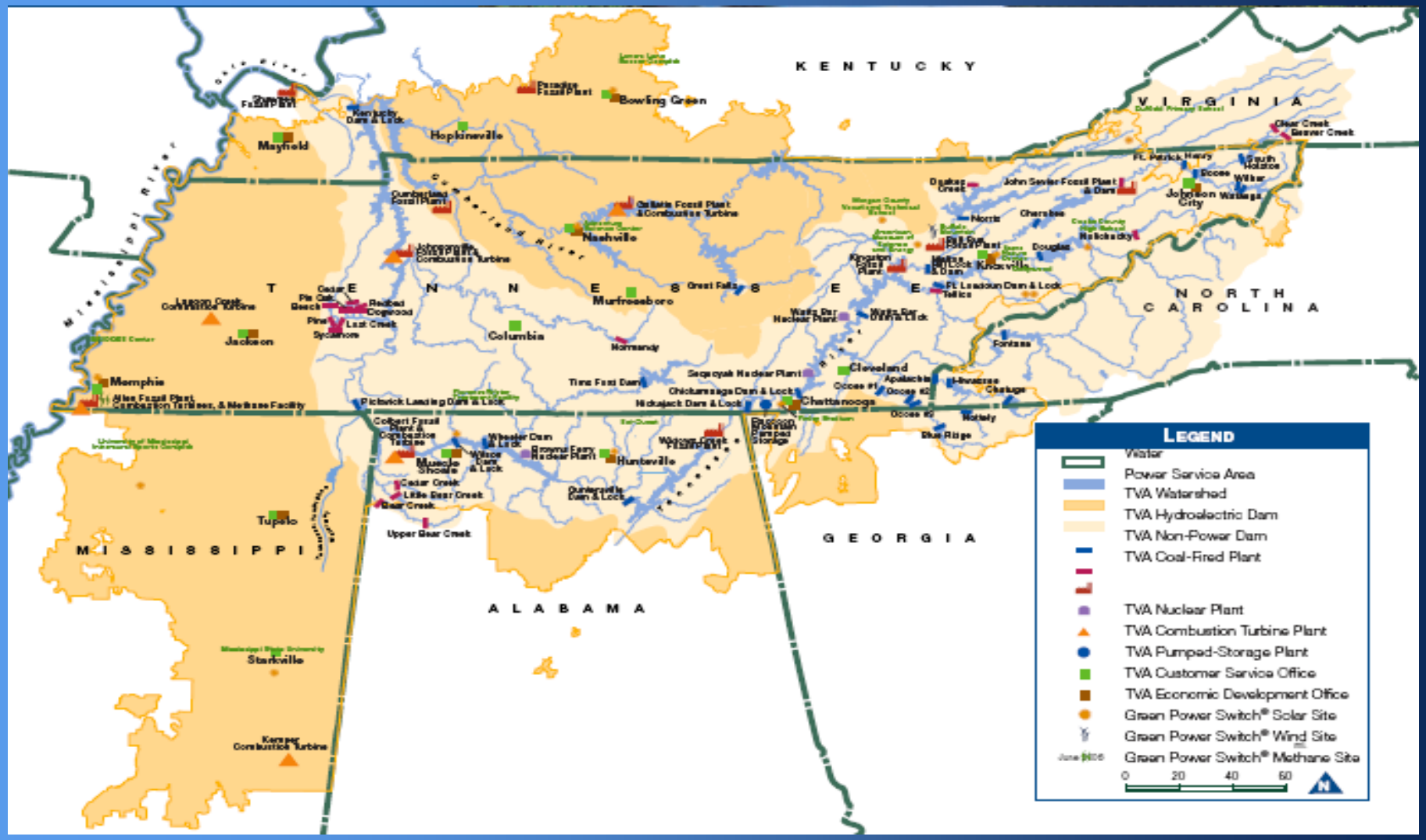
Kingston Ash Recovery Status
or
TVA's Unexpected Excursion into the World of CERCLA

Dennis H. Yankee

TVA Environment &Technology

Overview

- Background
- Failure Mechanics
- Response Phases
  - Emergency
  - Initial Recovery
  - CERCLA
    - Time-Critical
    - Non-Time Critical
    - Remedial
- Sampling & Monitoring
- Status and What's Next?
- "Under the Magnifying Glass"
- Lessons Learned
- Broader Implications
- Wildlife Sampling
- Some Final Thoughts


KENTUCKY
VIRGINIA
NORTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
TENNESSEE
Mississippi River
Ohio River
Cumberland River
Tennessee River
Paducah
Mayfield
Kentucky Dam & Lock
Hopkinsville
Paradise Fossil Plant
Bowling Green
Cumberland Fossil Plant
Gallatin Fossil Plant & Combustion Turbine
Nashville
Johnsonville Combustion Turbine
Memphis Combustion Turbine
Cedar Bluff
Pin Oak
Beech
Redbud
Dogwood
Pine
Last Chance
Sycamore
Jackson
Columbia
Murfreesboro
Great Falls
Normandy
Memphis
Allen Fossil Plant Combustion Turbines, & Methane Facility
Pickwick Landing Dam & Lock
Colbert Fossil Plant & Combustion Turbine
Wheeler Dam & Lock
Wilson Dam & Lock
Bellefonte Nuclear Plant
Huntsville
Guntersville Dam & Lock
Muscle Shoals
Cedar Creek
Little Bear Creek
Bear Creek
Upper Bear Creek
Tupelo
Starkville
Kemper Combustion Turbine
Tims Ford Dam
Sequoyah Nuclear Plant
Chickamauga Dam & Lock
Nickajack Dam & Lock
Chattanooga
Raccoon Mountain Pumped Storage
Watts Bar Nuclear Plant
Watts Bar Dam & Lock
Fort Loudoun Dam & Lock
Tellico
Knoxville
Kingston Fossil Plant
Douglas
Cherokee
Norris
Cumberland Fossil Plant
John Sevier Fossil Plant & Dam
Dyke Creek
Cleveland
Appalachia
Ocoee #1
Ocoee #2
Ocoee #3
Hiwassee
Chickamauga
Nottely
Blue Ridge
Fontana
Ft. Patrick Henry
South Holston
Boone
Wilbur
Watauga
Johnson City
Clear Creek
Beaver Creek
Legend
Water
Power Service Area
TVA Watershed
TVA Hydroelectric Dam
TVA Non-Power Dam
TVA Coal-Fired Plant
TVA Nuclear Plant
TVA Combustion Turbine Plant
TVA Pumped-Storage Plant
TVA Customer Service Office
TVA Economic Development Office
Green Power Switch® Solar Site
Green Power Switch® Wind Site
Green Power Switch® Methane Site
0 20 40 60
N

TVA’s Kingston Fossil Plant Video

QuickTime™ and a
decompressor
are needed to see this picture.

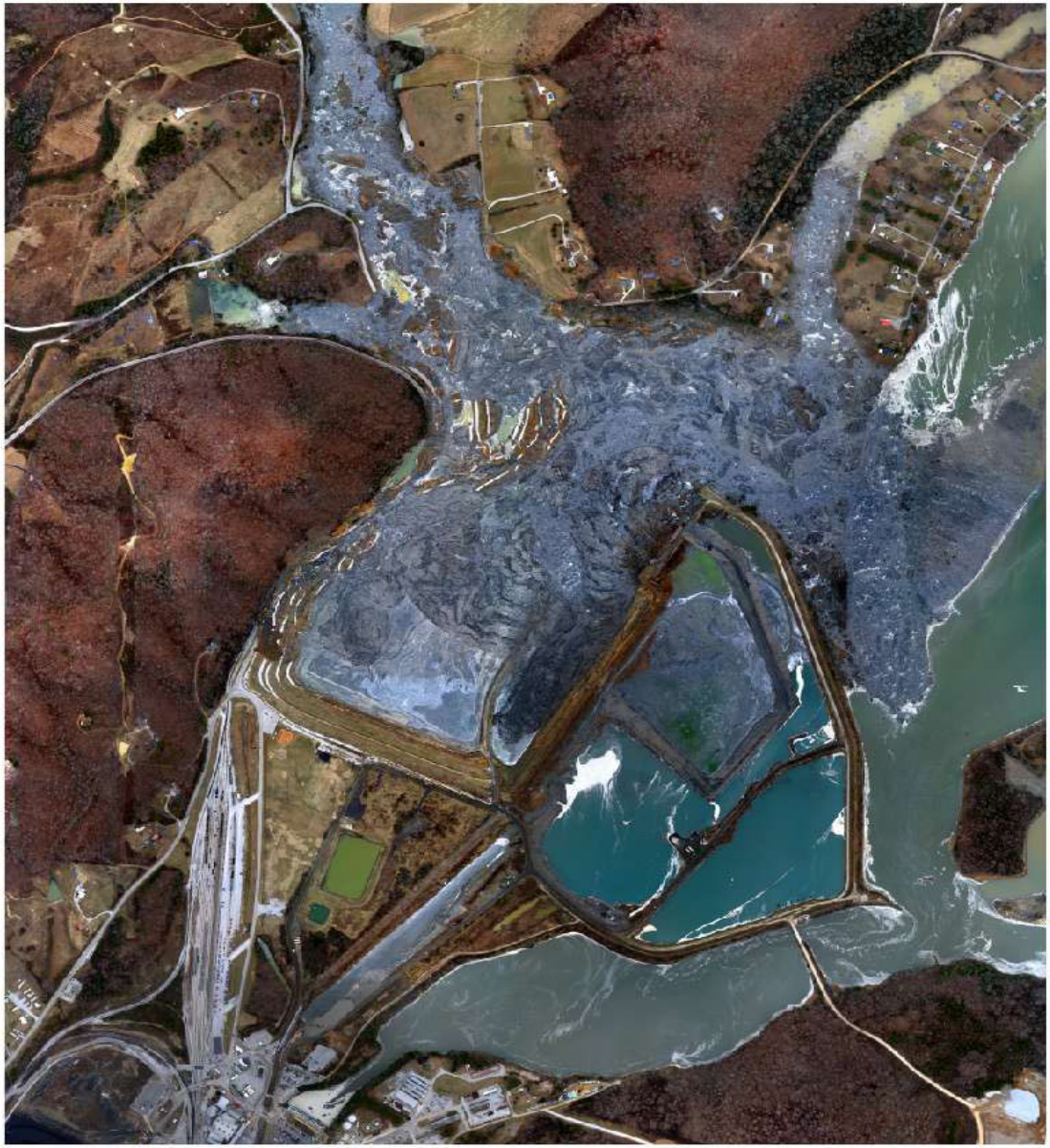
Aerial Image of Kingston Ash Slide Pre-Event 2008

N

0 500 1,000 1,500 2,000 Feet

Tennessee Valley Authority
OE&R - ER&S
Geographic Information & Engineering

Aerial Image of Kingston Ash Slide 12/23/2008



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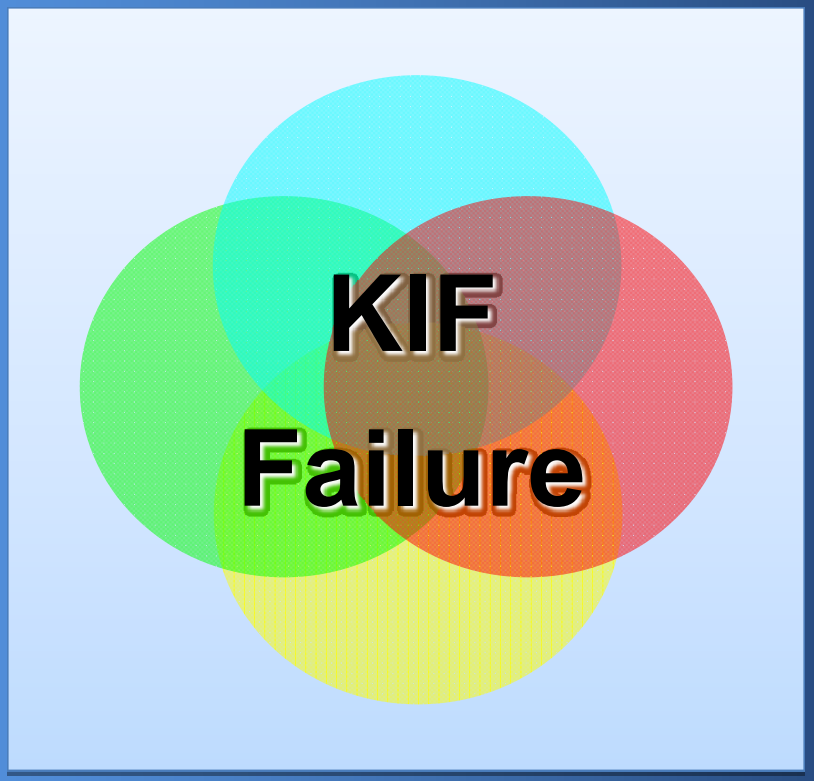
0 500 1,000 1,500 2,000 Feet

Tennessee Valley Authority
OE&R - ER&S
Geographic Information & Engineering

Kingston Dredge Cell Failure Conditions

Increased Loads Due to Higher Fill

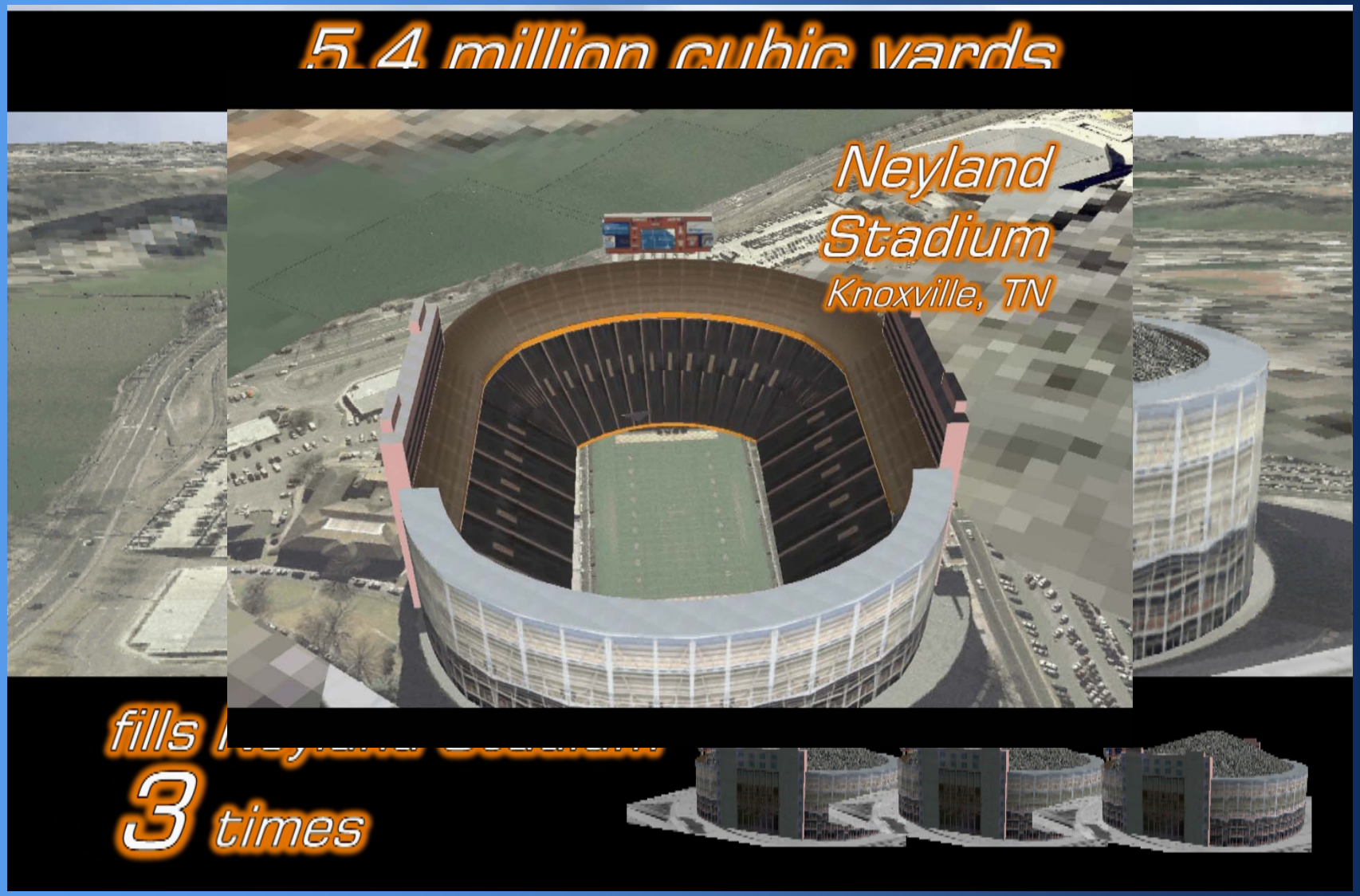
Hydraulically Placed Loose Wet Ash



Fill Geometry & Setbacks

<u>Unusually</u> Weak Silt/Ash Slime Foundation

How much was released?



Spill Progression

Emergency Response Phase

December 22, 2008– late January,2009

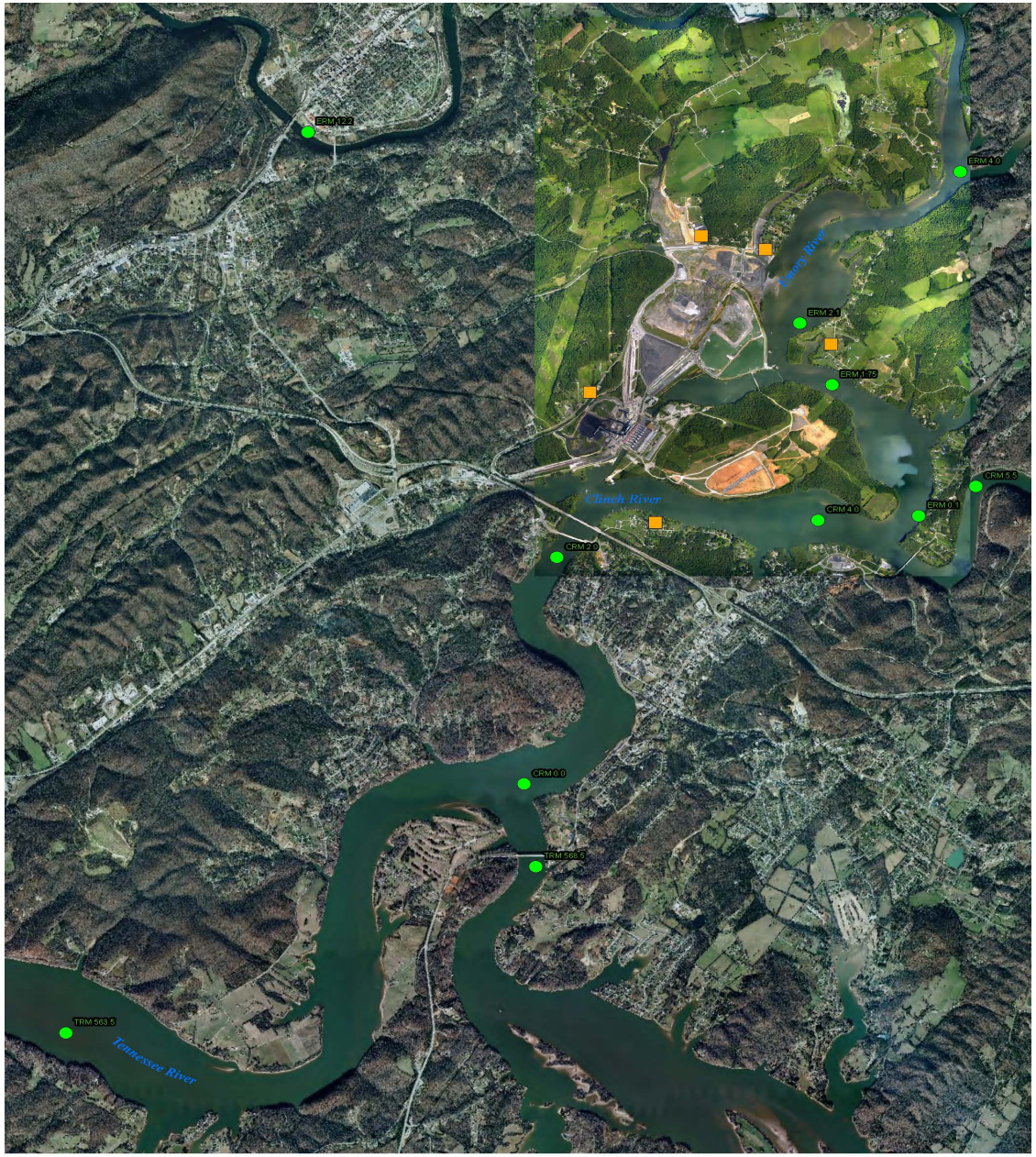
Initial Emergency Response

- Worked closely with:
  - Roane County Emergency Management Agency
  - Tennessee Department of Environment & Conservation (TDEC)
  - Tennessee Emergency Management Agency (TEMA)
  - U.S. Environmental Protection Agency (EPA)
  - U.S. Army Corps of Engineers
  - U.S. Department of Homeland Security

- Established unified incident command center with EPA, state and local agencies

- Inspected site to verify no further releases

Stationary Air Monitoring Locations and Routine Surface Water Sampling Locations



N

0 0.25 0.5 0.75 1 Miles

Stationary Air Monitoring Locations
Routine Surface Water Sampling Locations

Date of map imagery:
August 14, 2009
(Kingston Plant Area)
and
Spring/Summer 2006

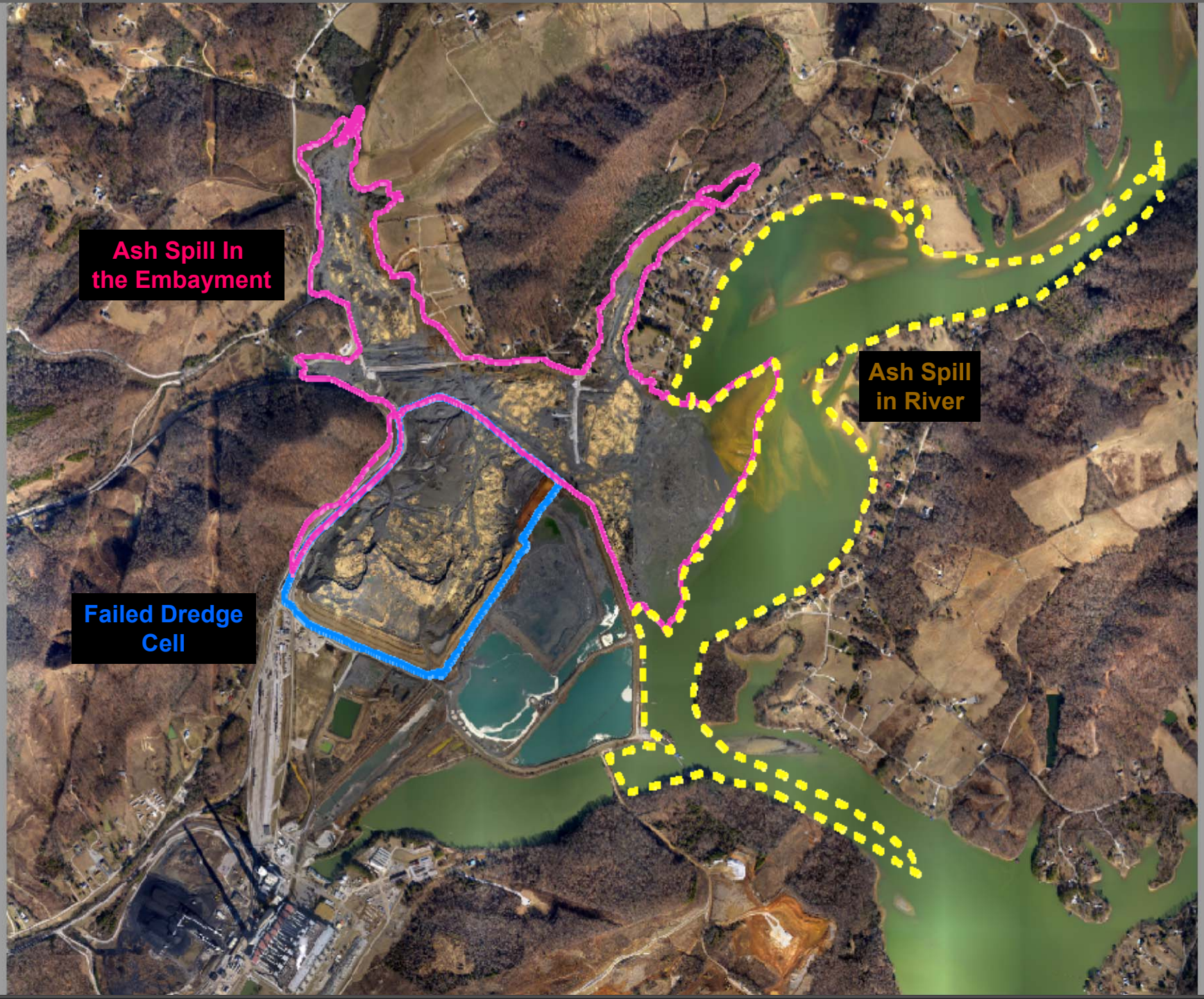
Tennessee Valley Authority
OE&R - Environmental Resources
Geographic Information & Engineering

Project: SETAC_KIF_FixedAW_Locations_20091109_15x20.mxd

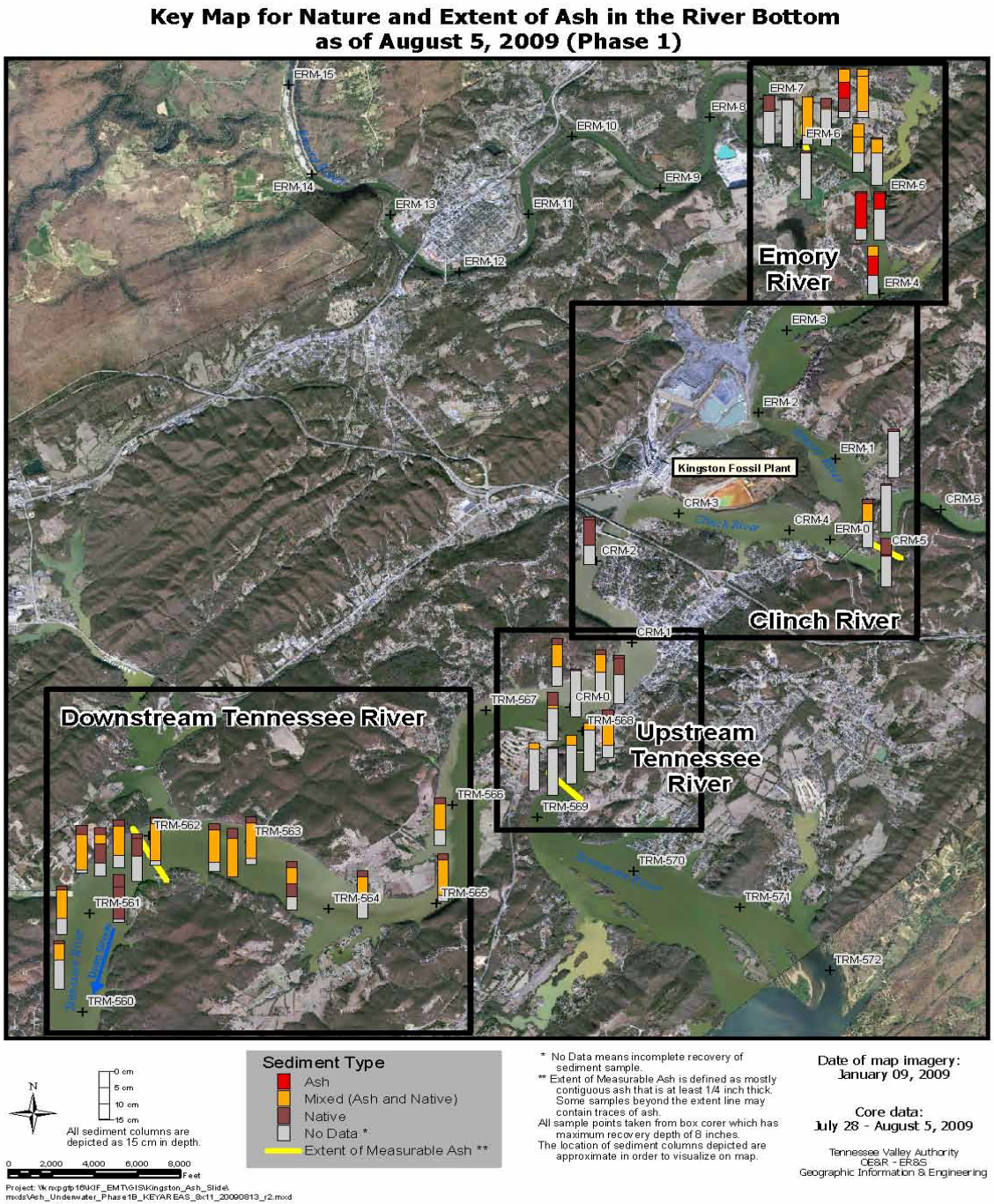
CAT
Caulfield Rural

Initial Recovery Phase

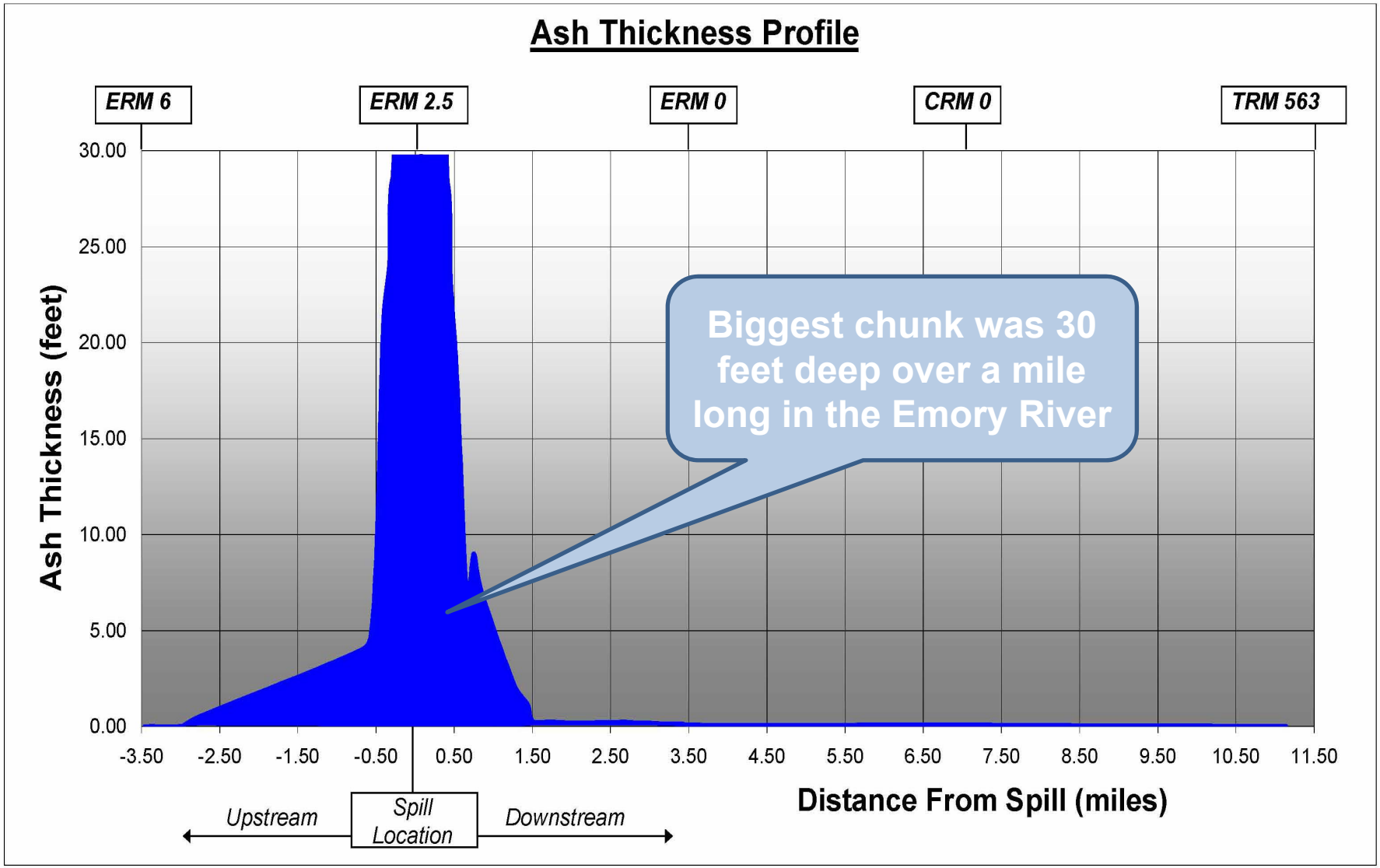
February—April, 2009


Ash Spill In
the Embayment
Ash Spill
in River
Failed Dredge
Cell

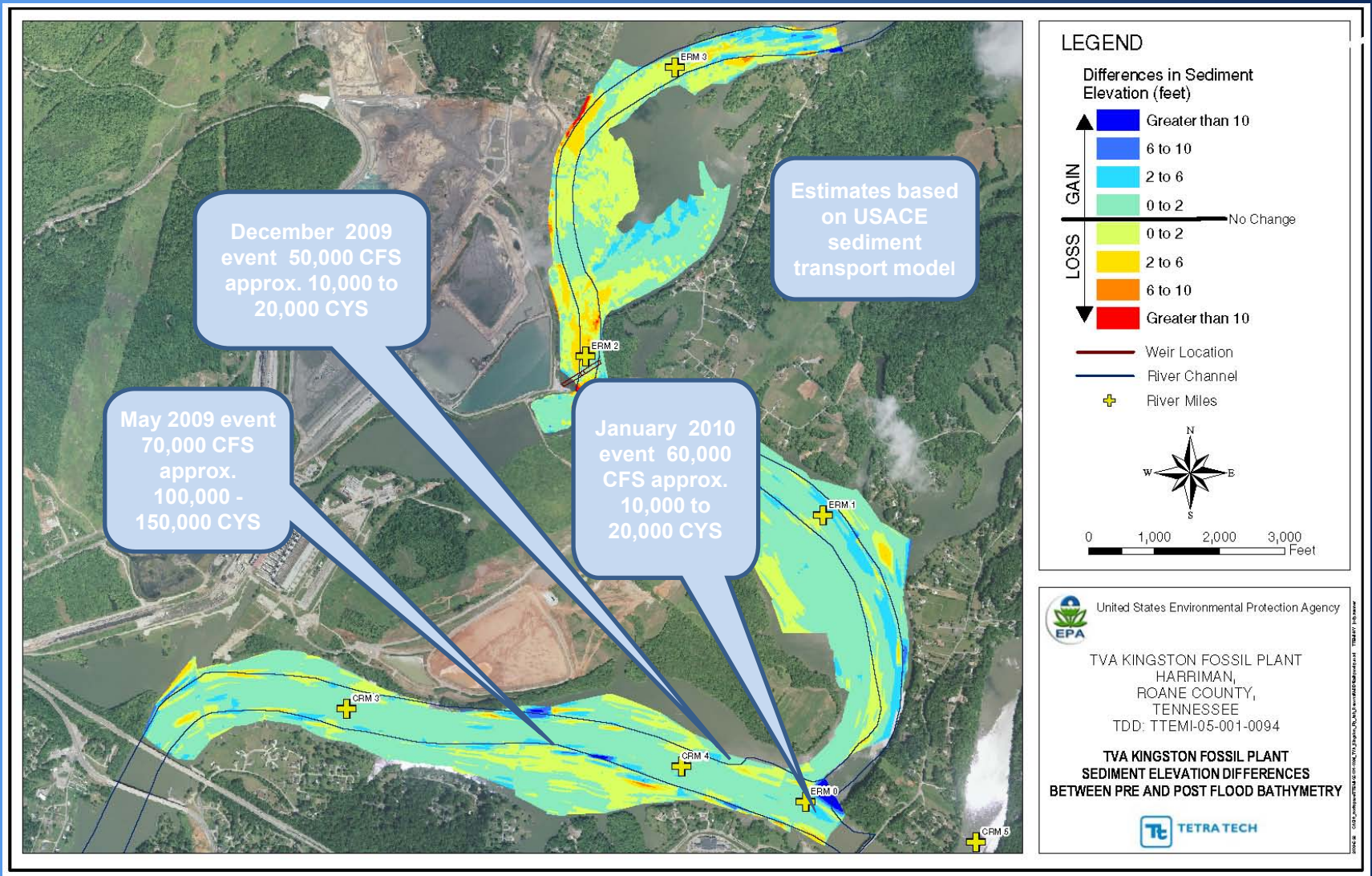
Nature & Extent of Ash



Ash Thickness in Rivers



Ash Migration during Highest Flow Events



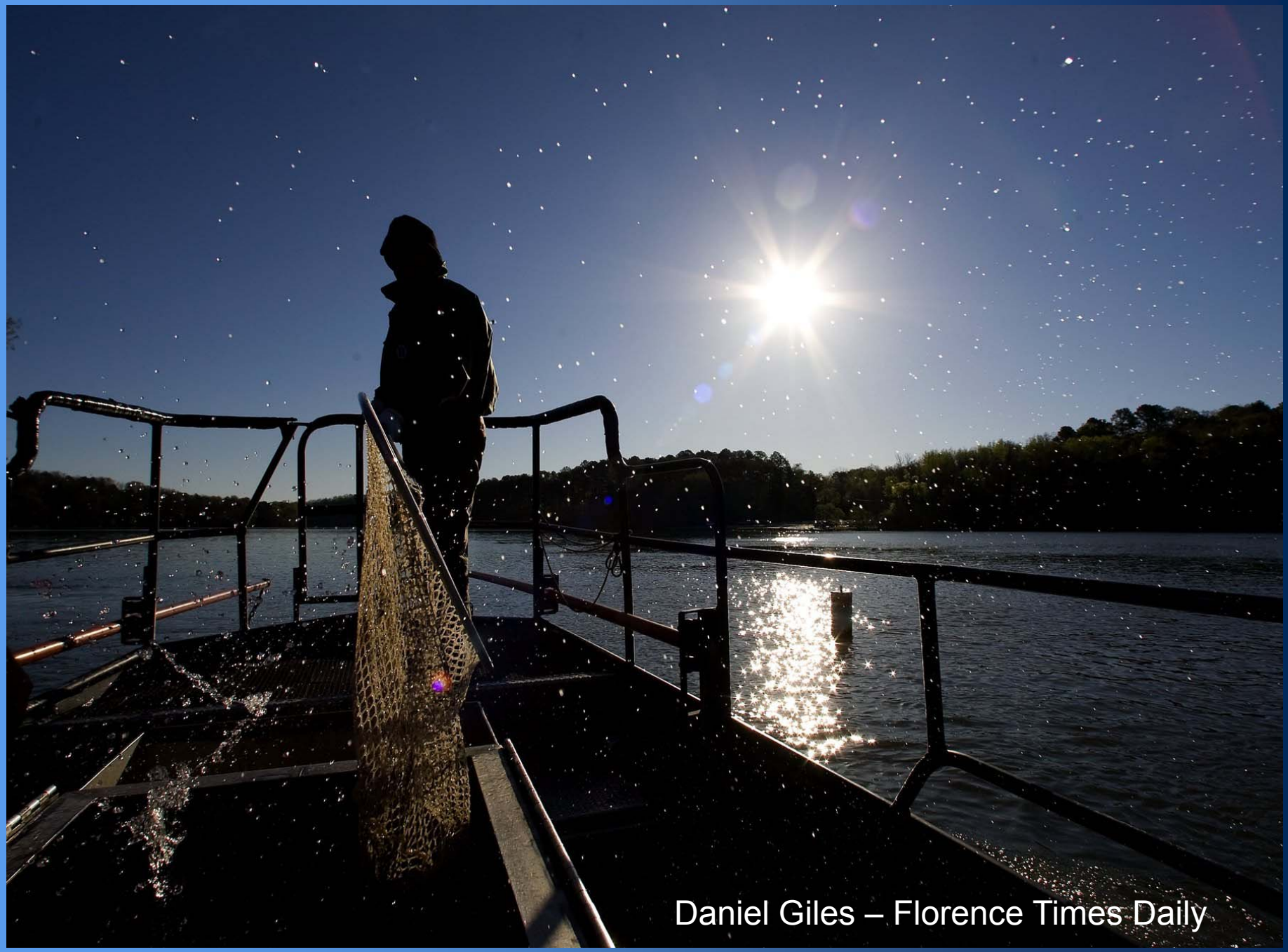
16MP-FAR LEFT-85mm

Dredge 1
Dredge 2
Dredge 3
Temp Ash Storage Area
Ash Recovery Area
Temporary Ash Processing Area
Segment 1
Segment 2
Segment 3
Segment 4

The Initial Dredge

Biological Monitoring Initiated

- Fish
  - **Community structure, bioaccumulation, spawning, fish health**
- Benthic Invertebrates
  - **Community structure, bioaccumulation**
- Small Mammals
  - **Bioaccumulation**
- Great Blue Heron & Osprey
  - **Bioaccumulation in eggs**
- Tree Swallows
  - **Bioaccumulation in eggs & hatchlings**
- Spring Breeding Frogs, Common Snapping Turtles
  - **Bioaccumulation**


Daniel Giles – Florence Times Daily

CERCLA Phase

May, 2009--Present

Why CERCLA Self-declaration?

- After emergency phase, back to normal processes (NEPA, compliance, action approval)
- Multiple regulatory lines of authority
- Lack of public trust

CERCLA—Really?

- Benefits
  - Supersedes NEPA
  - OSC replaces “cast of thousands” of regulators
  - The “Credibility Factor”
    - Nationally recognized experts on-call
    - Public interface
  - Structured public input
  - Exclusion zone—better access/egress control

- Liabilities

Setting a precedent for ash spills

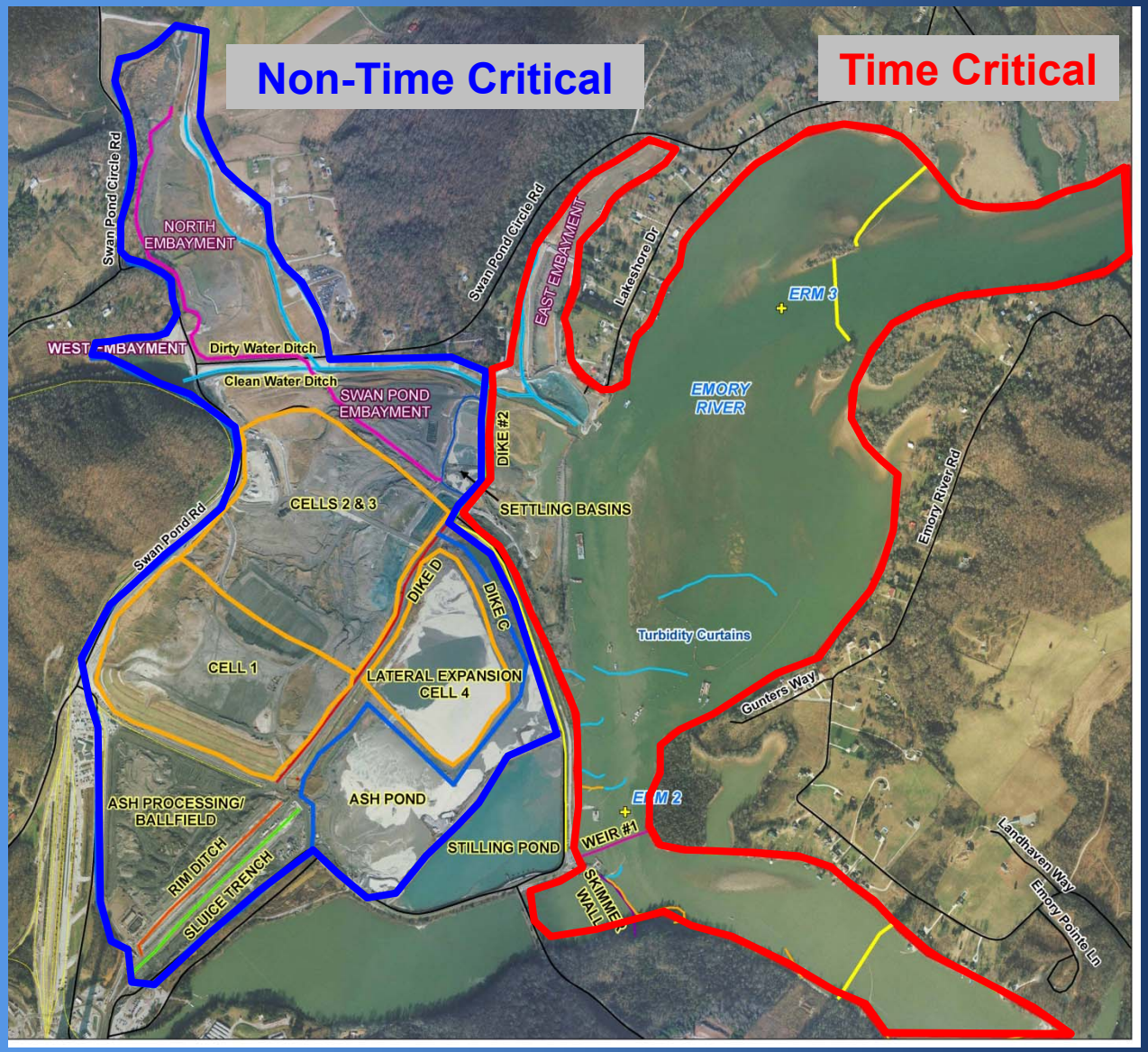
Reinforces perception of “toxic/hazardous “

You get another “cast of thousands” of OSC support staff

CERCLA Phases

- Time-Critical
  - Get the ash out of the river now!
- Non-Time-Critical—Embayment
  - Get the ash out of the embayment.
- Non-Time-Critical—River
  - Relative risks for Clinch & Tennessee Rivers: Remove Ash Vs “Leave in Place”

Ash Recovery Project Layout



Environmental Monitoring

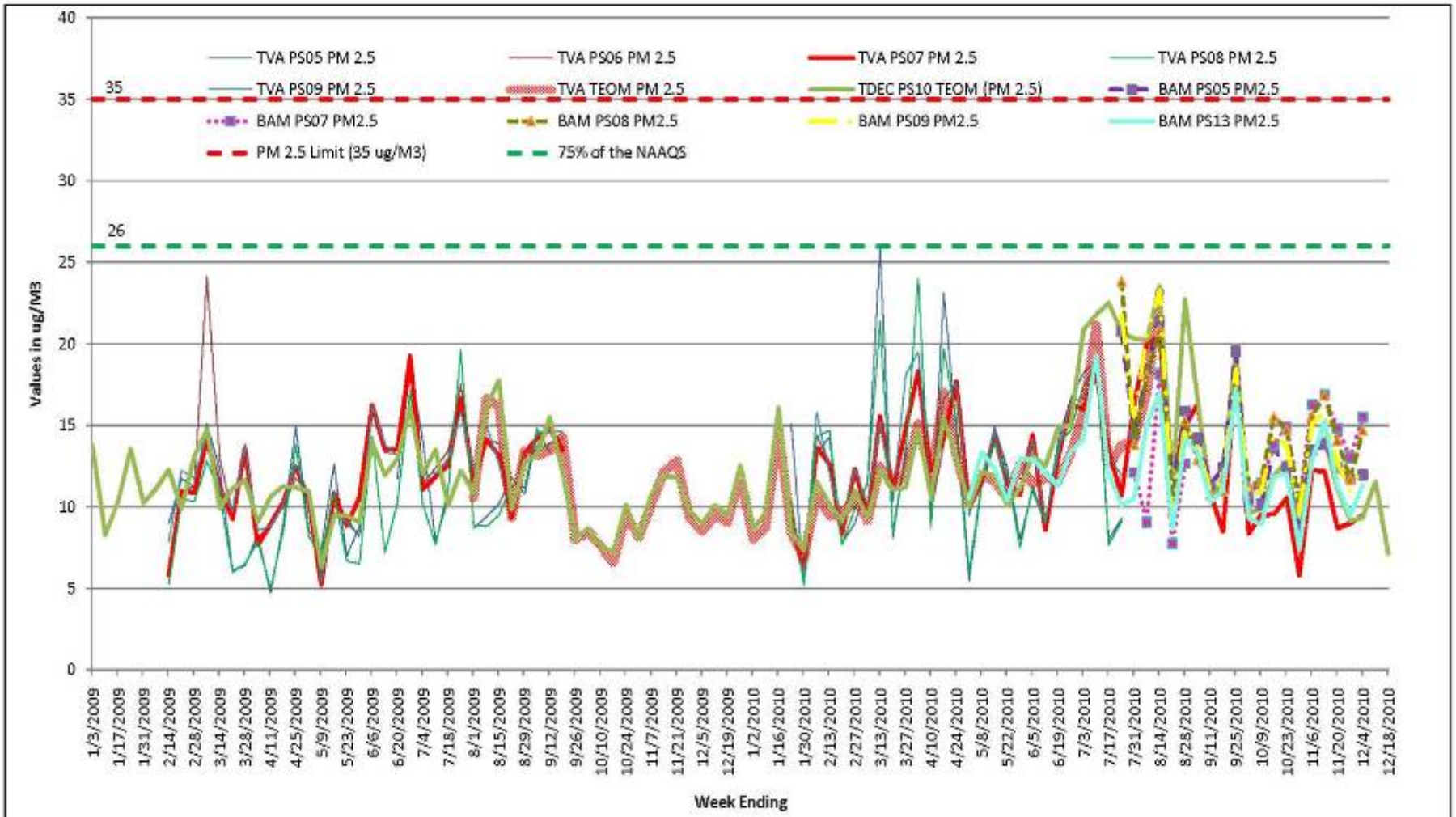
- **Time-Critical Phase**
  - Air (IH & Ambient)
  - Water
  - Groundwater
  - Dredge plumes
  - Sediment characterization (distribution, chemical, toxicological)
  - Ash Characterization (chemical, physical, radiological)
  - Water Supplies
  - Biota
- **Non-Time-Critical Phases** (River System Sampling & Analysis Plan)
  - Air (IH & Ambient)
  - Water (Storm event focus)
  - Groundwater
  - Sediment Characterization & Modeling
  - Biota

Air Monitoring

- Real-time air monitors (5 stations)
  - 2 TEOMs (PM 2.5 & 10)
  - 5 BAMs (PM 2.5)
  - 1 FRM (PM 2.5)

Loading & Transport
Updated 12/20/09
110 cars daily – in process 12/20/09
days/week – reserve Sunday's for make-up and maintenance days –
mplement plan – 2 weeks
n (NS)
eek of Dec 7 – prepped & in service by 12/20/09 - Complete
ews – Dec 7
port on duty at Kingston – Dec 7
Dependent on
Internet Service
((f) Below)
ty Yard more often for temporary storage of empty cars - Complete
ded surge cars off site at Waters or Storage 5 until 15A and 16
S IT Group) (Comcast Refused 12/02/09)
mitted 12/01/09 - Complete
- Complete
mitted 12/10/09 - Complete
– Renew topics each month
-Complete
R Engineering
week of 12/07/09
Issuing release
CTEC submits
ender
ric - Pricing

Air Data



Proportional Relationship Between Stations for PM 2.5*

Status & What's Next…

✓ **Phase 1 (Time-Critical Action Removal)**

- 3.5 million cys removed (excavated and dredged)
- 4.0 million tons disposed at Perry County, AL (completed 12/01/10)
- May 29, 2010 Emory River reopened
- Extensive environmental monitoring

- **Phase 2 (EECA and Non-Time Critical Action Removal - Selection of Alternative 3B)**
  - 2.8 million cys to be removed (north and middle embayment)
  - Consolidate in reinforced, on-site disposal area
  - Construct robust subsurface perimeter containment system to withstand local 6.0 magnitude earthquake
  - Continued air and water quality monitoring
- **Phase 3 (Residual Ash Study)**
  - River ecosystem and human health risk assessments
  - Supplemental investigations and research
  - Long-term monitoring (5-year reviews)

Rationale for Selecting Alternative (3b)

- **Eliminates Off-Site Disposal Impacts and Risks**
  - Transportation risks
  - Disposal capacity issues
  - Acceptability of offsite disposal
- **Safe Containment of Ash**
  - **Perimeter diking system** addresses identified failure factors (fill geometry, fill rate, foundation soils, and ash moisture)
- **Groundwater Protection**
  - Private drinking water wells **not impacted**
  - Groundwater monitoring data indicates **metals are not leaching** and no groundwater plume is present

Major Components Alternative (3b)

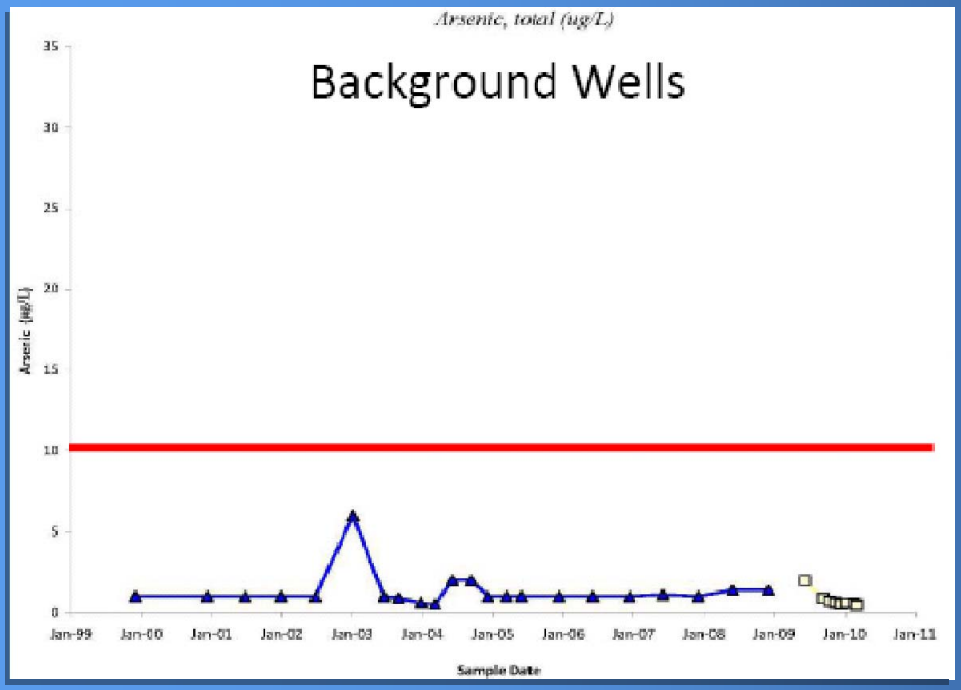
- **Restore Embayment Ecosystem**
  - **Excavate** to native material
  - **Restore** complex mosaic of forested, scrub-shrub, aquatic, and emergent wetland plant communities
  - Species composition and density based on historical embayment habitat and surrounding reference stations

No Liner or Leachate Collection

- **Groundwater Flow to Site**
  - Silty clay layer beneath site acts as **barrier to metal migration**
  - Groundwater **does not migrate** to drinking water wells, moves downgradient to river
  - New perimeter dike will **reduce lateral groundwater movement**
  - Clay and soil cover will **reduce water infiltration**

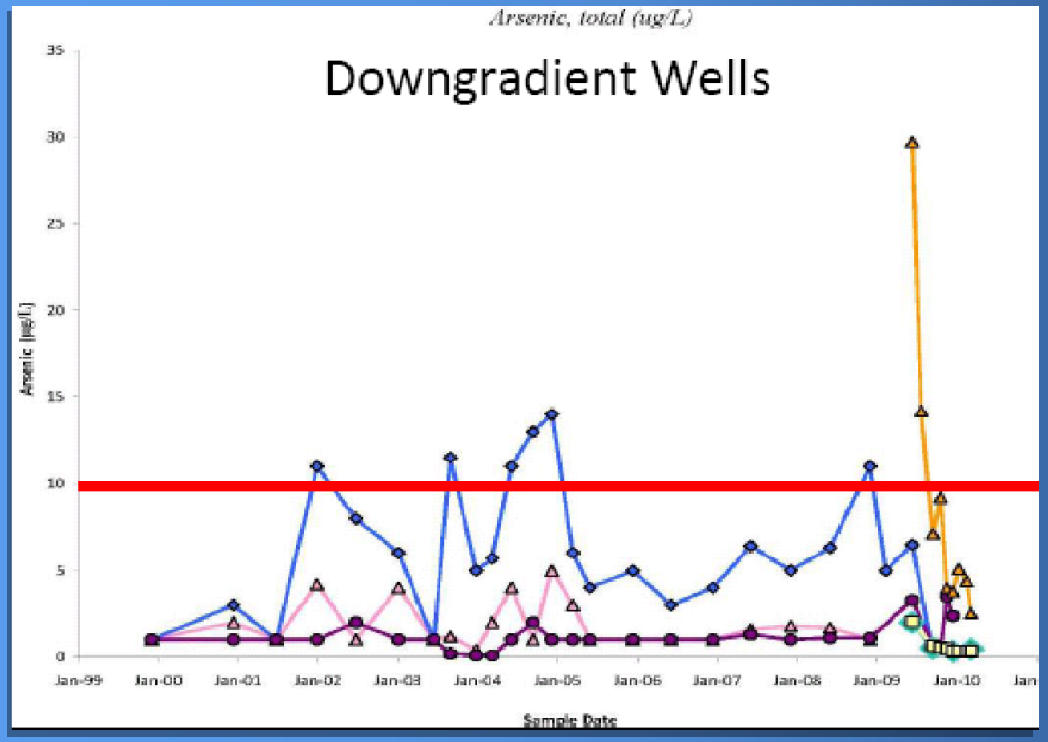
No Liner or Leachate Collection

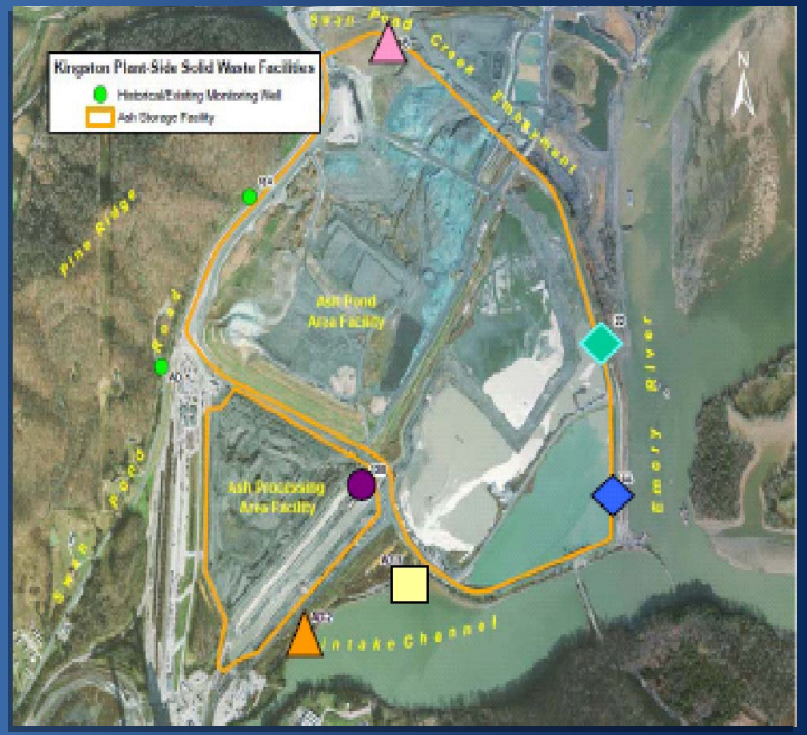
- **No Metals Leaching**
  - After over 50 years of groundwater in contact with ash, water quality **does not currently exceed drinking water standards**
  - EPA Science Panel and USACE/ERDC studies after spill conclude **metals not readily leaching** off ash under site-specific conditions
  - **TCLP (leaching test) does not exceed limits,** thus ash is not a hazardous waste



No Liner or Leachate Collection

- **No Groundwater Plume**
  - **Semiannual monitoring** over past 10 years
  - 2 of 40 samples since release in ballfield exceeded arsenic levels
  - No arsenic exceedances in past 7 months





Lessons Learned

- Strong Data Quality Assurance/Quality Control
- Communicate, Communicate, Communicate!
- The Emergency Response phase is the only time you get a “free pass”
- Identify and work to help good independent researchers
- CERCLA can be your friend…

Implications

- Pressure to change regulations develops quickly
- Public pressure “trumps” science in politics
- Politicians can’t totally ignore science & engineering
- Expect a push to extend regulatory changes to other contaminants --“The coat-tails effect”

A few inalienable truths we now hold to be self-evident…

- Events always happen after hours, on weekends, or holidays
- Perceived magnitude of disaster is directly proportional to distance from site
- Media's/public's perception of data validity is proportional to researchers' willingness to speculate and over-interpret…
- and inversely proportional to investment in data QA/QC
- Politicians' willingness to act on unfounded speculation & questionable data is proportional to their distance from site

12.22.08

09.25.09

Wildlife Sampling Video

QuickTime™ and a
decompressor
are needed to see this picture.

Progress Over Time

QuickTime™ and a
decompressor
are needed to see this picture.