill area, but not in the Little Emory River (Figure 2.1). This may account for the 0.3 million cy not located.

It is estimated that about 106,000 cy of this ash actually covers existing land beyond TVA's boundary. The majority of this is on TVA land. Areas affected in such a manner include the Swan Pond and Lakeshore communities. Private properties affected by the ash spill lie mostly along Berkshire Lane on Swan Pond Embayment, along Swan Pond Circle Road on Lakeshore Slough, and along Lakeshore Drive on the east shore of the Emory River. Of the roughly 300 acres covered, about 8 acres of private property are covered by the KIF coal ash. The rest is on TVA property.

The initial assessment of environmental impacts began immediately during the emergency response efforts. Assessment activities have been conducted by TVA, TDEC, and EPA as well as a variety of other groups or agencies. The TVA, TDEC, and EPA assessment results are readily available and have been posted on their respective web sites. The three entities have followed accepted quality control procedures for sampling and their results are considered comparable and are discussed in this section. Data continues to be collected and the information presented in this section represents data through the end of January 2009 collected by the three agencies. Much of the data collected has not yet been validated (quality control checks reviewed) and therefore, only summary level information is presented in this CAP. All of the data, including any data of sufficient quality collected by other agencies or groups, will be further evaluated in preparation for scoping efforts for the final assessment.

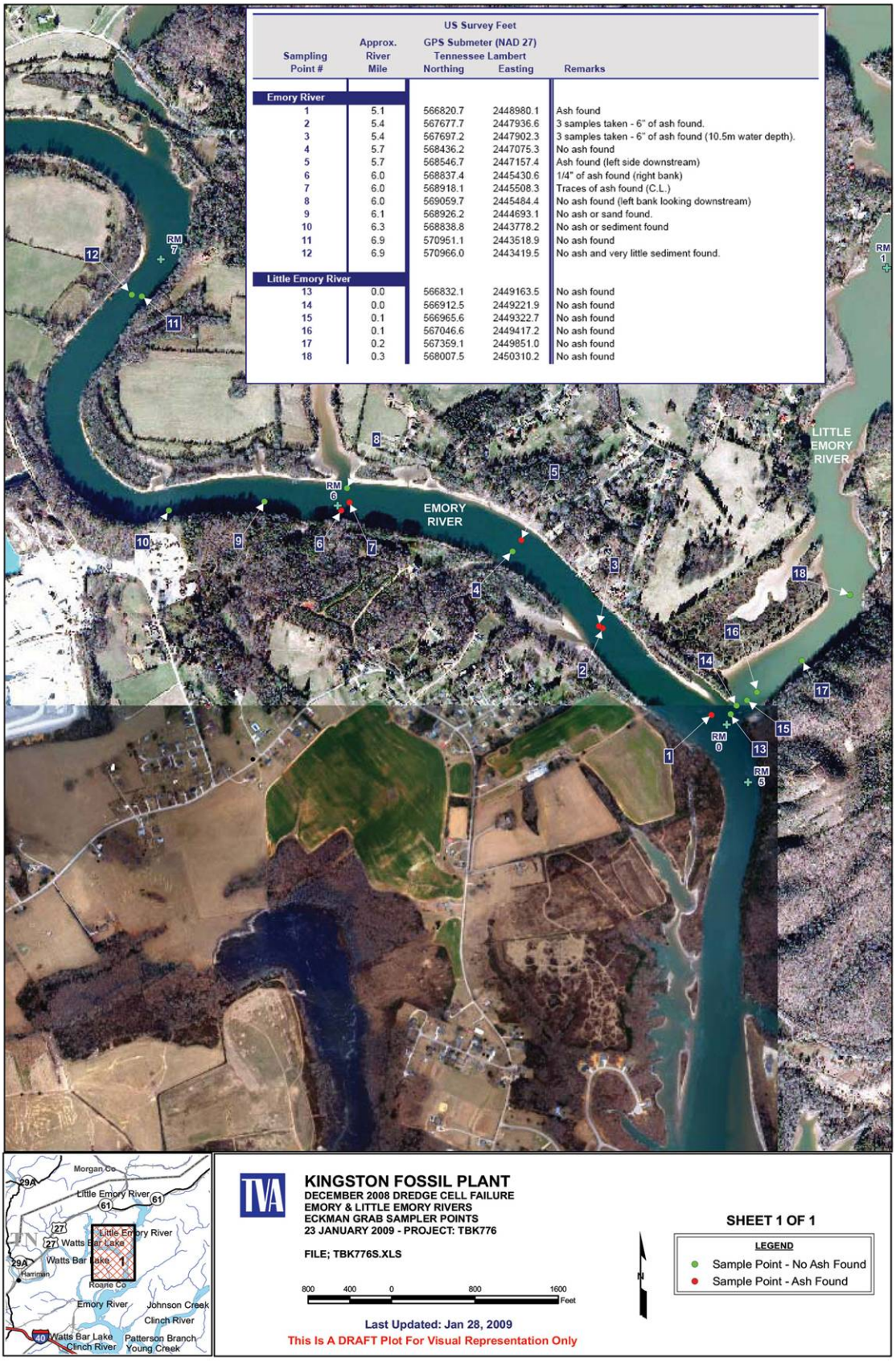


Figure 2.1. Extent of Ash Upstream of KIF

2.1.1 SOIL/ASH ASSESSMENT

TDEC, EPA, and TVA have all collected samples of the ash and, in some cases, nearby potentially affected soil areas. The purpose of the sampling in all cases was to characterize the ash and to determine if there are contaminants of immediate concern for human health.

TVA's initial ash sampling program focused on the ash remaining in the dredge cell area after the spill as well as in the area of the released ash (Figure 2.2). Five surface ash samples and 23 ash samples from the vertical profile at the one Geoprobe® location were collected on December 31, 2008, and analyzed for gasoline products (benzene, toluene, ethylbenzene, and xylene-BTEX), target analyte list (TAL) metals, and toxicity characteristic leaching procedure (TCLP) metals. TCLP metals analysis evaluates the leaching characteristics of the ash. Another nineteen, 5-point composite ash samples were collected on January 6 and 12, 2009, from the ash in the Swan Pond Embayment and 8 pairings of ash and soil samples collected from private residential properties. Target analytes were selected based on concerns about gasoline contamination, trace metals in coal ash, and hazardous waste characteristics.

All samples tested were free of gasoline products. Samples from ash in the Swan Pond Embayment were not tested for BTEX. Arsenic is one of the trace elements known to be concentrated in the ash through the coal combustion process at KIF. Arsenic was present above local soil background levels in all ash samples collected by TVA. Arsenic concentrations in ash varied from 18.3 mg/kg from ash in the embayment to 113 mg/kg at sampling interval from 44 to 46 ft below ground surface at the Geoprobe® location in the dredge cell. Most of the concentrations were between 20 and 45 mg/kg. Background arsenic levels for soils in Roane County (DOE 2003) are 14.95 mg/kg. Levels in the ash generally vary from approximately background levels to three times background levels. In all instances, the concentrations of the TCLP metals, including arsenic, were well below the threshold values that would categorize the ash as hazardous waste material. Ash samples collected from residential properties had results similar to those from the released ash in the embayment.

TDEC also collected ash and soil samples on January 6 and 7, 2009. TDEC collected 12 ash samples and 16 soil samples. Two of the ash samples were collected from the dredge cell while the rest were from surrounding residential properties or designated background locations (2 samples). Samples were analyzed for TAL metals, TCLP metals, volatile organic compounds, radionuclides, and polynuclear aromatic hydrocarbons. TDEC has reviewed the data and has posted relevant information on their web site. As reported on their web site, TDEC did not find any volatile organic compounds (which would typically include BTEX) or polynuclear aromatic hydrocarbons in the ash or soil samples. The ash does contain metals and radioactive materials. After review of the metal analyses of the ash samples, the only metal at levels that TDEC believe may present a potential health hazard is arsenic. The TDEC ash samples contained from 26 to 100 mg/kg of arsenic (with an average of 74 mg/kg). TDEC found about 2 mg/kg arsenic in local background soils however, the soils in the area of the spill varied from non-detectable to 83 mg/kg.

On December 23, 2008, EPA's contractor collected an ash sample (grab sample) from a sand bar on the Emory River. On December 27, 2008, EPA's contractor collected two 10-point composite ash samples from the ash pile on site. In the same sampling event, EPA's contractor collected three grab samples of ash that had been deposited along the roadway. Eleven 5-point composite samples of potentially affected soil were collected from the shoreline of the rivers. Analysis of the samples included TAL metals, BTEX, silica, and TCLP metals. (TCLP and silica analyses were not conducted for the first sample collected). Similar to TVA and TDEC sampling results, the EPA testing of the ash and soil found no gasoline products and showed that the ash and soil would not qualify as hazardous waste.

Figure 2.2. TVA Ash Sampling Locations

OE&R - ER&S
Geographic Information & Engineering

TVA_AshSamplingLocations_Fig2_2_8x11_20090123.mxd

The EPA testing showed arsenic to be present at elevated levels in the ash. EPA results showed arsenic ash results varying from 44.8 to 81.3 mg/kg and soil results varying from 1.3 to 34.5 mg/kg.

2.1.2 SEDIMENT QUANTITY ASSESSMENT

As discussed above, an estimated 5.4 million cy of ash was released. TVA has conducted several hydrographic surveys subsequent to the ash spill to characterize the distribution of the primary deposits of ash in the Emory River and movement of that ash during moderately increased river flows following rain events. In addition, field surveys have been performed with hand-operated sampling devices (Eckman and Ponar dredges) to identify the spatial extent of lesser amounts of ash deposits.

Results of those investigations show that trace amounts of ash have been transported as far downstream as Tennessee River mile (TRM) 564.0 and upstream to ERM5.75 with the bulk of the ash remaining in the reach between ERM1.5 to 3.5 (see Figure 2.3 for river sampling locations). Depths of ash in the nearby reach of the Emory River range from approximately one foot to about 30 feet. Initial maximum depths appear to have been reduced to about 26 feet by flow redistribution and slope realignment. The 26,000 cfs Emory River flow on January 7, 2009 after a significant rain event apparently moved some ash, but not significantly. Weir #1 and Dike #2 were installed to mitigate ash migration.

Downstream migration of heavier components of the ash in the Clinch River was mitigated to some extent by the presence of an existing underwater diversion weir at Clinch River Mile (CRM) 3.9. This weir diverts cold water from Melton Hill Dam releases upstream into the Emory River and to the cooling water intake channel for KIF. This barrier likely prevented some of the ash from traveling further downstream in the Clinch and Tennessee Rivers. Ash deposition of 2-3” was documented downstream of this dam, decreasing to less than 1” (or no ash observed) in the lower Clinch River and Tennessee River. A certain amount of ash has been passed through the condenser cooling water system at KIF and is deposited in the discharge channel, and areas of the Clinch River immediately downstream of the discharge channel. Very large inflows and floods could result in moving more ash into the lower Clinch River and in the Tennessee River if it is not removed.

2.1.3 SURFACE WATER QUALITY ASSESSMENT

As of February 23, 2009, TVA has collected 378 surface water samples in the Emory, Clinch, and Tennessee Rivers for total and dissolved metals analyses. In addition, TVA has collected more than 370 instream indicator readings such as pH, dissolved oxygen, and conductivity. Figure 2.3 presents river mile locations used to designate sampling locations. In general, sampling results of river water show that some metals were elevated just after the incident and again after a particularly heavy rainfall on January 6, 2009. Using arsenic as an indicator metal, and location ERM1.75, immediately downstream of the dredge cell site, the initial increase in concentrations followed by a decline in concentrations can be shown. On December 23, 2008, one day after the event, the total arsenic concentration at this location was 13 µg/L, just above the drinking water standard of 10 µg/L (the dissolved concentration was not detectable although a higher detection limit of 5 µg/L was in use by the laboratory, not allowing lower concentrations to be quantified).

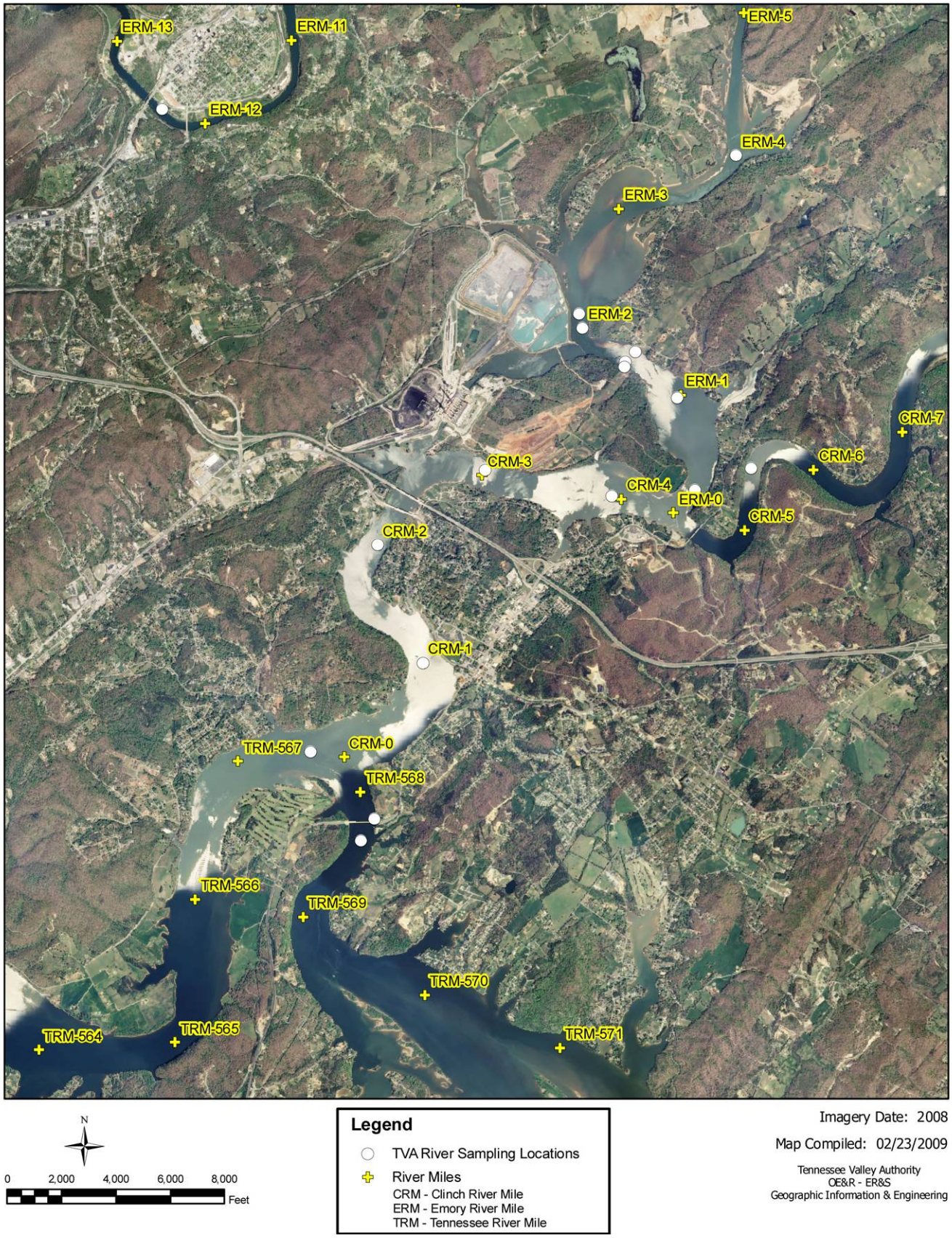


Figure 2.3. River Sampling Locations

By the next sampling event, December 26, 2008, both concentrations were below the 5 µg/L detection limit. On January 6, 2009, just before the rain event that day, arsenic was detected in the total metals sample at 0.6 µg/L (a lower detection limit was in effect) but then detected at 74 µg/L in the total sample the day after the rain (January 7, 2009). On January 9, 2009, the total arsenic concentration was again below lower detection limits. The total metal levels quickly rise with a significant rain event but just as quickly, they decrease once the rain event is over and any stirred up sediments re-settle.

Other than concentrations immediately after the incident and again, immediately after the heavy rain event, total arsenic concentrations remain below the drinking water standard of 10 µg/L for untreated water. All concentrations (even the total arsenic results) were below the chronic Water Quality Criteria of 150 µg/L for dissolved arsenic III to protect fish and aquatic wildlife.

On January 2, 2009, TDEC began bi-weekly sampling for heavy metals at several stations in the area of the KIF ash spill. TDEC also found the metal concentrations were the greatest immediately following the spill and whenever the ash was re-suspended by rainfall or other disturbances. TDEC concluded that no Water Quality Criteria were exceeded at any location for chromium, antimony, copper, nickel, selenium, or zinc. Specific metals were measured above Tennessee's chronic Water Quality Criteria for the protection of fish and aquatic life at least once in January 2009 including aluminum, cadmium, iron, and lead. Most of the Water Quality Criteria exceedences were from the sampling location near the ash spill. However, the sampling results at that location were not routinely above the Water Quality Criteria. TDEC found arsenic three times the drinking water standards on Decemver 23, 2008, immediately adjacent to the spill site in untreated raw river water but the elevated results were not duplicated in later sampling events, as was the case with TVA sampling. However, while TVA did not see elevated results near the ash spill except immediately after a heavy rain, TDEC found higher results up to a week after the rain rather than the day after the rain. In both cases, neither TVA nor TDEC found arsenic values above the Water Quality Criteria for the protection of aquatic organisms.

From December 23, 2008 to December 29, 2008, EPA's contractor collected a total of 26 river surface water samples for total and dissolved TAL metals analysis. Analytical results from the samples collected on December 23 show that antimony, beryllium, cadmium, chromium, and lead (in total analysis), and arsenic (both total and dissolved phase) exceeded drinking water standards in untreated raw river water at ERM0.1 . Samples collected on December 28, 2008 showed fewer exceedences of drinking water standards than those collected earlier. The EPA results are generally consistent with the TVA and TDEC surface water sampling results.

2.1.4 GROUNDWATER QUALITY ASSESSMENT

Kingston Fossil Plant and the area affected by the ash release lie within the Valley and Ridge physiographic province, a region characterized by narrow, subparallel ridges and valleys trending northeast-southwest. The controlling structural feature of the region is a series of northeast-striking thrust faults which have forced older rocks from the southeast over younger units. Bedrock units of the Rome Formation, the Lower Conasauga Group, and the Knox Group occur beneath the affected area in northeast-trending bands (Figure 2.4). These units generally dip to the southeast at angles averaging 45 to 50 degrees (Benziger and Kellberg 1951).

Alluvial and/or residual deposits generally cover bedrock in the site locality, and form a blanket separating ash deposits from underlying bedrock. Alluvium is generally limited to the natural (pre-reservoir) floodplains of the Emory River and its tributaries. Thickness of the alluvial deposits beneath the ash disposal areas at the plant site ranges up to 65 feet, but thickness is

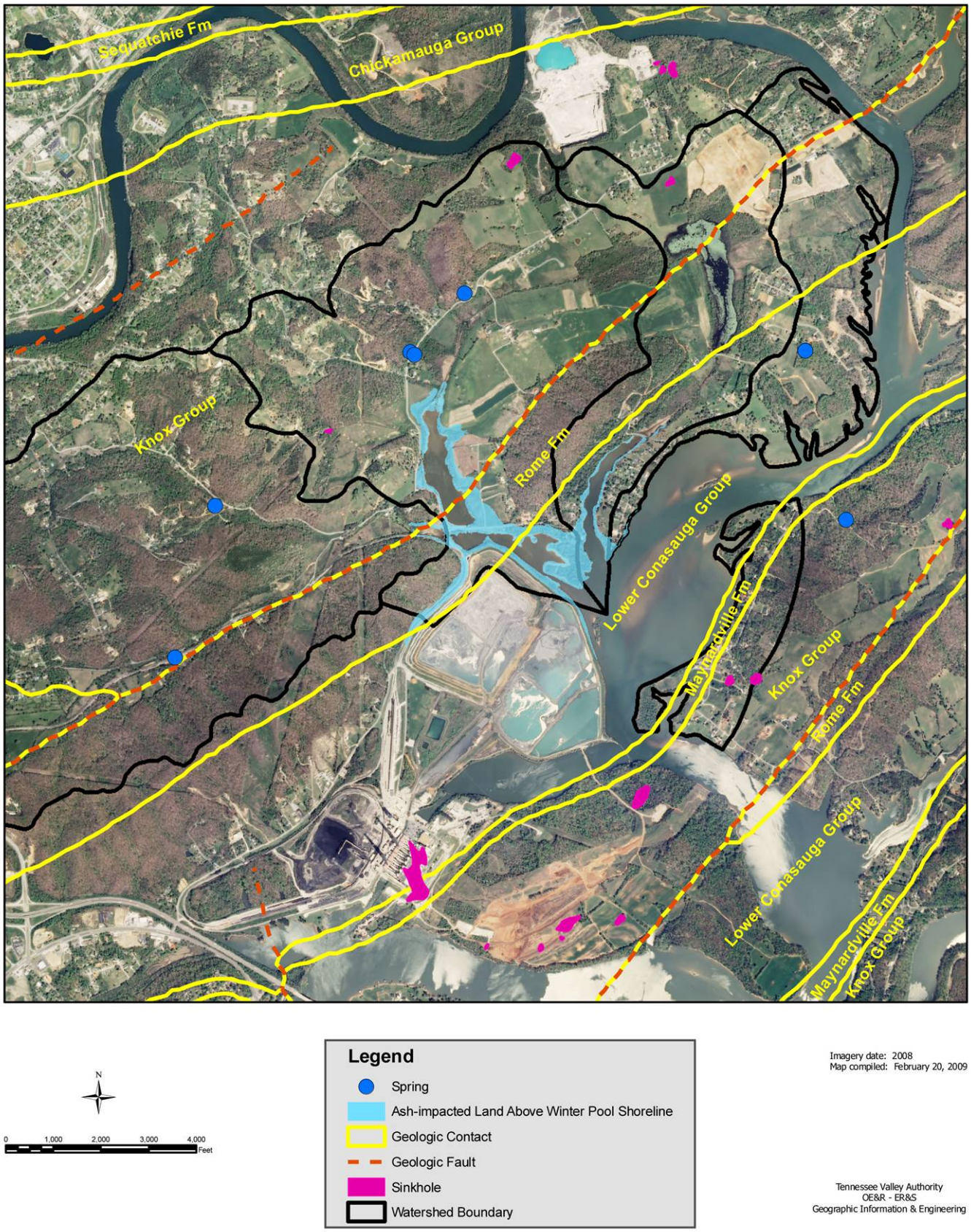


Figure 2.4. Hydrogeologic Features of the KIF Site

unknown in areas offsite. Residuum is expected to cover the remaining upland areas within the region, but data regarding its thickness offsite is currently unavailable.

Bedrock beneath most of the ash-affected area is represented by the Rome formation and Lower Conasauga Group. The Lower Conasauga Group primarily consists of shale with interbedded siltstone, limestone, and conglomerate, and is locally of low water-producing capacity. The Rome formation consists of interbedded shale, sandstone, and siltstone, and is a poor water producer. The primary water-bearing units of the region are the limestone and dolomite members of the Knox Group and the Maynardville formation (Upper Conasauga). The Knox Group includes several relatively pure, thick-bedded limestone and dolomite members susceptible to karst development, as evidenced by the sinkholes shown on Figure 2.4. The only ash-affected areas overlying the Knox Group include the stream bank margins along Swan Pond Embayment.

Groundwater within the site locality is derived from infiltration of precipitation through the soil overburden. Direct recharge to bedrock aquifers by storm runoff through sinkholes may also occur in areas underlain by karst bedrock. Shallow groundwater movement is generally from upland areas to adjacent stream valleys with groundwater ultimately discharging to streams and springs. Although some deep recharge of deeper bedrock aquifers may occur elsewhere in the region, it is likely that shallow groundwater recharge originating in the site locality discharges directly to the Emory River, its tributaries, or to springs. The occurrence of numerous springs along the Emory River indicates the site locality lies within a regional groundwater discharge area. Limited stream recharge of shallow groundwater could occur during periods of rapid rise in reservoir elevation causing temporary reversal of groundwater hydraulic gradients.

The primary affect of the ash release on local groundwater resources would be infiltration of ash leachate below ash-impact areas bordering the Emory River and its tributaries. Preliminary review of available water supply data indicates that most, if not all, of the water-supply wells and springs in the site locality are situated upgradient of ash-affected land bordering streams. Consequently, any ash-related chemicals entering shallow groundwater beneath affected areas would be transported a short distance to local streams without encountering wells or springs.

Groundwater detection monitoring in connection with the KIF ash dredge cell facility solid waste permit has been conducted since June 2005. Unfiltered groundwater samples have been collected semiannually from four monitoring wells associated with the ash dredge cell, and were analyzed for the 17 inorganic constituents listed in Appendix I of the TDEC Rule 1200-1-7-.04. Two of these monitoring wells (4B and 6A) were destroyed in the incident. Monitoring results have consistently been below maximum contaminant level (MCLs) of 10 µg/L. The upgradient well had arsenic values around 1 µg/L. Samples from Well 6A have routinely had some type of laboratory interference resulting in higher detection levels. The sample taken in December 2007 had a non-detect arsenic value but the detection level was 5 µg/L. The sample from Well 6A taken in June of 2008 had an arsenic value of 6.3 µg/L. The detection level for the sample taken in December 2008 was 20 µg/L and the value was below the detection level. However, in the last sample, the detection level was above the MCL of 10 µg/L. Low levels of arsenic could have been present in the groundwater near the ash disposal location prior to the spill.

Seven monitoring wells surrounding the Phase 1 gypsum disposal facility have been sampled quarterly for Appendix I inorganics since March 2008 to establish baseline groundwater quality at the disposal site. All unfiltered results have been below MCLs. In the last sampling round, the maximum detected arsenic value was 3.6 µg/L, notably below the MCL of 10 µg/L.

TDEC has collected samples from private drinking water wells within a four-mile radius of the KIF ash release site for heavy metals. As of February 3, 2009, nearly 100 wells had been sampled and results were shared directly with the property owners when received from the laboratory. Results to date have not indicated exceedences of the primary drinking water standards for metals.

EPA's contractor sampled three residential wells for TAL total and dissolved metals. As with TDEC sampling results, all results were below drinking water standards. All arsenic values were below detection levels.

2.1.5 AIR QUALITY ASSESSMENT

TVA began air sampling for particulate matter using mobile instantaneous instruments and stationary sampling pumps on December 28, 2009. Figure 2.5 presents the mobile sampling locations for February 15, 2009, a typical daily sampling pattern, as well as the results of that sampling for particulate matter 10 microns in size or smaller (PM10). Figure 2.6 is a running 30-day history of results from the mobile air sampling conducted. Results of air monitoring to date for the KIF ash spill have documented generally low concentrations of airborne particulates. None of the daily averages of the more than 13,000 instantaneous measurements approached or exceeded the 24-hour daily National Ambient Air Quality Standard. To date, six elevated instantaneous readings have been associated with either residential wood heating or open burning of brush on private lands. These readings were not associated in any way with TVA onsite activities. Two elevated readings have been associated with rock quarry or gravel truck operations on roadways off site. The standard concentration against which assessments are made is a daily average. While individual readings have exceeded the level of the standard, no daily averages have approached or exceeded the daily standard.

TVA operated a mobile air monitoring laboratory on the Kingston plant site from December 31, 2008, to February 4, 2009, collecting airborne dust samples and measuring particulate levels. To date, filter-based analytical results from both the air sampling pumps and the TVA mobile laboratory for airborne substances that could potentially impact human health are either below detection limits or below levels of a health concern. All particulate measurements to date have been well below the National Ambient Air Quality Standards of 35 $\mu g/m^3$ for the 24-hr average fine particle (PM2.5).

TDEC's Division of Air Pollution Control has been monitoring particulates in Roane County for quite some time. They have operated two PM10 monitors in Rockwood since 1993, as well as a PM2.5 monitor in Harriman since 1999. TDEC's PM2.5 monitoring site is located at the Harriman High School about 2.5 miles north-northwest of the ash spill site. TVA's contractor has co-located a PM10 monitor at this site, which will be used as a background site for comparative purposes. The PM10 background monitor at the school began operation on January 20, 2009. Preliminary particulate matter results indicate that the PM10 results are far below the PM10 standard of 150 $\mu g/m^3$.

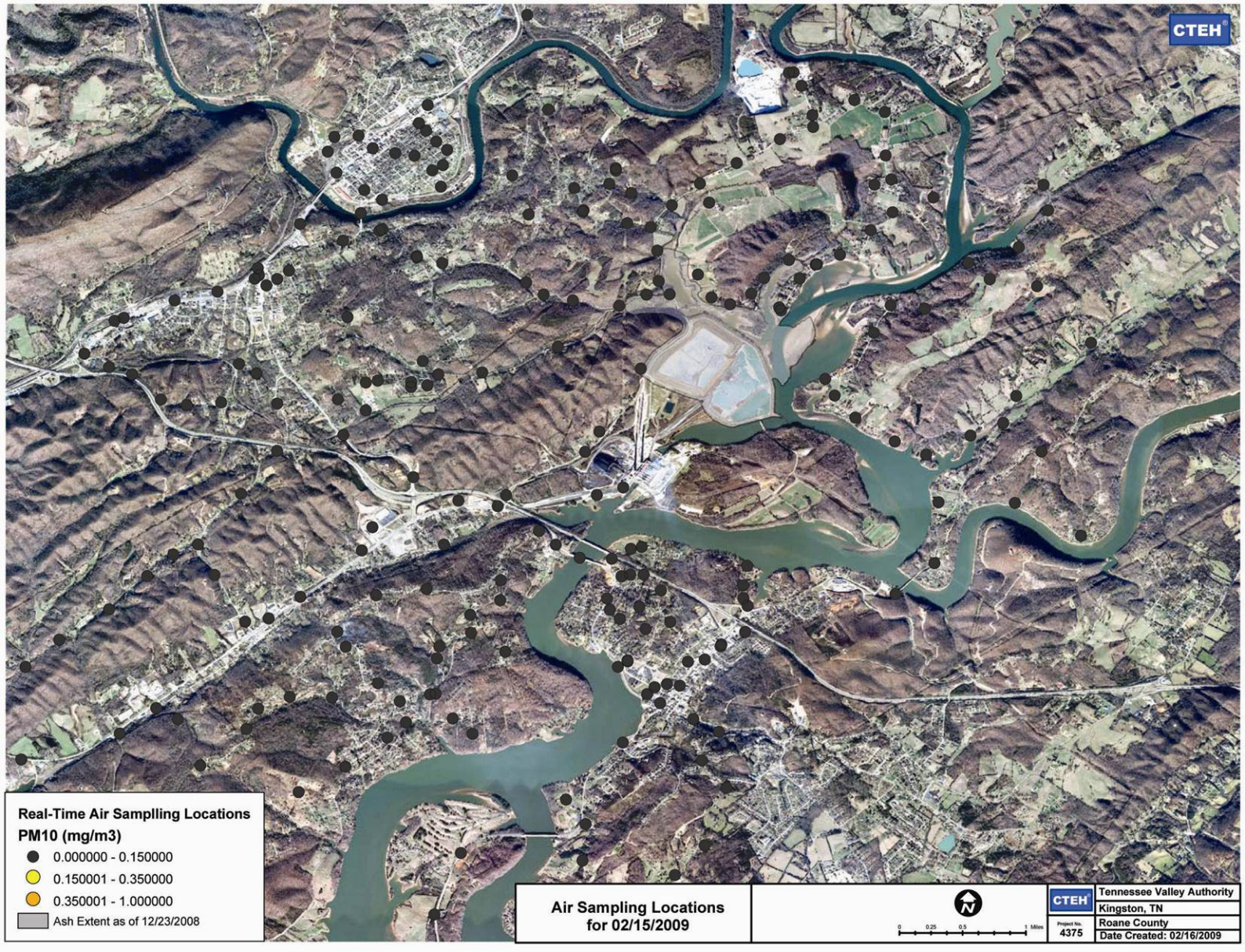
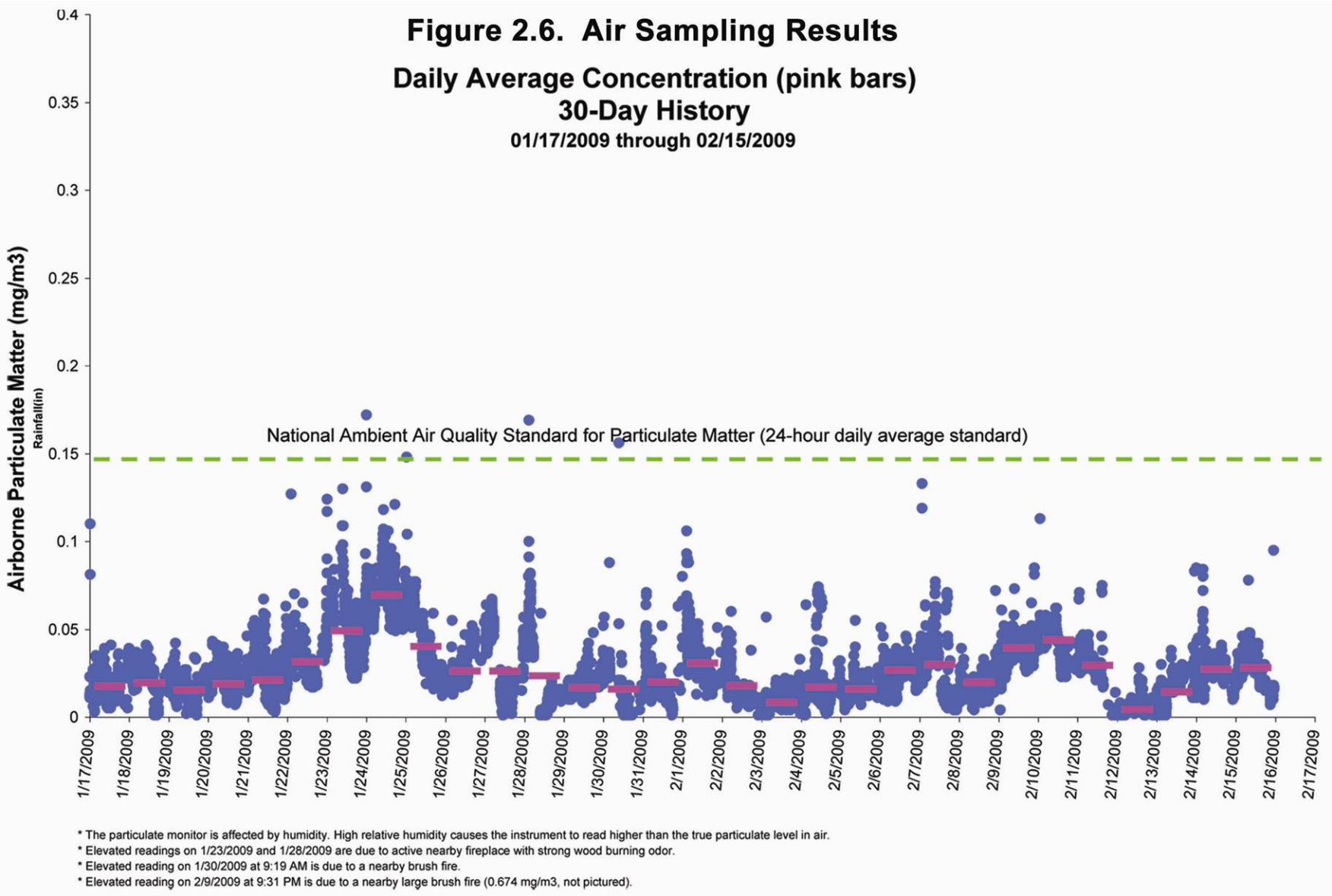


Figure 2.5. Example Air Sampling Location Results (February 15, 2009)

Figure 2.6. Air Sampling Results



* The particulate monitor is affected by humidity. High relative humidity causes the instrument to read higher than the true particulate level in air.
* Elevated readings on 1/23/2009 and 1/28/2009 are due to active nearby fireplace with strong wood burning odor.
* Elevated reading on 1/30/2009 at 9:19 AM is due to a nearby brush fire.
* Elevated reading on 2/9/2009 at 9:31 PM is due to a nearby large brush fire (0.674 mg/m3, not pictured).

2.1.6 NATURAL RESOURCES

An evaluation is underway to ascertain the pre-spill conditions and then to assess the conditions after the incident to better understand the impacts from the ash spill. The results of the analysis will be documented in deliverables discussed in Section 2.2. The information for this assessment will be scoped with the regulatory agencies although some initial discussions resulted in a list of appropriate research and monitoring needs that will be implemented, as appropriate, by TVA and various agencies and other scientists.

2.1.6.1 Assessment of Pre-Spill Natural Resource Conditions

Fish and Aquatic Life. Existing information from various TVA and Tennessee Wildlife Resources Agency (TWRA) projects and surveys are being compiled to provide an estimate of the aquatic community affected by the physical impact of the spill. These data include: TVA fish and benthic surveys used to satisfy National Pollutant Discharge Elimination System (NPDES) permit requirements for the KIF plant and for other TVA projects in the vicinity, and TWRA fish stocking data.

In addition, in order to compile a more accurate description of mussel and snail communities that were affected by the spill, TWRA and TVA will cooperate in spring mussel and snail surveys in an Emory River embayment and the main stem of the Emory River and Clinch River habitats that were unaffected physically (i.e., covered by ash) by the spill. Winter surveys for mussels and snails are not practical because these mollusks burrow deeply into the substrate and are not easily captured.

The existing data and proposed mollusk survey data will be used to estimate the composition and abundance of fish, mollusks and other species that comprised the aquatic communities in Swan Pond Embayment and in the main stem of the Emory River at the time of the spill.

Fish (channel catfish and largemouth bass) were collected by TWRA for tissue chemical analysis from two sites in the Emory River and two sites in the Clinch River. The samples will be analyzed for metals and organics, polychlorinated biphenyls (PCBs), chlordane, dioxins, and furans, which are part of TWRA's routine sampling of this area related to an existing human health consumption advisory.

Scientists will use fish collected by TWRA as baseline data for additional fish health studies on mid-range and long-term exposure to assess sub-lethal effects as a result of ash exposure. These fish health studies will include measurements that represent short-term responses such as physiological bioindicators and intermediate- and long-term responses such as histopathological and morphological indicators. An emphasis will be placed on assessing long-term effects on reproductive fitness of at least three sentinel fish species such as channel catfish, bluegill, and largemouth bass. In addition, these studies will be conducted in conjunction with the bioaccumulation studies so any cause-and-effect relationships between levels of chemicals in fish tissue and biological effects can be established.

Terrestrial Animals. TVA has monitored avian resources at KIF for many years. Shorebird and waterfowl information at the site has been collected systematically for five years. The remaining ash settling pond, not damaged during the ash spill, is used by a variety of shorebirds, waterfowl, gulls, and other species. TVA is collecting a series of reports from the Oak Ridge National Laboratory (ORNL) that describes avian, reptile and other terrestrial animal resources in the vicinity. TVA has also mapped and continues to examine additional wildlife resources near KIF.

Wetlands. Wetland acreage affected by the ash spill was determined using land use/land cover data. The data was derived from a baseline stereo-analysis of 1:12000 color-infrared aerial photography dated January 7, 2003. Recent (2006 and 2008) National Agriculture Imagery Program digital imagery was then used to augment the base data where features had changed over the course of time. Classification is based on the standard Anderson system (Anderson et al. 1976), modified to capture additional detail. Acreage calculations are based on the area of each individual polygon classified in the interpretation process.

This analysis determined that there were approximately 2.51 acres of wetlands affected by the ash spill. Habitat types as described by Cowardin et al. (1979) are listed below.

Wetland Type	**Acreage by Type**
Palustrine Emergent Wetland	1.56
Palustrine Forested Wetland	0.65
Palustrine Scrub-shrub wetland	0.30
Total Acreage	**2.51**

Land use land cover imagery analyzed post-spill indicates the 2.51-acres of wetlands present within the spill footprint were filled entirely by ash, thus eliminating these areas.

In addition, wetland habitats in the vicinity of KIF have been monitored as part of a larger study associated with the 2004 TVA Reservoir Operations Study and Environmental Impact Statement (TVA 2004). There are two wetland study sites within the Swan Pond Embayment area north of the KIF spill incident. Baseline data have been collected on these sites beginning in 2004 and subsequently in 2006. One scrub-shrub and one forested wetland plot were part of the original Reservoir Operations Study design. The Swan Pond sites were chosen because they were high quality wetland sites that were on TVA land, which ensured the long-term accessibility of these sites.

Other Ecological Habitat Types. Habitat losses are being estimated using various sources of information, including pre- and post-spill land use/land cover analyses, the amount of wetted area in the adjacent aquatic habitats at the time of the spill, Shoreline Aquatic Habitat Index surveys performed by TVA, and other available historical data. Extent of damage to terrestrial habitats, largely riparian interfaces between upland habitats and the reservoir and its tributaries, will also be assessed. These areas can be important habitats for a variety of wildlife species.

2.1.6.2 Assessment of Immediate Spill Impacts on Natural Resources

The ash pond spill on December 22, 2008 released ash into the Swan Pond Embayment, and into the Emory River, completely covering the aquatic habitat in this portion of Watts Bar Reservoir (at least ERM1.5 to ERM3.5). Ash deposits in the most severely affected portion of the reservoir range from deposits that are at least five feet deep, to complete filling of the reservoir pool in the Swan Pond Embayment and the Emory River immediately adjacent to the mouth of Swan Pond Creek. Ash deposit depths decrease with increased distance upstream and downstream from the spill site, but the precise amount of deposition in these areas has yet to be determined. Ash deposition has been observed in the Clinch River, and there is evidence that some ash has reached the Tennessee River proper. Estimated deposition amounts are discussed in Section 2.1.2.

Aquatic Life and Streambed Habitat. Fish, mussels, and other benthic macroinvertebrates (e.g. insects and crayfish) were eliminated in the area as a result of the ash spill. Dead fish (including threadfin shad, freshwater drum, smallmouth buffalo, largemouth bass, and sunfish)

were observed immediately following the spill. Any bottom dwelling animals (mussels, snails, insects, crayfish, etc.) in areas where large amounts (> 6") of ash were deposited were likely unable to escape the spill and were smothered by ash deposits. Some organisms may have survived the initial impacts and some larger fish may have moved into the area.

The week of January 20, 2009, TVA sampled fish community composition using existing reservoir Fish Assemblage Index protocols at two stations: CRM4.4 and CRM1.5. Although TVA's fish surveys are traditionally conducted during autumn rather than winter, a preliminary review of the information indicates that except for the area most affected by the ash spill, these organisms are present in numbers and conditions typically observed. These surveys will be conducted again to provide a comparison to previous autumn results.

The TWRA assessed visible damage to fish and aquatic life on December 23, 2008. Dead fish and mussels noted at the time of their survey were attributed to stranding onto dry stream banks as a result of the physical force of the ash movement into the Emory River adjacent to KIF.

In order to provide an estimate of freshwater mollusks that were immediately affected by the spill event, TVA (in cooperation with TWRA) will conduct surveys for snails and mussels in segments of the Emory and Clinch Rivers that were unaffected by the spill. Transects across the river channel will be surveyed in order to identify and sample all habitat types present in the rivers. Mollusk community composition is highly dependent upon habitat conditions. Sampling will occur in shallow overbank areas, as well as deeper former main channel areas in the Emory River and Clinch River.

Surveys will also be conducted in areas of the Emory River and Clinch River that were affected by lesser amounts (<1"-6") of ash deposition to determine if mollusks were present in these areas and if there were impacts to these resources. Transects will again be surveyed across the river channel in order to assess different habitat areas. Transects will be surveyed from the spill site downstream to the mouth of the Emory River. The Clinch River will be surveyed from Emory River confluence downstream to its confluence with the Tennessee River.

Species composition and density estimates resulting from these surveys will be used to estimate the type and number of snails and mussels present in similar habitats that are now covered by ash.

Terrestrial Animals. It appears that low levels of immediate wildlife mortality were associated with the ash release. A great blue heron carcass was found at the site. The specimen exhibited a broken leg and it is presumed that the bird died from injuries related to the spill. The carcass was collected by U.S. FWS. A large great blue heron colony occurs on an island near the spill. Although ash was deposited around the shoreline, the island remains intact.

The settling pond used by shorebirds and waterfowl was not affected by the release. Although direct observations are not available to document the magnitude of impact, various species of turtles, snakes and amphibians may have been affected as several wetland and riparian habitats used by these species was destroyed or seriously modified.

2.2 APPROACH TO COMPREHENSIVE ASSESSMENT

This section presents the approach for assessing the environmental impacts resulting from the released ash and evaluating alternatives for final remediation. The regulatory framework, the activities to be conducted, the documents to be produced, and the anticipated interaction among the various entities are discussed.

2.2.1 REGULATORY FRAMEWORK

The National Environmental Policy Act (NEPA) and its implementing regulations establish a process for evaluating the potential impacts of proposed actions and alternatives to those actions. NEPA provides an integrated and systematic approach for balancing varying and in some cases, conflicting resource impacts. Depending on the significance of proposed actions, NEPA also requires agencies to obtain the views and comments of other agencies and the public on impact analyses. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and its associated processes and methodologies can be used to formulate and test remediation alternatives to ensure that they appropriately restore the impacted area and that the public and the environment are protected in the short- and long-term. Both NEPA and CERCLA require analyses of potentially impacted resources, the formulation of alternatives to restore those resources and appropriately protect public health and the environment, and involvement of the public and other agencies in doing this.

Both of these regulatory programs provide a framework which TVA could evaluate, document, and determine what actions to take to clean up the ash release, especially alternative long-term remedial actions.

2.2.2 COMPREHENSIVE ASSESSMENT ACTIVITIES

Long-term remediation decisions to be made include:

- What to do with the ash in Swan Pond Embayment,
- How to close the failed dredge cell,
- What to do with residual ash/contamination in the rivers or on land (left behind after short-term dredging actions),
- To what level and how to restore affected media such as surface water, groundwater, and soil, and
- How to finally dispose of released ash.

There are some basic steps that the TVA contemplates employing. These include scoping, data collection, data evaluation, risk assessment, alternative evaluation, and selection and implementation of a remedy.

Scoping. Scoping activities typically begin with the collection of existing site data and information. Based on this information, the initial boundaries of the study area are defined, likely remedial action objectives identified, and preliminary applicable or relevant and appropriate requirements (ARARs) established. Whether the residual contamination is best remediated as a single action or through several interim actions, followed by a final decision, would be discussed. Under the integrated approach, TVA also anticipates issuance of a Notice of Intent to prepare an Environmental Impact Statement (EIS) for the remediation stage of the cleanup. This will seek public input on all elements of the action plan.

A series of data quality objectives (DQO) workshops would be held with key regulatory decisionmakers to assess the gap in information between what is available and what is needed to reach a decision. The DQO (Figure 2.7) process is a seven-step iterative planning approach used to prepare plans for environmental data collection activities. It provides a systematic

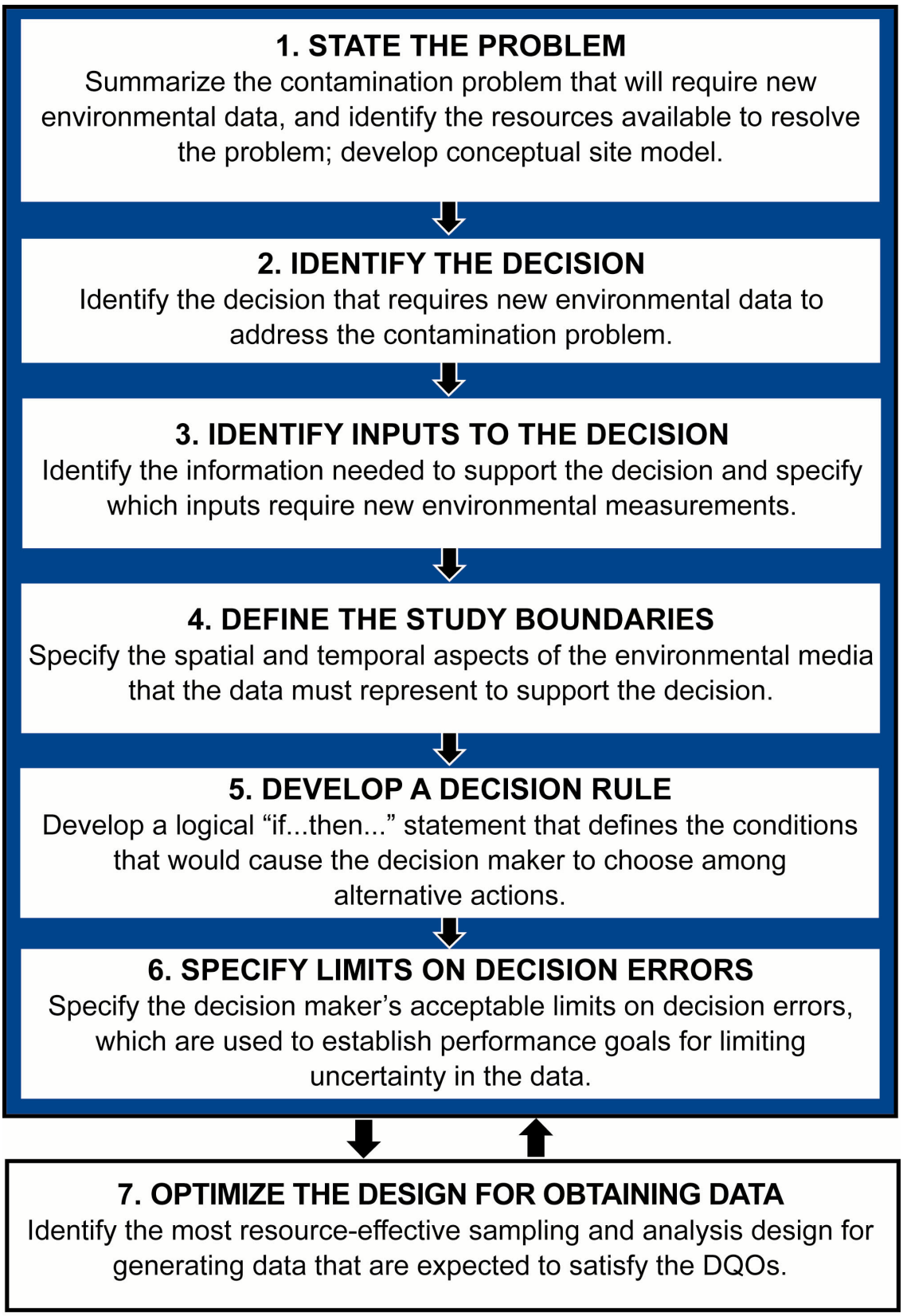


Figure 2.7. The Data Quality Objectives Process

approach for defining the criteria that a data collection design should satisfy including: what, when, where, and how to collect samples or measurements along with the number of samples to collect. DQOs define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. In summary, the DQO process defines what question the data is to answer to support a decision and ensures that the necessary information is collected to answer the question.

Once additional data collection activities are defined, the collection locations, frequency, methods, and quality control procedures are documented in the sampling and analysis plan(s) (SAPs). The data are then collected. Some information has already been identified by the various entities as being necessary to support final decision making.

Data Collection. It has been suggested that TVA use an approach similar to a Natural Resource Damage Assessment and Restoration process, with appropriate state and federal trustees, as one process for characterizing and evaluating the potential and extent of damage or injury to natural resources, to design long-term monitoring needs related to the event, and to determine adequate compensation and/or restoration for damaged or injured natural resources, including lost uses. This activity will be conducted as part of the risk assessment. Some suggested data collection activities that have come out of the need to assess the natural resource damages include continuing TVA's existing Reservoir Fish Assemblage Index and Reservoir Index of Benthic Integrity surveys to provide long-term data that will document spill impacts and recovery of fish and other aquatic life by comparing post-spill data to pre-spill data.

Likewise, continuing the existing fish tissue analysis by TWRA, (supplemented by samples and analyses by TVA, TDEC and ORNL) will document changes to baseline conditions including recovery for fish captured near the spill site. This includes understanding the existing Department of Energy (DOE) related sediment contamination that resulted in the fish consumption advisory for fish caught in the KIF area that was in place before the spill event.

Studies are being considered that will help determine the impact of ash deposition on a variety of aquatic organisms that are found in sediments of reservoir habitats like those that were affected by the spill. This testing could include various life history stages of bottom-dwelling (benthic) organisms, including several common, reservoir-tolerant mussel species. Typical toxicity tests do not include mussels, but recent technology and techniques have been developed that permit more accurate characterization of spill-related impacts to mussels or other sensitive bottom-dwelling aquatic life.

The possible movement of chemicals from aquatic to terrestrial wildlife resources has been well documented. TVA, in conjunction with TWRA, EPA, U.S. FWS, and third party toxicologists, would examine the available terrestrial animal resources that exist in the vicinity of KIF. The biologists and toxicologists would identify the appropriate wildlife species to examine and document any movement of chemicals from the fly ash through various wildlife trophic levels. Potential terrestrial wildlife resources that may be examined include great blue herons, cliff swallows, raccoons, belted kingfisher, woodland songbirds, and bats.

In addition to assessing the natural resources impact, data or information may be needed to refine residual ash volumes; to support modeling of sediment transport processes to help determine the ultimate fate of ash swept downstream by high flows; and to assess potential future impacts to groundwater. This information will be combined with existing groundwater, surface water, air, and ecological data.

All data will be collected following TVA sampling Standard Operating Procedures and the site-wide Quality Assurance Project Plan currently under development. An independent assessment of sampling techniques will occur periodically to ensure the quality of the data being collected. Only data and information meeting the sampling and laboratory quality requirements will be used.

Data Evaluation. Once the data are available, they are evaluated for quality and then for scientific information. EPA Region 4 procedures for data quality will be followed. For instance, data being used for risk assessment work will be validated. Standard operating procedures are under development for data management activities so all data are evaluated and stored appropriately.

Other data evaluation activities will include assessing the nature and extent of contamination in the various media as well as transport between media. If appropriate to the decision, sediment transport modeling may be conducted to assess future potential migration of unremediated ash.

Data will be compared to various regulatory and risk-based levels during the evaluation to focus any further evaluations. Criteria that will be considered for evaluation include drinking water standards, Water Quality Criteria for the protection of aquatic life, industrial and residential preliminary remediation goals (PRGs), ecological benchmarks, and any other chemical-specific ARARs.

Risk Assessment. A baseline risk assessment is performed to identify the existing or potential risks that may be posed to human health and the environment by the site. This assessment also serves to support the evaluation of the no-action alternative by documenting the threats posed by the site based on expected exposure scenarios. Because this assessment identifies the primary health and environmental threats at the site, it also provides valuable information for the development and evaluation of alternatives.

For soil/ash exposure pathways, depending on the amounts of ash left after the short-term management actions, it is anticipated that both a residential and industrial future hypothetical user will be evaluated in the human health risk assessment. Likewise, future industrial and residential use of the groundwater will likely be evaluated. Recreational use of adjacent surface water would be evaluated as well as residential use to assess baseline conditions.

The receptors evaluated for the ecological risk assessment are less clear at this stage although risk to benthic invertebrates, fish, aquatic amphibians and reptiles, piscivorous wildlife, aerial insectivores, and various other terrestrial species are likely to require evaluation. A continuation of the discussions initiated with the ecological stakeholders in January 2009 is needed to assess the scope of the ecological risk assessment.

If agreement is reached to make a decision on just parts of the residual contamination, some of the receptors discussed above may not be relevant to that decision and therefore not evaluated.

Evaluation of Alternatives. The no-action alternative will be considered for any decision made. It will set baseline conditions that will exist if nothing further is done. Depending on the size and complexity of the decision, one to several more alternatives will be engineered and evaluated. The proposed Interagency Team would help scope out the range of alternatives to be considered, ensuring that all preferred alternatives are given equal consideration. A key decision that is needed will be the final end-state of the area affected by the ash. To make a sound decision, a range of final end-states are likely to be evaluated so the benefits and impacts of each can be assessed. If the decision is simpler, a streamlined evaluation may be

conducted after coordinating with members of the proposed Interagency Team to expedite the decision.

Alternatives would be evaluated using regular NEPA criteria plus implementability issues, potential effectiveness, and cost.

Selection and Implementation of a Remedy. Under the NEPA process, the public is involved in the selection of a remedy. A summary of TVA and the regulatory agencies' preferred alternative will be documented and presented to the public for input. TVA contemplates holding one or more public meetings as part of this process. After consideration of public comments, TVA's preferred remedial approach will be identified and submitted to TDEC and EPA for their concurrence.

Once selected, the remedy is implemented. As appropriate, design plans may be developed along with any necessary SAPs for implementation during construction (see Section 3.1 of this CAP). Upon completion, a completion report will be drafted for regulator review. This report will document any verification or confirmation sampling that may have been needed to confirm that final cleanup levels were met. If contamination above ARARs or risk-based levels is left behind, long-term monitoring will be required with periodic reports generated to illustrate that the alternative is still protective.

2.2.3 DOCUMENTATION

For the larger decisions (final end-state) an EIS will be produced for public comment. For quicker decisions, an engineering evaluation/cost analysis (EE/CA)/environmental assessment (EA) will document the site conditions, alternatives evaluated, and the preferred alternative. Once public comments are received, the decision will be documented in an action memorandum (AM). This process will be particularly useful for decisions that do not require additional data or a detailed baseline risk assessment. The level of detail in these documents is typically less than in an EIS, hence the decision can be expedited.

The final closure reports will document the action taken, deviations to the planned remedy, the results of any verification or confirmation sampling, and if necessary, an evaluation of residual conditions. If post-remediation monitoring is needed, the closure report will contain a monitoring plan to illustrate the long-term protectiveness of the remedy.

2.2.4 INTERACTIONS

Agency decision makers will participate in a proposed Interagency Team as described in Section 1.3. In addition to TVA, the Interagency Team will have representatives from the key regulatory decision makers such as TDEC, U.S. FWS, TWRA, and EPA. This group will scope the decisions to be made, data to be collected, evaluate results generated, and participate in selecting a preferred remedy. At times, depending on the topic being evaluated, members of other groups such as natural resource damage assessment trustees, the DOE interagency working group, and the scientific community will be asked to participate.

The Community Involvement Plan will establish a mechanism to work with local officials and stakeholder groups to engage in dialogue and collaboration with the affected community. It will be founded on the belief that people have a right to know what TVA is doing in their community and to have a say in it. It will give people the opportunity to become involved in TVA's activities, get community concerns understood and addressed, and help shape the decisions that are made.

2.3 PRELIMINARY SCHEDULE AND REPORTING

Key activities, participants, and potential time frames for near term activities are as follows:

- Determining scope of future decision(s)-proposed Interagency Team-March 2009
- Draft Community Involvement Plan - March 2009
- Notice of Intent -March 2009
- DQO workshops for future ecological decision-proposed Interagency Team, natural resource damage assessment trustees, and scientific community-April 2009
- DQO workshops for other future decisions-proposed Interagency Team-April/May 2009
- SAPs for any necessary data collection-produced by TVA, reviewed by proposed Interagency Team-early summer 2009
- Data collection-TVA and scientific community-begin summer 2009, end depends on extent of sampling proposed

If early decisions are identified, an EE/CA/EA may be able to be generated in the spring/summer of 2009 with community involvement to support a summer 2009 early decision.

Progress reports will be through status meetings at least every other week with the proposed Interagency Team. As documents such as SAPs are generated, they will be sent to the Interagency Team and appropriate support agencies for review. Most documents are anticipated to receive an expedited two- week review since the proposed Interagency Team will have been involved in scoping the documents. Larger documents developed later in the process such as the EIS will have a longer review period and incorporate community involvement.

3.0 PLAN FOR ENVIRONMENTAL MONITORING DURING CLEANUP

As discussed in Section 2.1 of this CAP, the initial assessment of environmental impacts of the ash spill began immediately during emergency response efforts at the KIF site. Ongoing monitoring activities are currently in progress with TVA and involved regulatory agencies conducting the monitoring of air, surface water, groundwater, soil/ash, and natural resources. Aspects of the environmental monitoring program by media during various stages/activities of ash cleanup are discussed in detail in the following sections.

3.1 OVERALL MONITORING APPROACH DURING CLEANUP

Monitoring approaches in support of ash recovery efforts at KIF can be categorized into three primary types: 1) Routine or ongoing monitoring as part of incident response and ongoing efforts to monitor conditions related to public and environmental health, 2) Monitoring that will be related to task specific cleanup activities such as dredging, and 3) RI or risk-based type monitoring as discussed previously in Section 2.2. For the purpose of this section, the first two types of monitoring, routine or ongoing and task specific will be discussed.

Routine or ongoing monitoring will continue throughout the ash cleanup effort. This type of monitoring was initiated almost immediately after the ash spill and is used to ensure public and environmental health is protected throughout cleanup activities. Examples of ongoing monitoring being conducted include, but are not limited to, fixed and mobile air station monitoring, effluent and finished water monitoring at public water supply facilities, monitoring of private groundwater wells and springs, and monitoring of adjacent surface water bodies. More detailed SAPs will be developed for these routine/ongoing monitoring efforts as activities move more from the initial response phase to the cleanup phase.

Task or activity specific monitoring programs will be developed and implemented during the various phases of ash cleanup. For example, during dredge operations, surface water monitoring locations will be identified and sampled to assess point source as well as upstream and downstream impacts to surface water caused by the dredge. Focused, activity-specific air monitoring may also be established to deal with potential fugitive emissions related directly to mechanical removal operations.

A summary of potential remedial phase media monitoring programs, both routine and task-specific, are discussed below.

3.1.1 AIR

A preliminary AAMP for the KIF ash spill was completed as part of immediate response activities following the spill. This initial plan outlined air monitoring activities to be conducted during the initial response phase of the incident. The updated AAMP outlines the proposed plan for the current and long-term air monitoring onsite and in proximity to the KIF plant during ash remediation efforts. This plan includes both fixed-site and mobile monitoring efforts to be used during the ash recovery phases. The primary purpose of these air monitoring activities is to determine the potential for particulate matter exposures for persons at the KIF plant and to persons who live and work nearby. Ash may become airborne under certain conditions, and re-suspension of inhalable and respirable ash particles is of concern for persons located on and off site. Currently, TVA is taking significant actions to mitigate fugitive dust emissions from ash. These actions are described in Section 6.2.1 of this CAP. The air monitoring tasks outlined in

the AAMP will aid in identifying potentially adverse off site impacts, so that these conditions can be remedied as necessary.

This monitoring plan may be augmented for task-specific activities, as appropriate. For instance, if a type of dust suppression agent is used on the ash, air samples from closer locations may be collected for additional analysis to determine the efficacy of the chosen agent.

3.1.2 GROUNDWATER

As discussed in greater detail in Section 4 of this CAP, monitoring of groundwater from both onsite and offsite locations has been an ongoing activity since the initial ash spill in order to determine affects on localized groundwater resources and public health. This routine monitoring will continue and a SAP will be developed to support this work.

In support of task specific cleanup activities or design requirements, focused DQO sessions will be completed which will establish task specific groundwater sampling approaches and subsequent SAPs to support these activities. These plans may include the installation of additional groundwater monitoring and observational systems to supplement existing monitoring networks. The content of the plans will depend on the type and location of planned remedial activities.

Groundwater well abandonment plans and procedures may also be developed in order to support activities associated with the well abandonment for KIF wells damaged during the initial event or wells deemed as no longer required as part of future monitoring. Groundwater well abandonment plans will be developed in accordance with applicable state requirements.

3.1.3 SURFACE WATER

Initial water quality monitoring began December 22, 2008 and was focused on evaluating the extent of water quality affects associated with the ash spill. Variables monitored focused on total suspended solids and heavy metals, as these variables were determined to be most likely to be elevated by a spill of this type. One focus of the early monitoring was to determine whether there had been any effect on public drinking water supplies. Samples of river water were collected in close proximity to the Kingston Water Treatment Plan (KWTP) intake near TRM 568. Subsequently, following a few days of TVA monitoring of river water and finished drinking water quality at that plant, a program was developed in which TDEC obtained samples of both raw and finished water, ultimately at the four water utilities in closest proximity to the spill, and had them analyzed by the Tennessee Department of Health Environmental Laboratory. It is expected that this routine monitoring of public water supply intakes and finished water will continue throughout the ash cleanup effort.

In support of both routine and task specific activities, TVA will continue its monitoring of surface water three times per week at five locations on the Emory River, four locations on the Clinch River, and two locations on the Tennessee River during dredging operation (Table 3.1). These designated surface water monitoring sites will also be sampled after every 0.5” or greater (24-hour total) rain event as monitored at the onsite TVA mobile lab and the meteorological station co-located with an air monitoring station on Lakeshore Drive. This plan will be amended or updated, as required, as various remedial actions are planned. Additional in-situ stream measurements such as turbidity monitoring could be conducted as specified in the plans. Implementation of a long-term sampling plan for surface water will continue throughout the recovery and remediation process to ensure that any threat to public health is quickly detected.

TABLE 3.1
ROUTINE SURFACE WATER SAMPLING LOCATIONS

Sample Number	Location	RM	Site Label	Sample Type	Depth (ft)	Latitude	Longitude
1	Clinch River	0.0	KIF-CRM0.0-Date	Grab	15	N35.86364	W84.53181
2	Clinch River	2.0	KIF-CRM2.0-Date	Grab	15	N35.88621	W84.52778
3	Clinch River	4.0	KIF-CRM4.0-Date	Grab	15	N35.88956	W84.49892
4	Clinch River	5.5	KIF-CRM5.5-Date	Grab	15	N35.89274	W84.48142
5	Emory River	0.1	KIF-ERM0.1-Date	Grab	15	N35.88986	W84.48778
6	Emory River	1.75	KIF-ERM1.75-Date	Grab	15	N35.90305	W84.49708
7	Emory River	2.1	KIF-ERM2.1-Date	Grab	mid-depth	N35.90925	W84.50055
8	Emory River	4.0	KIF-ERM4.0-Date	Grab	15	N35.92416	W84.48255
9	Emory River	12.2	KIF-ERM12.2-Date	Grab	0.5	N35.92899	W84.55450
10	Tennessee River	563.5	KIF-TRM563.5-Date	Grab	15	N35.83941	W84.58283
11	Tennessee River	568.5	KIF-TRM568.5-Date	Grab	15	N35.85539	W84.53068

3.1.4 ASH SEDIMENTS

Sediment/ash sampling or monitoring of migration of ash may be appropriate during implementation of various actions. Several hydrographic surveys have been performed subsequent to the ash spill to characterize the distribution of the primary deposits of ash in the Emory River and movement of that ash during moderately increased river flows following rain events. In addition, field surveys have been performed with hand-operated scientific dredges (Eckman and Ponar dredges) to identify the spatial extent of lesser amounts of ash deposits (trace amounts to a few inches' depths). Future task-specific work may include monitoring the resultant downstream distribution of ash to determine if ash has migration during cleanup efforts.

3.2 REPORTING

3.2.1 REGULATORY

TDEC and EPA have been actively engaged in helping to review and plan TVA's immediate response since the outset. TVA has cooperatively worked with these and other regulatory authorities in a joint effort to minimize any immediate threats to human health and the environment. As previously noted, comprehensive sampling and monitoring programs have been, and will continue to be, established in coordination and cooperation with the regulatory authorities to assess impacts and formulate a comprehensive recovery strategy.

TVA initially compiled monitoring results in a database that was being updated daily. TVA provided Excel spreadsheet reports and analysis sheets to TDEC and EPA on an ad hoc basis. A more formal data management procedure has been implemented to ensure that information presented is accurate and secure using a modified version of the Access based SCRIBE program provided by EPA.

Reporting documents such as task specific closure reports, engineering reports, or remedial investigation type reports will be an additional primary means for discussing and documentation of monitoring results.

3.2.2 PUBLIC

Since December 22, 2008, TVA has published information about the event on the TVA internet site, www.tva.gov/Kingston. Beginning on December 29, 2008, TVA established the Kingston Ash Slide web pages as the primary means of reporting to the public. This information has been accessible through navigation web links on the TVA internet home page. Updates are made on a frequent basis as provided by communications and technical staff. Updates will continue as results from routine monitoring become available.

TVA's internet site includes:

- Summary of recovery and cleanup activities
- Air, water, and soil/ash sampling results from TVA and regulatory agencies
- Community outreach information (e.g., phone numbers, addresses, times of operation)
- Public health information released by governmental agencies
- Inspection reports
- Photographs and videos
- Links to related governmental internet sites
- Archived information (e.g., previous fact sheets and updates, press releases, incident action plans)

To supplement internet communications TVA established an update telephone line as well as routinely publishing information in the local Roane County newspaper.

4.0 PLAN TO PROTECT WATER SUPPLIES

In response to the ash spill, both surface water and groundwater monitoring efforts were initiated by TVA and other regulatory agencies. Surface water sampling locations have been established to assess the impacts of the ash spill on the local river system and at public water supply intakes. TVA sampling teams are currently conducting surface water sampling three days per week on the Tennessee, Clinch and Emory Rivers. Current surface water monitoring locations encompass approximately 14 miles of the local river system and establish upstream, point-of-release, and downstream surface water monitoring. Figure 4.1 shows the current groundwater sampling area and surface water monitoring locations established by TDEC. In addition, following the ash release, frequent monitoring of the KWTP near TRM 568, and Rockwood Water Treatment Plant (RWTP) raw (untreated) and finished water was initiated. Samples analyzed to date indicate the municipal water supplies are safe with no results above regulatory standards for the treated drinking water at either KWTP or RWTP. Public drinking water supply monitoring (raw and finished water) will continue to be conducted at both KWTP and RWTP during ash removal and in-river cleanup activities. Based on results of data collected to date, distance from the primary ash impacted portion of the Emory River, and treatment capabilities of the KWTP, it is unlikely that a contingency plan is needed for finished water exceedences of drinking water standards resulting from the KIF ash spill.

4.1 KINGSTON PLANT SITE MONITORING WELLS

Periodic groundwater monitoring in connection with solid waste landfills at the KIF plant will continue during the clean-up phase in accordance with facility permits. Prior to the ash spill incident, unfiltered groundwater samples were collected semiannually from four monitoring wells associated with the Ash Disposal Area (IDL 73-0094), and were analyzed for the 17 inorganic constituents listed in Appendix I of TDEC Rule 1200-1-7-.04. Figure 4.2 shows the well locations. Two of these monitoring wells (4B and 16A) were destroyed by the dredge cell dike failure. Replacement of these two wells appears likely. Ten monitoring wells surrounding the Phase I Gypsum Disposal Facility (IDL 73-0211) have been sampled quarterly for the 17 Appendix I inorganics since March 2008. Any evidence of groundwater contamination associated with either of these facilities having the potential to impact offsite groundwater supplies will be reported to TDEC.

Groundwater monitoring will be performed at the dredged ash processing area (ballfield area) located just west of the active ash pond. One upgradient and two downgradient monitoring wells will be installed at the facility. Quarterly monitoring is scheduled to begin in March 2009. Samples will be analyzed for the 17 inorganic constituents listed in Appendix I of TDEC Rule 1200-1-7-.04.

Additional groundwater monitoring wells and sentinel wells (early warning system) will be installed, as needed, at selected locations in order to provide early detection of ash chemical migration prior to impacting offsite groundwater supply wells or springs. The number, locations and monitoring frequency of these wells will be determined on the basis of further evaluation of the groundwater regime and will be agreed to by TVA and the regulators prior to installation.

A representative background monitoring well network may also be established in order to assist in characterizing background water quality for relevant aquifers of the site region, if data from existing wells and springs is determined to be inadequate. The number and location of potential background wells will be determined following evaluation of existing background data.

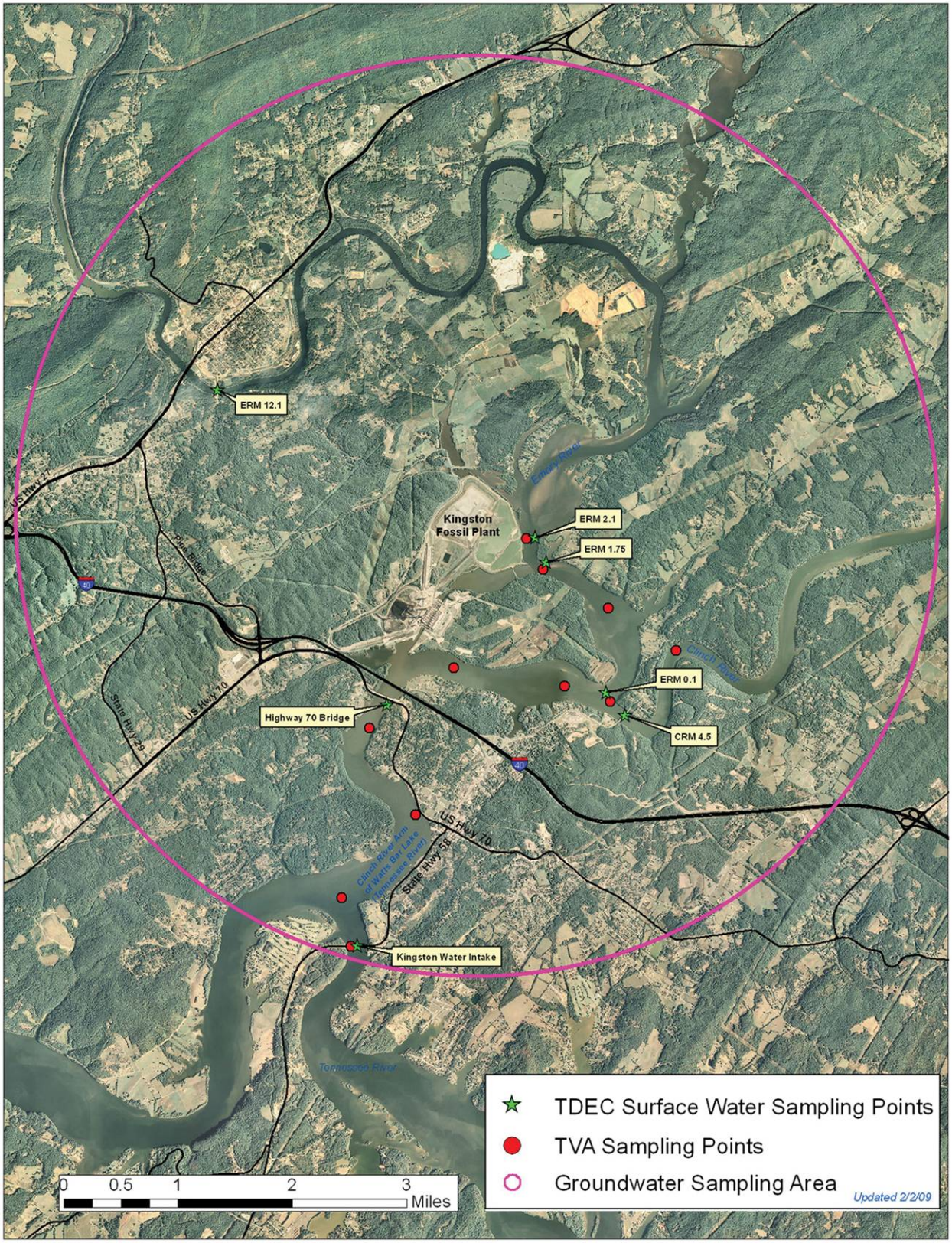


Figure 4.1. Current Groundwater Sampling Boundary & Surface Water Sampling Locations

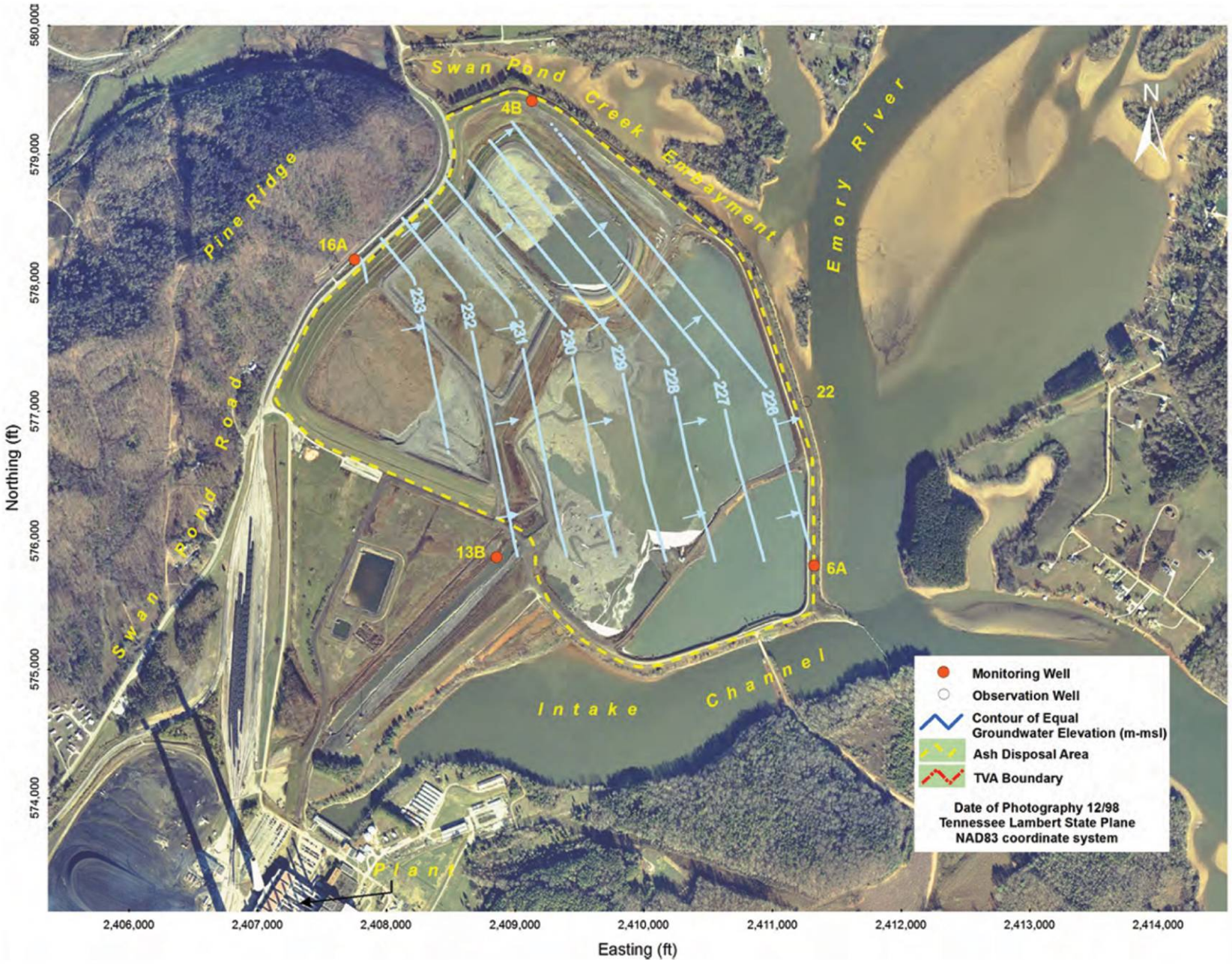


Figure 4.2. Pre-Event TVA Ash Disposal Cell Monitoring Wells

During the ash cleanup period, observation wells will be installed in relevant aquifers at selected locations in ash impacted areas to acquire data such as groundwater elevations, both prior to and during cleanup. Data will be used to evaluate groundwater gradients and gradient changes in response to changes in reservoir stage and to pumping of one or more wells. Observation wells may be equipped with continuous pressure transducer data recorders. An additional pressure transducer/recorder may also be placed in the reservoir and monitored in conjunction with observational well systems.

4.2 OFFSITE PRIVATE WATER SUPPLY WELLS AND SPRINGS

Residential well water sampling is currently being conducted by TDEC. TDEC has sampled residential well water within a 4-mile radius of the ash spill (Figure 4.1). On-going groundwater monitoring to ensure protection of offsite private water-supply wells and springs during the cleanup phase will be performed within the region proposed on Figure 4.3. The primary groundwater contamination pathway of concern for offsite groundwater supplies is infiltration of ash leachate below the ash laden land bordering the Emory River and its tributaries. Shallow groundwater movement within each tributary watershed is expected to generally follow topographic slope, i.e., with groundwater migrating down slope and ultimately discharging into the stream. Any potential chemicals leaching from ash deposited along stream margins would be expected to generally flow toward the stream. On this basis, the monitoring region shown on Figure 4.3 is generally confined to the lower portions of the watersheds associated with ash-impacted tributary streams on the west side of the Emory River. The region of monitoring conservatively extends approximately 0.25 mile upslope of ash-impacted land and surface water. This 0.25-mile buffer allows for uncertainties regarding localized groundwater flow direction that can occur in fractured bedrock aquifers. Potential gradient reverse issues will be evaluated as part of the overall groundwater monitoring program to be developed in conjunction with the regulators.

On the east side of the Emory River, groundwater monitoring will be limited to river frontage properties having wells located directly across the river from the ash-filled portion of the channel (Figure 4.3). Although no ash-impacted land is present on or near these properties, monitoring will be performed to assure there is no transport of ash-related chemicals from ash deposits in the river channel to groundwater supplies due to hydraulic gradient reversals caused by over-pumping of wells or seasonal changes in reservoir stage.

Forty-seven (47) land parcels having inferred well or spring supplies are indicated within the designated offsite groundwater monitoring region. Information regarding land parcels with inferred private or individual water supplies on Figure 4.3 was provided by Roane County Emergency Management, and is based on property records and records of residents served by local public water systems. Examination of recent photo imagery indicates some of these parcels are undeveloped and probably have no water supply. The status of existing well or spring supplies within the monitoring region will be confirmed during the first monitoring event. In addition, an attempt will be made during that event to obtain additional information regarding each groundwater supply (e.g., well depth, screened interval, aquifer penetrated, water usage rate, etc.).

Wells or springs located on properties impacted by ash deposits or within approximately 500 feet of ash deposits will be sampled quarterly during the first year. Other wells and springs in the designated monitoring region will be sampled semiannually. The frequency of monitoring of each well and spring will be re-evaluated annually based on monitoring results and proximity to ash laden areas.

Figure 4.3. Proposed Groundwater Monitoring Area

Unfiltered groundwater samples collected from all offsite groundwater supply wells and springs within the designated monitoring region during the first sampling event will be analyzed for all field and laboratory parameters listed in Table 4.1. Laboratory parameters include the 17 inorganic constituents listed in Appendix I of TDEC Rule 1200-1-7-.04 and several macroconstituents useful for overall groundwater characterization. Boron and sulfate are included because they are relatively mobile characteristic indicators of ash leachate, and may provide early warning of possible ash leachate contamination. Sample analytes for subsequent sampling events will be limited to field parameters, boron, sulfate, and the 13 Appendix I inorganics having primary drinking water MCLs (Table 4.1).

TABLE 4.1
GROUNDWATER MONITORING ANALYTES FOR OFFSITE WELLS AND SPRINGS

Field Parameters		
Acidity	Dissolved Oxygen	Temperature
Alkalinity	Oxidation-Reduction Potential	Water Level
pH	Temp	
Laboratory Parameters		
Aluminum, Total	Filterable Residue (TDS)	Selenium, Total*
Antimony, Total*	Fluoride, Total*	Silver, Total*
Arsenic, Total*	Inorganic Carbon, Total	Sodium, Total
Barium, Total*	Iron, Total	Strontium, Total
Beryllium, Total*	Lead, Total*	Sulfate, Total
Boron, Total*	Magnesium, Total	Thallium, Total*
Cadmium, Total*	Manganese, Total	Vanadium, Total
Calcium, Total	Mercury, Total*	Zinc, Total*
Chloride, Total	Molybdenum, Total	
Chromium, Total*	Nickel, Total*	
Cobalt, Total	Non-Filterable Residue (TSS)	
Copper, Total*	Potassium, Total	

***Parameter having primary MCL**

4.3 EVALUATION AND REPORTING OF MONITORING DATA

Surface water and groundwater monitoring data collected during ash cleanup phases will be evaluated no later than thirty (30) days following receipt of analytical results. If data is determined to be critical in nature, expedited review times will be scheduled. Data will be examined for concentrations exceeding MCLs or above the normal range of background, as well as for evidence of increasing concentration trends. Confirmatory resampling of any well or spring exceeding one or more MCLs will be performed within 7 days following identification. Data will be examined for increasing trends or values exceeding the normal range of background concentrations. For example, elevated levels of boron or sulfate could be indicative of ash contamination, and would prompt increase monitoring frequency of affected locations.

TVA will review the scope of the monitoring program at least yearly. Any recommended changes to the program (e.g., changes in wells/locations to be sampled, sampling frequency, or analyses) will be discussed with the Interagency Team.

It is assumed that TDEC will continue to perform monitoring of offsite groundwater monitoring wells and springs. Monitoring data will be available from TDEC, and summary results of the monitoring program will continue to be available on their website (http://www.tennessee.gov/environment/kingston/results.shtml).

Formal reporting of data will be via Interagency Team agreed to preliminary status reports and formal decision documents. Actual formats for these reports and reporting schedules will be agreed to at a later date by TVA and the applicable regulatory agencies.

Data will be submitted to the EPA SCRIBE.net site for management and subsequent publishing.

Public meetings may also be a format utilized to present the planned monitoring program(s) and results of these programs to interested members of the community. Additional details regarding public meetings will be presented in TVA's Community Involvement Plan.

4.4 REPLACEMENT OF AFFECTED GROUNDWATER SUPPLIES

If well or spring water supplies are affected by the KIF ash spill and exceed a drinking water standard, TVA will provide an alternate water supply at no cost to the owner. Water supply replacement may include, but is not limited to one of the following options: (1) connection to a public water supply system (2) provisions to provide bottled water, (3) well replacement, or (4) installation of a localized water treatment system.

Specific criteria or guidelines for establishing the need for alternate groundwater supplies will be developed on the basis of a thorough review of groundwater quality data for the site locality, including statistical characterization of background groundwater for each aquifer currently in use. As previously discussed, depending on the availability of reliable data, this might require installation and sampling of representative background monitoring wells to adequately characterize background water quality. In general, evidence of ash-related contamination would be concluded only if sample results are above MCLs, are also above the range of local background concentrations, and are not associated with metals often leached from plumbing materials (e.g., copper, lead, zinc). Resampling or additional sampling of the affected well or spring may be required to determine MCL exceedences. For example, direct sampling of an affected well (prior to the well water pumping through residential plumbing systems) may be necessary to eliminate potential plumbing-related sources of metals. Additional samples analyzed for an expanded analyte list may also be necessary in order to differentiate potential contaminant sources. An alternate water supply will be provided to the affected well or spring owner until such investigations are completed.

5.0 PLAN FOR THE MANAGEMENT OF COAL ASH

The coal ash management plan for KIF is described in three components: 1) short-term management of spilled ash; 2) long-term management of spilled ash, including a revised closure plan for the Class II ash disposal facility; and 3) future management of production ash via dry ash conversion.

5.1 SHORT-TERM COAL ASH MANAGEMENT

Short-term management actions are planned to address the following elements:

- Removal of ash and debris from the main channel of the Emory River (Phase I dredging).
- Scouring concerns for Dike C.
- Removal of ash east of Dike #2 in the mouth of the Swan Pond Embayment.
- Dewatering of dredged ash and temporary stockpiling of recovered ash.
- Short-term disposition of ash generated from removal actions.
- Management of surface water run-on and drainage from the Swan Pond Embayment. area

5.1.1 DREDGING OF THE EMORY RIVER

TVA has prepared and submitted to TDEC, EPA and other involved agencies, the Phase I Emory River Dredging Plan, dated February 2009. The primary objective of the Phase I dredging plan is to remove ash and debris from the main channel of the Emory River, clearing the channel to a design elevation of 710 feet msl utilizing hydraulic and mechanical dredging. In addition, the recently-constructed underwater weir (referred to as Weir #1) will be lowered to the depth of the dredge cut. This will restore flow to the original channel without disturbing legacy, native river sediments. The Phase 1 dredging plan includes mitigation and monitoring actions to minimize the re-suspension of ash during the dredging operations, and addresses dredge material handling, drying, and temporary storage. The approved Dredging Plan will be posted on the TVA website.

Dike C Scouring Evaluation

Concurrent with planning for Phase I dredging, a river morphology engineering evaluation is underway for the segment of the river upstream of the plant intake channel. Changes in the river flow due to the new ash deposits and construction of Weir #1 could potentially lead to scouring of Dike C. The evaluation is proceeding with both short-term scour mitigation planning and an overall river morphology assessment. The short-term evaluation focuses on immediate action items needed to reduce the risk of scour along the shoreline and river channel immediately below Dike C. The overall river morphology study includes both two-dimensional and three-dimensional modeling of the river current dynamic forces considering the altered channel geometry following the dredge cell incident under varying flow conditions. The objective of this evaluation is to establish if the altered flow regime will result in significant scour forces and to develop associated scour mitigation plans. Initial recommendations regarding river bank revetment are to place riprap as shown in Figures 5.1 and 5.2.

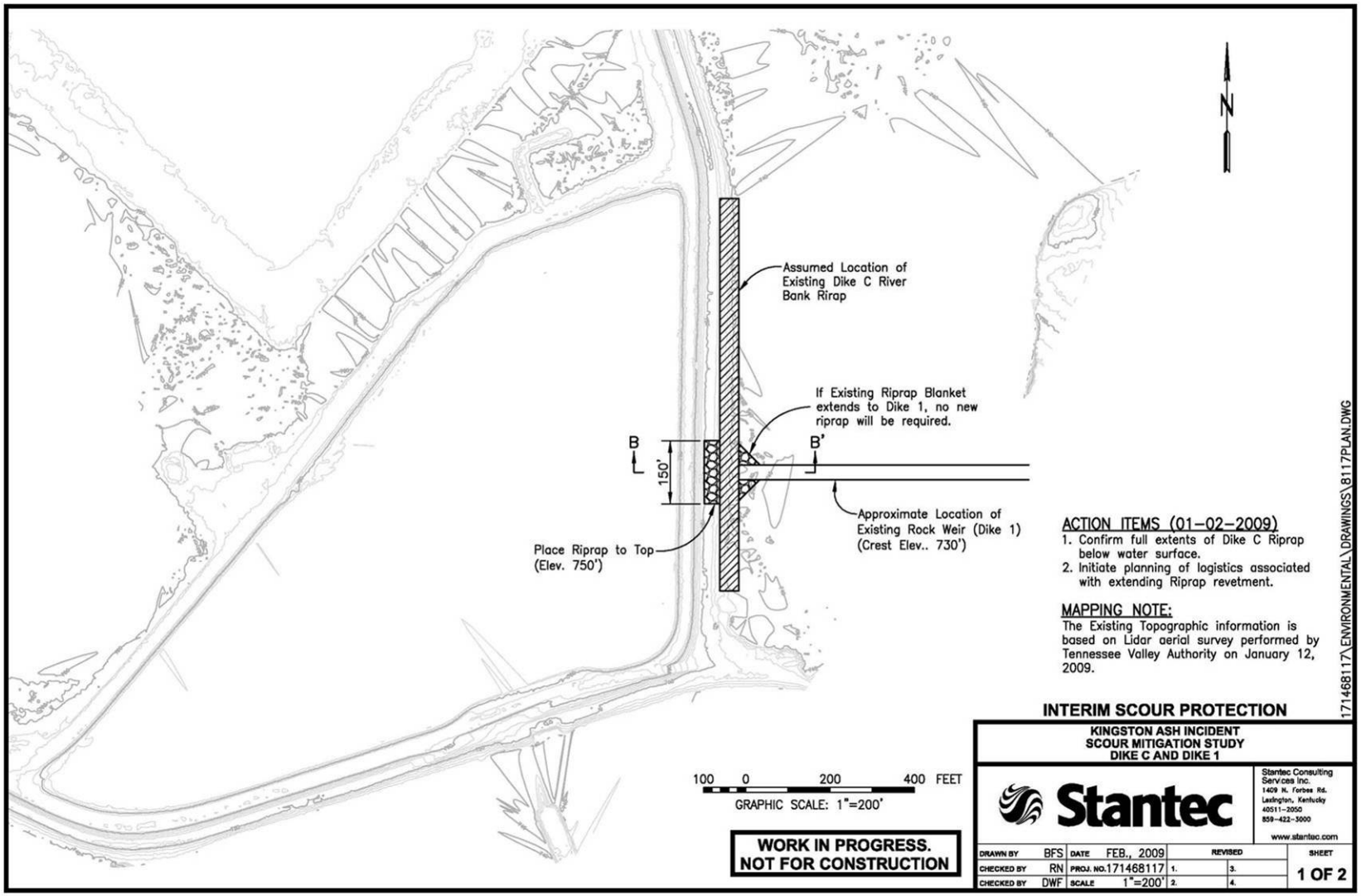


Figure 5.1. Proposed Interim Scour Protection for Dike C Plan View

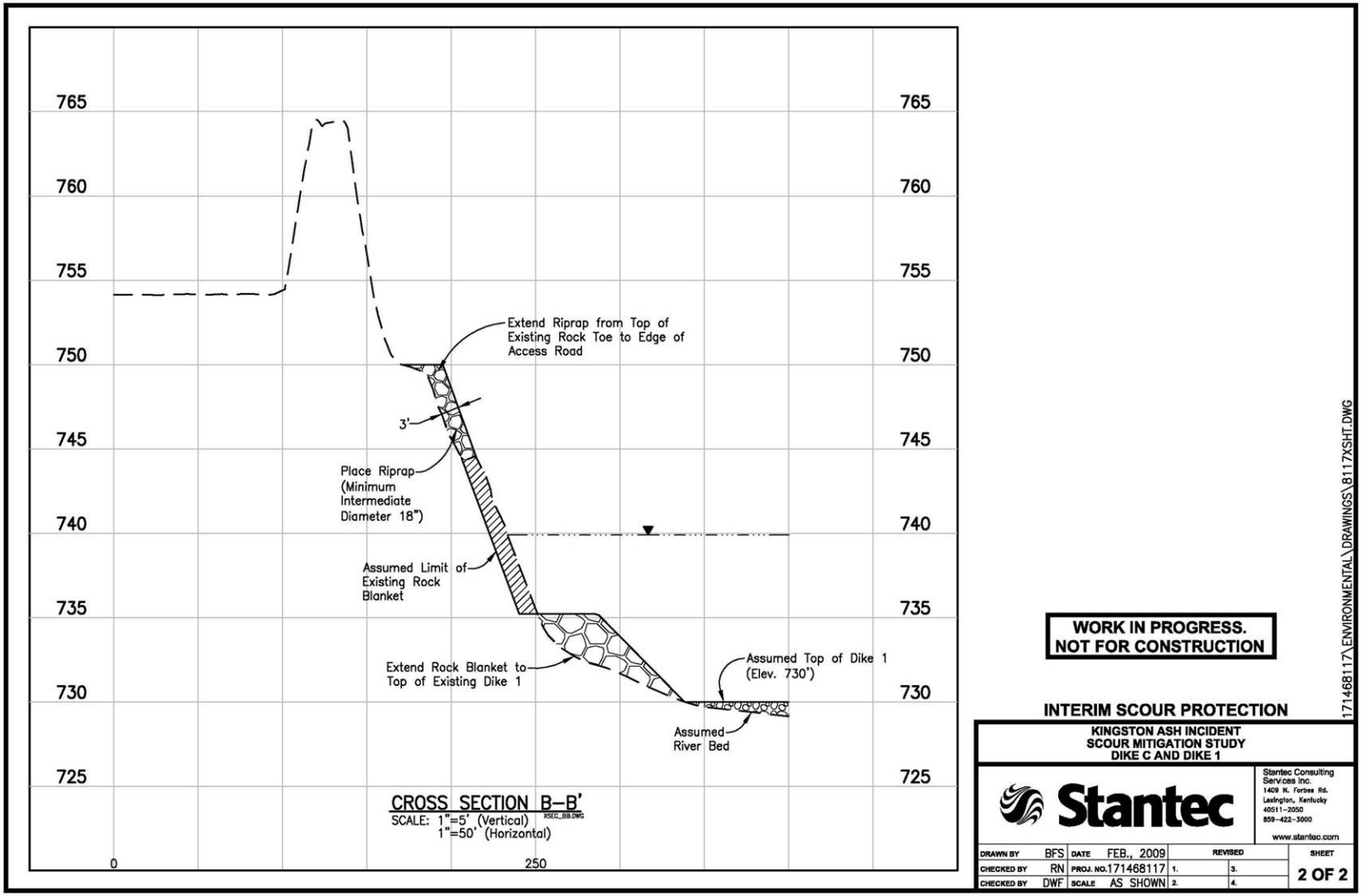


Figure 5.2. Proposed Interim Scour Protection for Dike C Cross-Section

TVA divers performed a survey of existing river bank revetment on February 12, 2009. The water elevation was approximately 736 feet msl and at that level, the bottom of the dike riprap is exposed and some of the river bottom is exposed. The water was so shallow that they were able to do the inspection from the boat. The depth of the water approximately 20 feet from the bank is about 4 feet deep and no significant riprap existed under the water. The river modeling study is currently being performed.

Phase II and Subsequent Dredging Plans

The Phase II dredging plan has not been developed, but it will address the restoration of the Emory River channel back to its original depths, while minimizing the disturbance of legacy sediments. The Phase II plan will incorporate lessons learned from the Phase I dredging operations, as well as the comments received on the Phase I plan from TDEC, EPA, and other agencies. It is anticipated that TVA, TDEC, EPA, and other agencies will convene an in-progress review of the Phase I dredging operations that will be incorporated into the final scoping for Phase II and subsequent dredging plans.

A subsequent dredging plan is contemplated to focus on removal of ash deposits that are outside of the Emory River channel, east of Dike #2. As ash removal operations progress westward from the Emory River into the Swan Pond Embayment, the plan is to shift removal operations from dredging to land-based equipment, possibly working these in parallel. The plans for ash removal from land have not been developed and will be scoped through the proposed Interagency Team as the longer-term actions are evaluated.

5.1.2 DEWATERING AND TEMPORARY STORAGE OF RECOVERED ASH

As dredged material is recovered, it will be dewatered and temporarily stockpiled at KIF prior to being transported and disposed. Two on site areas are currently being developed for ash processing and stacking. One area is commonly known as the “Ball Field Area” and the second is the Phase II Gypsum Pond area. The detailed plans for the preparation and operation of the Ball Field Area have been submitted for regulatory review concurrent with the Phase I Dredging Plan. Additional planning is underway to develop the Phase II Gypsum Pond to expand the capacity for onsite temporary processing and storage in order to accommodate sustained Phase I dredging operations. Figure 5.3 shows the general locations of these areas on the KIF site. The following sections summarize the development of and planned operations for these two areas.

Ball Field Area

The Ball Field Area is triangular in shape and roughly 65 acres in size. It is bordered on the north by the existing ash stack cell 1, on the east by the existing ash sluice channel, and on the west by the plant entrance road. It was formerly an ash pond which is now soil covered and contains several ball fields, and two chemical treatment ponds. The area is also currently being used for temporary storage of ash removed from the west side of the failed dredge cell area. A filter fabric and crushed limestone layer will be installed over the entire area as a separation between the new processed ash and the old ash in the original ash pond. This layer will act as a demarcation indicator to aid in the removal of the processed ash, as well as a means to chemically bind arsenic and mitigate its transport into groundwater.

Figure 5.3. Ash Processing and Temporary Storage Locations

Due to the need for expediency, an interim closure of the two chemical ponds will be completed and involve temporarily leaving the sludge material in place after stabilizing and capping with a demarcation layer of crushed stone and filter fabric. A risk assessment consistent with TDEC criteria will be performed to determine the risk involved in leaving the sludge encapsulated in place as part of a final closure. If the risk assessment determines that it is not acceptable to leave the material in place, a final closure of the pond will be accomplished at a later date when the sludge is removed.

As currently planned, the Ball Field Area will be sub-divided into at least two areas to accomplish ash dewatering, drying and temporary stockpiling. The material will be dewatered in a series of adjacent ditches and the recovered ash placed in a stock pile. The west side of the triangle is reserved primarily for short-term storage and additional drying. The current plan does not include stacking against the slopes of the failed dredge cells. A stability analysis of the site has been developed based on very conservative soil parameters and assumptions. The limiting factor is assumed to be the very loose ash fill material that will provide the foundation layer within this area. Since laboratory testing data was not available at the time of preparation of these calculations, conservative materials properties are assumed and in-situ density is varied in order to estimate the maximum safe filling height.

This analysis limits the maximum height of the stack to approximately 8 feet utilizing a safety factor of 1.5, which is a typical safety factor employed for a permanent facility design. Additional geotechnical investigation of the site is currently being performed which will include a further stability analysis of the area. This in-depth evaluation will ultimately determine whether material can be stored at heights greater than 8 feet in this area.

The current plan is to stockpile the ash in the Ball Field Area on a temporary basis until it can be moved to an authorized final disposition location. As currently planned, ash will not be stored for more than a year; however processing will continue beyond a year. Preparation of this area is on the critical path to initiate the Phase I Emory River dredging. In addition, an off site disposition alternative must be quickly selected to accommodate the commencement of Phase I dredging as soon as possible.

Phase II Gypsum Pond Area

A plan to develop a second temporary ash processing and stacking area will be proposed for the permitted Phase II Gypsum Pond area. This site is approximately 41 acres in area, and is the eastern section of the area previously identified and permitted to receive flue gas desulphurization byproducts from the scrubber system currently under construction at KIF. The preliminary plan for this area includes details for mass excavation and grading to construct the settling trenches, dewatering trenches, stacking area for drying operations, and temporary ash stacking areas all to be located on a temporary basis within the Phase II Gypsum area.

The preliminary plan contemplates the Phase II Gypsum area to be designed to accept the discharge from two dredges potentially removing 1.5 million cy of ash from the river channel. A settling trench would be utilized to remove approximately 90% of the solids from the dredge flows. The solids would then be removed from this trench and placed into and adjacent dewatering trench via mechanical means. After water is allowed to drain from the material in the dewatering trench, it would be removed with excavating equipment and placed in the temporary stacking area. Material in the temporary stacking area would be wind-rowed using grading equipment to promote further drying. It is anticipated that the moisture content of the ash at this stage of the process would be approximately 20%. The ash would then be hauled from the temporary stacking area to permanent storage. Discharge water from the dredging

and dewatering operations would be returned to the existing ash pond using pumps and solid piping.

Dust Suppression During Dewatering and Temporary Storage Operations

Fugitive dust will be controlled through the use of a water truck with spray bars and a top-mounted cannon. The water truck has front and side sprayers to water haul roads to control traffic related dust. This vehicle is also equipped with a water cannon capable of spraying stockpiles and other areas not directly accessible by vehicle. This should be adequate for dust control of wind-rowed ash and intermediate storage surfaces. If the stock pile is expected to be inactive for a period of time and normal water spray dust suppressant is ineffective, a crusting agent may be applied to the surface of the stockpile. A vinyl acrylic emulsion blend liquid dust suppression agent such as TM-06-515 MINCRYL X50™ produced by Momar Inc. or an erosion control mulch such as Flextarra FGM produced by Profile Products LLC, can be applied via a truck and sprayer on the ash. Both of these products are readily available and are currently being used at KIF for dust suppression.

5.1.3 SHORT-TERM DISPOSITION OF ASH GENERATED FROM INITIAL RECOVERY ACTIONS

An immediate challenge is to identify a short-term disposition location for the ash recovered from the Emory River dredging operations. There are several longer-term plans and evaluations that must be completed prior to identifying a permanent disposal location for all of the recovered ash. The revised KIF Class II Closure Plan needs to be finalized and other long-term ash recovery and disposition alternatives need to be evaluated.

TVA's initial focus is to identify off site disposal locations for the dredged ash. Several options are being evaluated, including rail and/or truck transportation to a permitted disposal facility. Requests for proposals will be issued shortly to vendors to furnish rail transportation and permitted off site disposal services. TVA is developing thirty-, sixty-, and ninety-day plans to provide off site disposal capacity when it is needed. Key variables that are being considered in the development of these plans include the start date and production rate of dredging; the capacity of temporary on site storage for dredged ash; and the permitting and development time required if other on site options can be identified.

In parallel, TVA is searching and evaluating long-term options, incorporating input from TDEC Division of Solid Waste and local governments. Among options being considered were existing Class II landfills, sites for new Class II ash monofill sites, and sites where ash could be beneficially reused as structural fill to improve land for civic or industrial reuse. Reclamation of one or more of the many mine sites in the area is another beneficial reuse under consideration.

5.1.4 MANAGEMENT OF SURFACE WATER RUN-OFF AND DRAINAGE FROM THE SWAN POND EMBAYMENT AREA

TVA submitted a stormwater pollution prevention plan (SWPPP) to TDEC on January 31, 2009, and TDEC subsequently approved the SWPPP on February 2, 2009. The plan addresses management of water from both the ash processing and the Swan Pond Embayment areas. Relative to the embayment, the plan incorporates collection of clean water at upstream diversion berms at the northern and western ends of the embayment. The collected clean water will be piped/ditched to culverts in Dike #2 and then discharged in a channel. Dredging operations must be coordinated to open the channel allowing discharge to the Emory River. Water draining through the ash in embayment will be collected via several ditches cut into the

ash deposits and conveyed to two sediment basins. Once suspended ash settles in the sediment basins, the water will be discharged to the river via controlled standpipe structures. These actions would preclude further movement of ash in the embayment, minimize Swan Pond Embayment inflow contact with the ash, and help facilitate recovery of the area in the future. Further detail for the embayment drainage is being prepared for submittal to TDEC.

5.2 LONG-TERM COAL ASH MANAGEMENT

In parallel with implementation of the short-term coal ash management actions previously described in Section 5.1, plans are being initiated to evaluate alternative long-term actions for final removal and disposition of the spilled ash that is not in the Emory River. Generally, these include alternatives for removal of ash west of Dike #2, removal of material immediately north of the failed dike, and finalization and implementation of the revised Closure Plan for the permitted Class II facility (failed dredge cell).

The evaluation of alternatives for these actions will be incorporated into the NEPA framework that is described in Section 2.2 of this CAP. This section describes some of the current ideas for managing ash beyond that removed during the Phase I and II dredging operations. The results of the Root Cause Analysis for the dredge cell failure will drive final design considerations and evaluation for the revised existing dredge cell Closure Plan. This in turn will affect decision making for final disposition of the remaining spilled ash.

Removal of Ash West of Dike #2 and Immediately North of the Failed Dike

Removal of material west of Dike #2 can be accomplished by two methods. Ash below water can be dredged. Ash and debris above water can be removed via a drying and mechanical removal process. This process will remove material to the current water level or to natural ground depending on topography. If material can only be removed to the current water level, dredging will be used to remove the balance of ash or debris.

The reservoir water levels will dictate the removal processes described above. Reservoir elevations fluctuate depending on storm events and seasonal operational levels. Based on the Watts Bar Dam operating curve, the minimum water elevation is (~735.0 msl), and normal full pool is (741.0 msl).

Consideration was given for removal of material adjacent to Dike #2. The stability concerns were discussed with the designer of the dike. Based on the shear mass of this dike and the method of placement, there was no concern about removal of material next to this dike. No limitations are specified.

The remaining portion of Dike C that contains the intact portion of the plant ash pond is being evaluated for stability in addition to the potential scouring due to river flows (Section 5.1.1). Once this evaluation has been completed, a sequencing of material removal adjacent to Dike C will be provided. This will include a buffer zone next to Dike C required during the normal material removal process. A detailed sequence of material removal and revetment placement will be required.

Revised Closure Plan for Class II Ash Facility

TVA has committed to ceasing wet ash storage in the failed dredge cell. However, the cell must be closed and capped,. As part of several long-term actions a plan will be developed and include public input opportunities on the proposed alternatives. Although several alternatives will be considered as part of the NEPA process associated with the cell closure, TVA has looked at one option that may help expedite removal of the ash in the Embayment. TVA is considering an option that involves constructing a dry ash landfill within the permitted footprint, capping the ash with soil, and permanently closing the landfill. Since the root cause of the failure has not yet been determined and the subsurface investigations are not fully complete, only conceptual information is available. As the field and laboratory data become available, further evaluation will be performed.

This closure option would require a replacement for the failed dike as well as possible reinforcements for the remaining dikes, and caps for the entire footprint of the permitted landfill. TVA could employ robust, proven techniques for soil improvement and extend those improvements down to bedrock, about 60 feet deep. Depending on the final engineering evaluation of all data and information, the dikes could have rock reinforcements that would provide a stable dike system. Other features could be installed to control and relieve pore water pressure as the ash is placed in the landfill.

Alternative final ash disposition plans will also be considered as part of the NEPA process based on the volume of material, if any, that can ultimately be placed back into the cell.

5.3 MANAGEMENT OF FUTURE ASH PRODUCTION

In order to manage future ash production, TVA is considering the installation of equipment that enables the fly ash from Kingston to be collected dry. Collecting fly ash on a dry basis will allow for more flexible marketing and disposal options and reduce the size of pond structures. TVA will use the NEPA process to evaluate several options for dry collection systems and other feasible management approaches. If the decision is made to convert to dry collection, the time from project start to completion is expected to take 18 - 24 months. This includes contracting with the vendor, permitting, preliminary engineering, detailed engineering, material procurement, fabrication, delivery, construction, installation, and startup. Once the conversion is complete, there are several options for managing the fly ash. If the quality of the ash meets the Tennessee Department of Transportation's (TDOT) specifications for use in concrete, TVA would sell the ash as a cement replacement in ready mix concrete. If the fly ash does not meet TDOT specifications, beneficially reusing the fly ash in concrete may not be possible without additional processing of the ash. Other off-site options for managing the fly ash include landfills, structural fill projects, mine reclamation projects, and daily cover material for other landfills.

5.4 PRELIMINARY SCHEDULE AND REPORTING

The short-term coal ash management actions described in Section 5.1 are currently ongoing and in various stages of planning and implementation, including submittal of plans to the regulatory agencies, site preparation, and procurement. The majority of these actions are expected to start in the construction phase in the coming spring months, including:

- Phase I dredging in the Emory River navigation channel.
- Dewatering, temporary storage, and off-site disposal of dredged material.

- Dike C scouring evaluation and placement of riprap.
- Management of surface water from the Swan Pond Embayment.
- Phase II dredging of remaining Emory River.

TVA will prepare and issue construction completion reports, including as-built documentation as appropriate, at the conclusion of each major action. The completion reports will become the basis for documenting the progress of the overall ash spill cleanup and communicating progress to the regulators and the public.

Regarding the schedule for the long-term coal ash management actions described in Sections 5.2 and 5.3, it is anticipated that the planning done by the proposed Interagency Team would be utilized to set schedules and establish protocols for future reporting.

6.0 PLAN TO ADDRESS ANY HEALTH OR SAFETY HAZARDS POSED BY THE ASH TO WORKERS AND THE PUBLIC

This section addresses the plan for protection of the public and worker health and safety during ongoing recovery actions and future cleanup actions. A summary of TVA's initial actions to assess and mitigate any hazards to the public and workers is also provided. The most critical element of the public and worker health and safety plan as it is implemented is early and frequent communication. The public will be informed via multiple media of the ongoing monitoring and mitigation measures to be employed during various actions of the cleanup. Data will be posted on the Web and communicated at public meetings. The workers will participate in the overall TVA safety and health program that is designed to protect their health and safety as the cleanup continues.

6.1 INITIAL ASSESSMENTS AND RESPONSE

Immediately after the event, TVA undertook a number of actions to both assess the impact of the event on the public health and safety and implement health and safety procedures to address the safety of the initial response workers. The following is a summary of those actions.

6.1.1 PUBLIC HEALTH AND SAFETY

TVA's initial assessment of the event impact included immediate evacuation of nearby residents, an evaluation of the extent of damage, and dissemination of information to the public. TVA assisted the evacuation of residences impacted by water and ash; and subsequently performed within five days of the release an initial assessment of impacted homes to evaluate the extent of moisture intrusion relative to the potential for mold amplification. Based on this evaluation, recommendations for cleaning of household contents were developed. An initial assessment of the extent and level of risk of debris (e.g., downed trees at the shoreline) and downed utility lines was performed to determine appropriate response actions. MSDS and other informational handouts on coal ash were disseminated to the public. Traffic safety was also addressed due to the obstruction of local roads, heavy equipment operations associated with the initial response, and public curiosity for the event.

TVA's Safety Operations staff provided immediate support and oversight for health and safety, including 24/7 coverage of the evacuation, traffic control, assessment, and recovery activities by a team of TVA professionals augmented by contractor safety experts.

As part of the immediate actions to minimize dust and erosion, TVA implemented an immediate dust suppression plan, as described below. Figure 6.1 is a schematic illustration of this plan.

Ash Deposits

TVA spread grass seed, fertilizer, and straw over the centralized areas of displaced ash via an aerial, helicopter application. More than 85 tons of winter rye grass seed and 12-24-24 fertilizer were used and 650 tons of straw were spread. These operations took place from January 3, 2009 through January 15, 2009. Winter rye requires a temperature of at least 50 degrees Fahrenheit for seven to ten days for germination to occur. A cold front moved in near the end of seeding operations, preventing the seed from properly germinating. TVA will further seed and fertilize if it becomes necessary. The straw that was spread has been successful in reducing fugitive dusting. The seed and straw are temporary measures for controlling dust and erosion until final disposition of the ash is achieved.

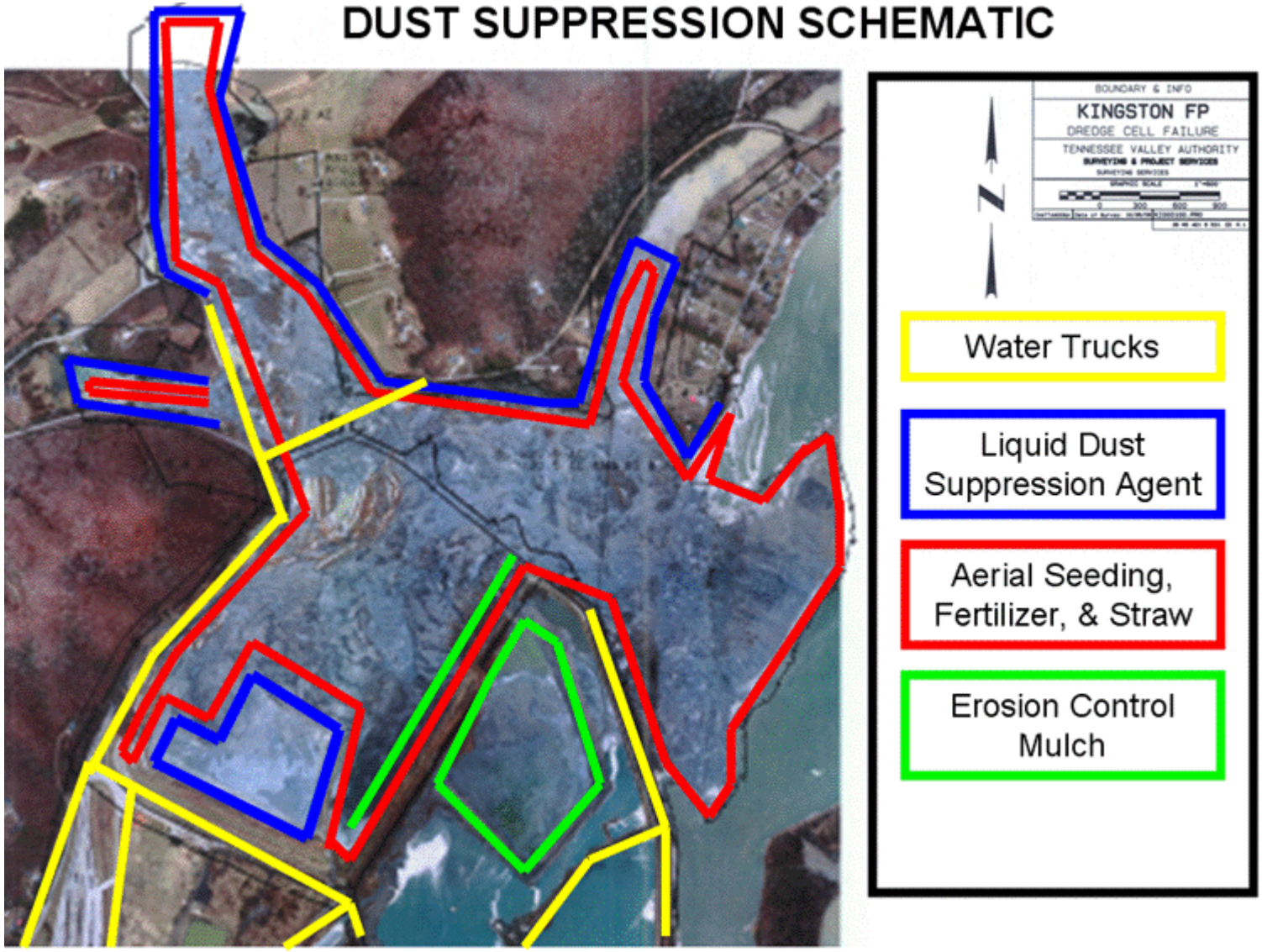


Figure 6.1. Dust Suppression Schematic

The remaining, undisturbed portion of the ash dredge cell was covered with a vinyl acrylic emulsion blend liquid dust suppression agent. Approximately 1,650 gallons of agent were applied via a truck and sprayer. The agent was applied at the lower end of the recommended temperature range, reducing its effectiveness. The top layer flaked off of the ash when exposed to high winds. TVA proceeded to cover the area with straw to prevent fugitive dust. Spraying of the liquid will continue as necessary to suppress dust.

The perimeter of the displaced ash was also treated with the liquid soil binding agent and an erosion control mulch. The areas that were accessible from the road were treated via a truck and sprayer. TVA's Outreach Team worked with home owners to obtain access to these areas. In less accessible places, an amphibious vehicle towing a sled mounted sprayer was used. Approximately 2,300 gallons of agent and 44,000 tons of mulch have been applied to these areas.

TVA also put up snow fencing on residential properties to help deter children and pets from the ash deposits on the shoreline. Air monitoring is described in Section 3.1.1.

Roads

The on-site haul roads and the portions of the public roads that are used by construction equipment were sprayed daily by water trucks. The paved surfaces of public roads were also cleaned by a sweeper/vacuum truck. The combination of the two methods cleaned debris from the roads and reduced dusting. This type of spraying will continue until an alternate construction road is completed, or where it remains necessary. The area around Swan Pond Road and Swan Pond Circle where work is ongoing will continue to be sprayed by water truck. To reduce fugitive dust during freezing conditions, TVA applied a calcium chloride solution along portions of the gravel covered roads that are being used by construction equipment.

Trucks and vehicles leaving the site that have the potential to track ash, mud, or dust were sprayed by a water truck prior to leaving. TVA has purchased and is in the process of installing three wheel-wash stations. These will be installed at strategic locations near the Kingston site, with input on the locations from TDEC and local officials.

Additional Measures

TVA undertook additional actions to address public health and safety concerns during the recovery phase. These included mobilizing contractors specializing in disaster relief to assist in cleaning, removal, and storage of household contents from impacted residences; area control and security to limit access to residents and response personnel; traffic flaggers to direct traffic away from potentially hazardous heavy equipment operations; and, truck washes to minimize the spread of ash offsite.

6.1.2 OCCUPATIONAL HEALTH AND SAFETY

Specific actions taken during initial response actions included industrial hygiene (IH) sampling and industrial safety plans to assess any hazards associated with the immediate response actions. Response workers initially donned dust masks; however, IH monitoring performed initially indicated that respiratory protection was not required. IH monitoring to date has not identified any unanticipated hazards to workers. Activity-specific IH monitoring plans will continue to be implemented as part of initial activity-specific planning. The initial industrial hazards for response actions included heavy equipment operations, downed utility lines, river operations, and fatigue from long work hours. As an added level of diligence, TVA requested a

third party review of onsite workers health and safety conditions. The Shaw Environmental and Infrastructure group inspected the Kingston Ash Recovery site and activities and determined that "the current site operations do not fall under the scope of the Occupational Safety and Health Administration (OSHA) HAZWOPER standard because the current operations do not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards, as related to the HAZWOPER standard".

6.2 CURRENT AND FUTURE CLEANUP ACTIONS

Current actions for the cleanup are planned or ongoing, including Phase I dredging in the Emory River, site preparation for processing and disposition of ash from the dredging, stabilization of the failed ash cell, and management of surface water drainage through the Swan Pond Embayment. As actions are completed and further actions planned, additional evaluations will be performed to identify any new mitigation measures specific to the potential health and safety hazards of the activity. As potential hazards are identified, engineering and administrative controls will be applied to mitigate the hazards; and, activity-specific monitoring plans and action levels will be established to assess the effectiveness of the controls. Routine environmental monitoring and observations already implemented will continually assess the effectiveness of controls implemented to protect the public and workers. Measures currently being implemented and/or planned to protect public and worker health and safety are described below.

6.2.1 PUBLIC HEALTH AND SAFETY

Public health and safety during the cleanup encompasses a wide variety of concerns, principally:

- Protection of area private drinking water supplies,
- Protection of the Kingston and Rockwood municipal water supplies,
- Prevention of upstream flooding along the Emory River, coupled with a release of ash into the Clinch and Tennessee River systems,
- Increased recreational use of the river system as warmer weather approaches, and
- Fugitive dust control and suppression of the spilled ash, both in the current configuration and during cleanup actions.

<u>Protection of area private and municipal drinking water supplies</u>

Section 4.0 of this CAP provides the plan to continue monitoring private and public water drinking water supplies for spill-related constituents. Contingency plans are in place to provide alternate drinking water sources for private supplies. It is not expected that downstream public water supplies could be impacted by KIF-related constituents, but monitoring will continue.

<u>Prevention of upstream flooding along the Emory River</u>

Section 5.1 of this CAP references implementation of the Phase I dredging plan recently submitted to the regulatory agencies. Implementation of this plan will remove the ash currently obstructing the main channel of the Emory River, and will alleviate concerns for flooding and a release of ash downstream into the Clinch and Tennessee Rivers should a major rainfall event

occur. TVA has performed an evaluation and survey of the potentially affected Emory River upstream properties and has issued advisories to the property owners.

Increased river recreational use

It is anticipated that increased recreational use of the rivers adjacent to KIF will trigger additional Emory River boat traffic. Current measures to control public boating traffic on the Emory River will be continued, along with operations to respond to calls regarding cenospheres. Routine (see Section 3.0 of this CAP) and activity-specific (e.g., Phase I Emory River dredging) surface water monitoring will be performed and the data evaluated for any potential public health and safety impacts. As the recreational season approaches, it will be important to develop some additional communication tools that reassure the public that the recreational uses are safe and monitoring is in place to continuously determine the effectiveness of the mitigation actions associated with the cleanup activity.

Fugitive dust control

The most visible, post-event public health and safety concern is fugitive dust control. Since the initial ash removal efforts are focused on the Emory River, the spilled ash in the Swan Pond Embayment and terrestrial areas will remain in place until further decisions on the disposition can be made. With the approach of the normally drier time of year, fugitive dust control will require significant ongoing attention. The ash from KIF is mostly inert but contains small amounts of heavy metals. The powdery ash is not harmful if touched, and breathing ash for a short period of time in low concentrations is unlikely to be a health concern, although breathing particulates (ash or any other airborne particles) in elevated concentrations over long periods of time can irritate the respiratory system. TVA is taking actions to mitigate the amount of airborne dust, as described below. The effectiveness of the initial dust control measures has been evaluated via a comprehensive air monitoring plan, the results of which are described in Section 2.1 of this CAP.

As part of the long term actions to minimize dust and erosion, TVA is in the process of evaluating and implementing various types of equipment and products. The following outlines these items (Also see Figure 6.1).

Ash Deposits

For areas of ash that will remain undisturbed for longer periods of time, TVA plans to apply either the vinyl acrylic emulsion blend liquid dust suppression agent or erosion control mulch as needed. These will be applied using a truck mounted sprayer or a sled mounted sprayer towed by an amphibious vehicle. The mulch mixture requires no curing period and upon application forms a bond with the soil surface to create a continuous, erosion resistant layer. When weather conditions optimize, TVA will further seed and fertilize if it becomes necessary.

The remaining, undisturbed portion of the ash dredge cell is bordered by a stepped wall on the northern portion. TVA plans to excavate the stepped wall and construct a flatter (~3:1) slope of ash in its place. This slope will be treated with the erosion control mulch using a truck mounted sprayer.

Roads

TVA will continue to use a combination of water trucks and sweeper/vacuum trucks to minimize dusting on the roads.

To reduce fugitive dusting during freezing conditions, TVA has contracted with a company to spray a calcium chloride solution along all of the gravel covered roads that are being traveled by construction equipment. Calcium chloride is hygroscopic, meaning that it attracts moisture from the atmosphere and its surroundings. This characteristic helps keep unpaved surfaces damp and reduces fugitive dusting.

Dust suppression agents capable of being applied in sub-freezing temperatures are currently being investigated for the on-site roads that are neither paved nor covered with crushed stone.

TVA has purchased and is in the process of installing three wheel-wash stations. These will be installed at strategic locations near the Kingston site, with input on the locations from TDEC and local officials. TVA also intends to work with the Rogers Group quarry that is supplying rock to KIF to install a type of fogger system that can mist their trucks prior to leaving the quarry. This fogger system will provide enough water to decrease dusting and tracking from this quarry site without introducing unnecessary amounts of water to these trucks.

TVA management and staff are participating in ongoing public forums and meetings with local residents and municipal authorities to listen to concerns and update the community on actions being taken to protect the public health and safety.

6.2.2 WORKER HEALTH AND SAFETY

A KIF Health and Safety Plan has been prepared and implemented. The key elements of the plan for daily operations include the following:

- Job safety analysis –TVA and contractor operations are reviewed using a Job Safety Analysis (JSA) process, which divides a task into specific subtasks, then lists identified hazards and protective measures by subtask. Contractors are required to develop JSAs for all applicable activities; these are reviewed and approved by TVA and its onsite safety consultant.

- Training – Safety and health training is required for all onsite staff for ash response activities. This training includes general plant safety training (e.g., ammonia emergency actions in the event of an ammonia release from the facility's scrubber system), as well as job-specific training based on developed JSAs. At the start of each shift, a prejob safety briefing is conducted that includes a discussion of the planned activities for that day, associated hazards, and protective measures required for those operations.

- Onsite Safety and Health Consultant – The Consultant continues to provide safety and health support for ash response activities.

- IH sampling – The IH sampling plan remains in effect for all applicable site activities. Samples are collected via personal monitoring devices. All sampled employees are informed of their measured exposures; and the independent consultant provides the analysis and quality control for industrial hygiene sampling and reporting. All personal sample results to date have been below the Permissible Exposure Limits (PELs) established by OSHA and the State of Tennessee Department of Labor and Workforce Development. The sampling strategy is fluid and may change with each sampling event, based on the results of previous sampling and site activities. All changes to the sampling strategy are made by a Certified Industrial Hygienist. Materials sampled for have included a 13 or 21-metal scan and total particulates, as well as respirable particulates and silica (quartz, cristobalite, and tridymite).

- Fatigue management program – Individuals actively engaged in ash response activities are included in a fatigue management program to reduce the potential for incidents caused by overwork or inadequate rest. Covered employees are required to take time off from ash response activities after ten to fourteen on site work days. The facility will adjust schedules accordingly; potential actions included reducing non-critical operations to shorter shift lengths, possible discontinuation of night shift for heavy equipment operations, or discontinuation of weekend work for selected activities.

- Incident reporting and investigation – an incident reporting and investigation system was established shortly after the initiation of work. This system uses an accident reporting and investigation form (Safety Hazard Assessment Report and Evaluation, or SHARE). All incidents (including near misses) are reported and investigated using the SHARE process at the site and the requirements of TVA accident investigation procedure SPP 18012.

- Personal protective equipment – All site workers actively engaged in ash response activities are required to wear personal protective equipment (PPE). PPE presently being used includes personal flotation devices around water operations, hard hats, safety glasses, safety (hard toe) shoes, reflective vests for traffic safety, gloves (glove type is dependent on the operation), and hearing protection around noisy activities.

- Minimum requirements for work – All contractors are ensuring employees are fit to perform the assigned activities (e.g., capable of lifting a certain weight, ability to grasp if required). This fitness for work helps ensure employees are not given tasks they may not be capable of doing safely.

- Ongoing plant safety – TVA's KIF Safety Professional is providing general safety and health oversight of ash response actions. This individual has extensive experience in the safety and health aspects of ash and its handling.

- Vehicle safety – all over the road drivers (e.g., articulated dump truck operators) are required to possess a Commercial Drivers License.

Regulator oversight personnel and site visitors are trained and/or briefed on site safety requirements as needed.

7.0 PATH FORWARD

This CAP provides a framework for making future decisions about environmental remediation, for monitoring during cleanup activities (both short-term and long-term), for protecting water supplies, for the management of both the spilled ash and future ash produced at KIF, and for protecting public and worker health. Near-term activities such as dredging and air monitoring have fully developed designs and/or plans. Long-term activities are discussed in the plan but in less detail with a commitment to produce subsequent plans and documents.

Section 7.0 discusses the future plans that will be developed as well as the path forward for this CAP. Several plans for short-term actions have already been submitted for regulatory review. As opposed to putting referenced plans into this CAP that may require revision and therefore revision to the CAP, this approach allows the CAP to be finalized. Changes in methods and approaches that occur as the remediation progresses will be captured in the subsequent plans.

To provide an understanding of the future work planned, the subsequent activities, plans, and reports for each element of the CAP are presented below in bullet format.

Plan for Comprehensive Assessment (all actions except emergency actions, Phase I dredging, future ash management)

- Scoping to define number of decisions
- DQO workshops to define data collection activities
- EE/CA/EA for early decision (probably those with no data collection needed)
- AM for early decision
- SAP (may be more than one, depending on type, schedule, and quantity of sampling)
- Data collection/evaluation/risk assessment
- EIS for all decisions not part of early decisions
- ROD
- Implementation of remedy
- Closure report with SAP for long-term monitoring if contamination left behind
- Final assessment of natural resource damages by trustees

Plan for Environmental Monitoring During Cleanup

- SAP for routine air quality monitoring (included in CAP)
- SAP for routine residential well sampling
- SAP for routine surface water sampling
- SAP for routine groundwater sampling
- SAP for additional monitoring during dredging (included as a monitoring discussion in Phase I dredging plan)
- SAP(s) for additional monitoring during cleanup (need for more than routine monitoring depends on the scope of the action)
- Data collection/evaluation
- Routine reports

Plan to Protect Water Supplies

- See SAP for routine residential well sampling, drinking water, and routine surface water sampling mentioned above.
- If action levels exceeded, report for providing alternate water supplies

Plan for Management of the Coal Ash

- Most of the short-term management projects (dredging, processing, clean water diversion) discussed in published Environmental Assessments
- Long-term management such as revised closure plan and final disposition of ash covered in Plan for Comprehensive Assessment activities listed above
- Future production ash management-NEPA process

Plan to Address Any Health or Safety Hazards Posed by the Ash to Workers and the Public

- Public health and safety mitigation plans per activity
- Worker health and safety program in place
- Job Safety Analyses per future task

8.0 REFERENCES

Anderson, J.R., E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. *A land use and land cover classification system for use with remote sensor data*. Geological Survey Professional Paper 964. U.S. Geological Survey, Washington, DC.

Benziger, C.P. and J.M. Kellberg. 1951. *Preliminary Geological Investigations for Eastern Area Steam Plant*: Division of Water Control Planning, Geologic Branch, Tennessee Valley Authority, Knoxville, Tennessee.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetland and Deepwater Habitats of the United States*. Washington, D.C.: U.S. Fish and Wildlife Publication U.S. FWS/OBS-79/31.

Tennessee Valley Authority (TVA) 2004. *Reservoir Operations Study-Final Programmatic Environmental Impact Study*; Tennessee Valley Authority, Knoxville, Tennessee.