



Kingston Recovery Project

Roane County Environmental Review Board

June 5, 2014

Kingston Recovery Site: Then

- December 22, 2008
- 5.4 million cy of ash
- 300 acres of property covered
- 3 miles upstream, 6 miles downstream
- 3 homes uninhabitable
- Roads, rails, utilities damaged

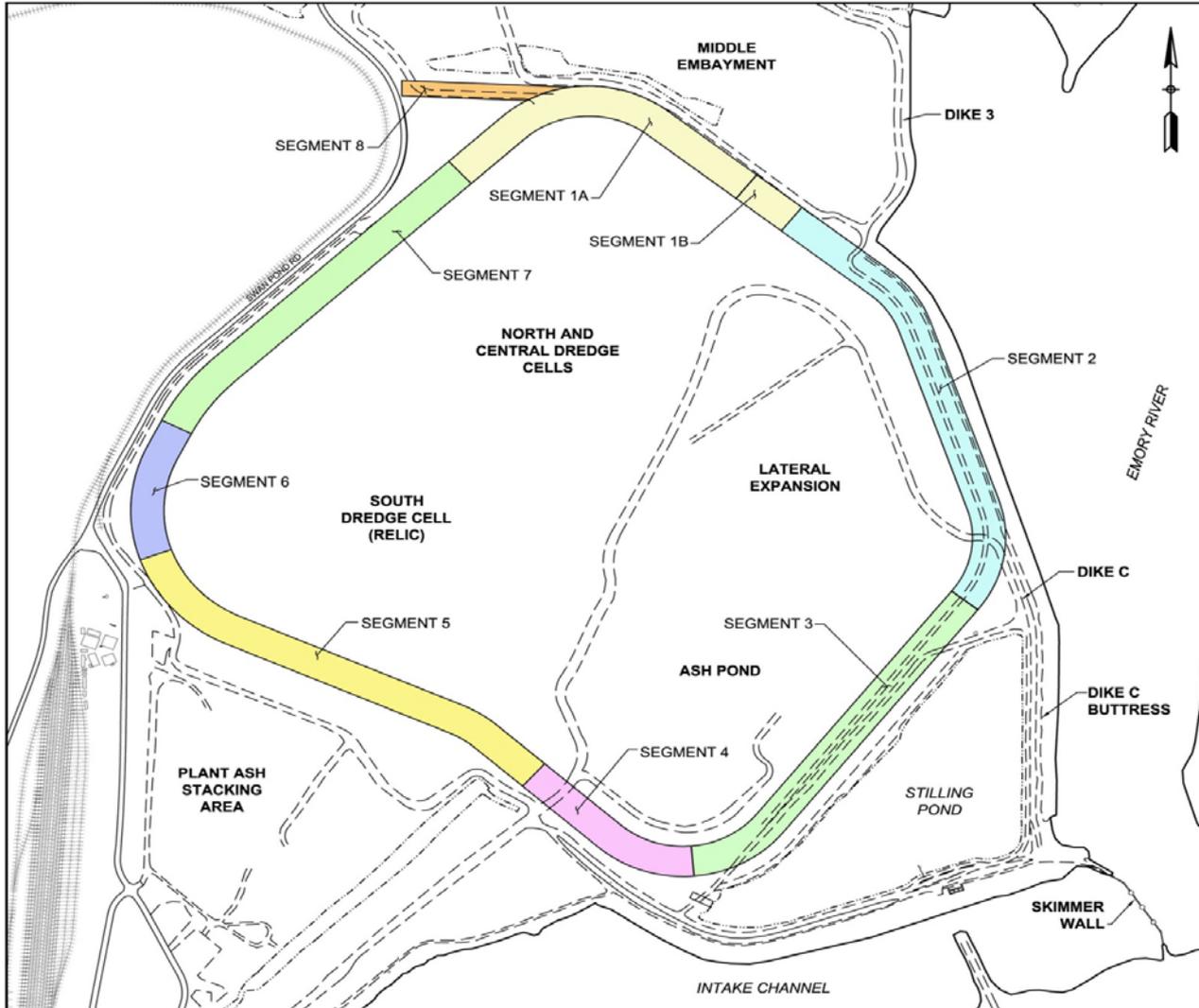




Kingston Recovery Site: Now



Perimeter Wall Stabilization



- 2 ½ years to construct
- Completed February 2014
- Contractor: GeoCon
- Quality Control/Engineer of Record: Stantec
- Largest slurry wall built in U.S.
- 12,000 linear feet of wall;
60,000 linear feet of trenches
- 500,000 cy of slurry
- Designed to withstand a 6.0 earthquake

Perimeter Wall Stabilization



During Construction

After Construction



Cap and Closure Progress



- 240-acre containment cell
- 40 mil Flexible Membrane Liner (FML)
- Geo-composite drainage layer
- 2 ft. of soil cover
- 30-50 ft. above river level
 - 30-50 ft. lower than before spill
- Acres covered to-date:
 - FML: 142 acres
 - Geo-composite: 132
 - Soil cover: 130

Cap and Cover





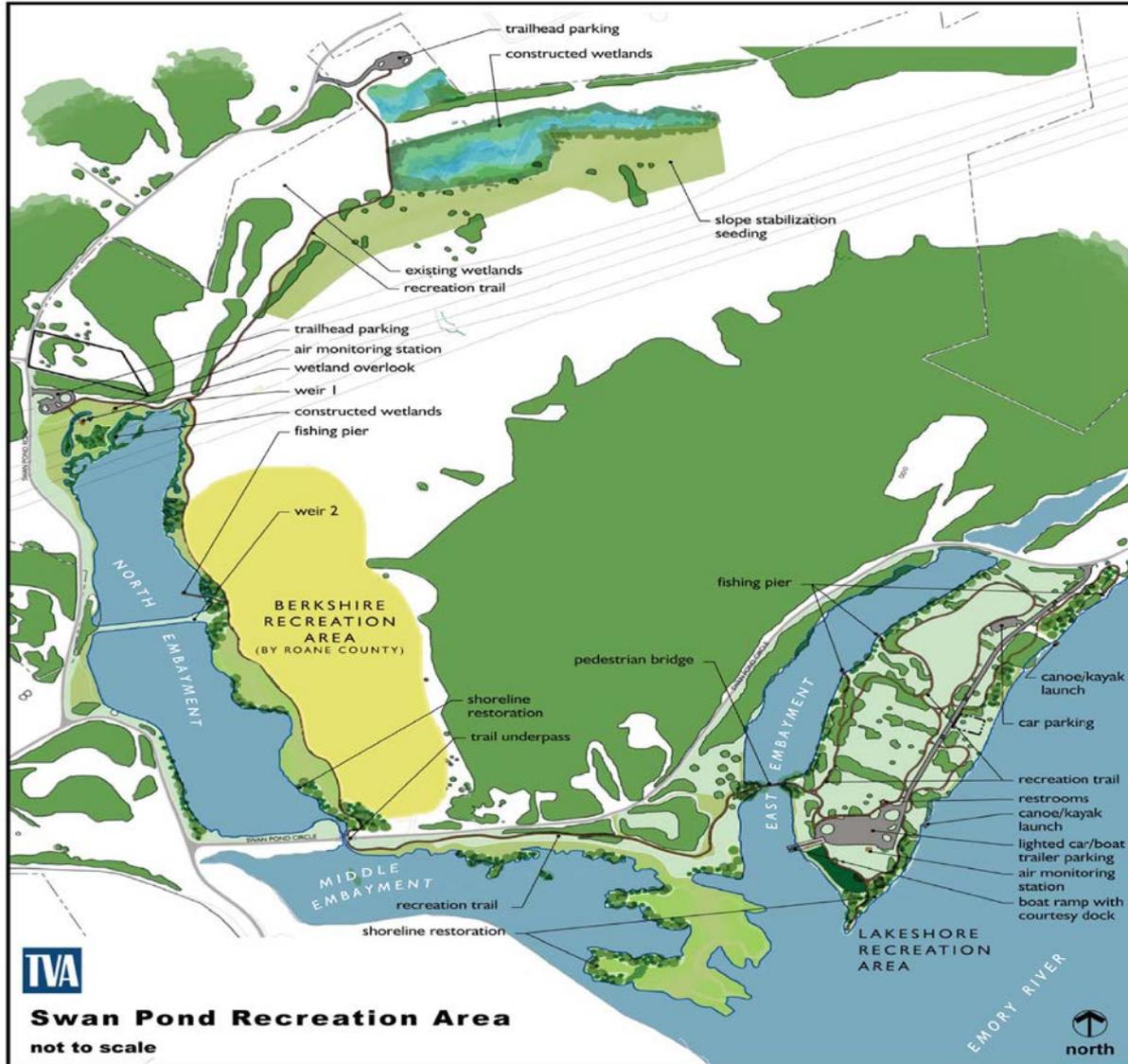
RECREATION AND RESTORATION



Recreation and Restoration

- Completed Lakeshore Park May 2014
- Complete remaining scope of project January 2015.
- Key features:
 - 3+ miles of paved walking trails
 - 2 Courtesy docks and 4 fishing piers
 - Boat ramp
 - Pedestrian bridge
 - Constructed wetlands and shoreline stabilization
 - Native plantings and bird/fish habitats

Recreation and Restoration



Lakeshore Park



ENVIRONMENTAL MONITORING



Environmental Monitoring

- 30-year EPA-approved monitoring plan for the river system with five year review cycle.
- Most recent data shows:
 - Ash concentrations are not adversely impacting organisms
 - Metal concentrations are decreasing at and downstream of the spill site
 - Fish and aquatic insect communities have fully recovered from any ash-related impacts
- Summary of the 2013 results will be published this summer by EPA and TVA.



Environmental Monitoring: Background

- Two year, \$40M study
- More than 16,000 samples and 400,000 analyses
- Many state & federal agencies involved, including:
 - Tennessee Department of Environment & Conservation
 - Tennessee Wildlife Resources Agency
 - Oak Ridge National Laboratory
 - U. S. Geological Survey
 - U.S. Army Corps of Engineers
 - U.S. Fish & Wildlife Service
- 10 universities conducted research, including:
 - Virginia Tech
 - University of Tennessee
 - Duke University
 - Appalachian State University



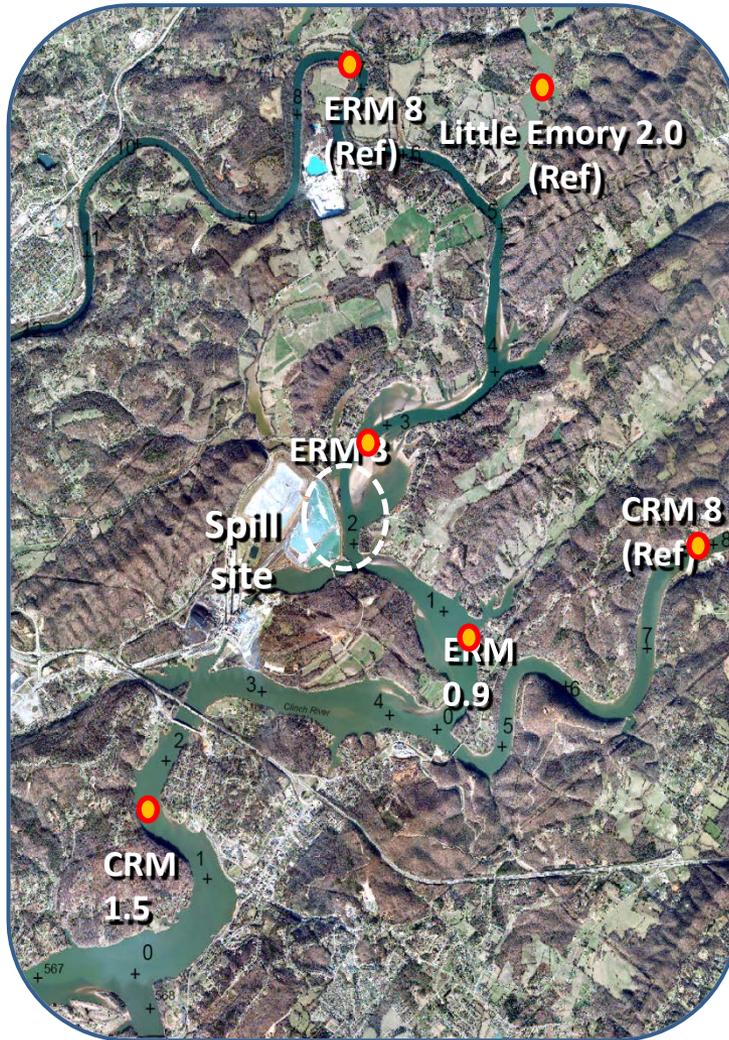
Environmental Monitoring Components

- Sediment transport modeling
- Sediment quality
- Sediment toxicity
- Benthic macroinvertebrates
- Tree Swallows
- Fish

Table 2-1 Selection of Remedial Goals and Tissue Monitoring Endpoints

Remedial Goal Options					
Receptor / Exposure Pathway	Wet or Dry Weight	Equivalent Reference Concentration	Threshold Effect Concentration		Selected Remedial Goal Range
			IC ₂₅ (Midge)	IC ₂₅ (Amphipod)	
Benthic Invertebrates					
Arsenic concentration in sediment	Dry	8.0	29	41	29 - 41
Selenium concentration in sediment	Dry	3.0	2.8	3.2	3.0 - 3.2
Tissue Monitoring Endpoint Options					
Receptor / Exposure Pathway	Wet or Dry Weight	Equivalent Reference Concentration	Threshold Effect Concentration		Selected Tissue Monitoring Endpoint Range
			NOAEL	LOAEL	
Killdeer					
Arsenic concentration in diet (larval mayfly)	Dry	8.4	34	81	34 - 81
Selenium concentration in diet (larval mayfly)	Dry	7.1	2.3	5.0	7
Tree Swallow					
Selenium concentration in diet (adult mayfly)	Dry	7.0	1.6	2.8	7

Note: All units in mg/kg.

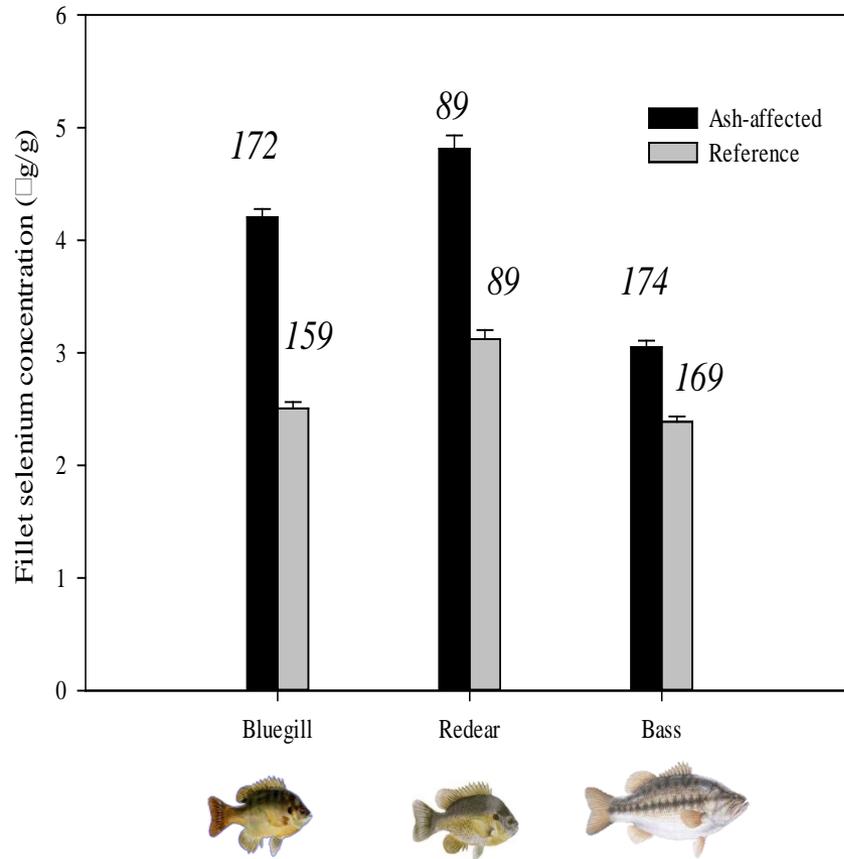


Bioaccumulation Fish Sampling Sites:

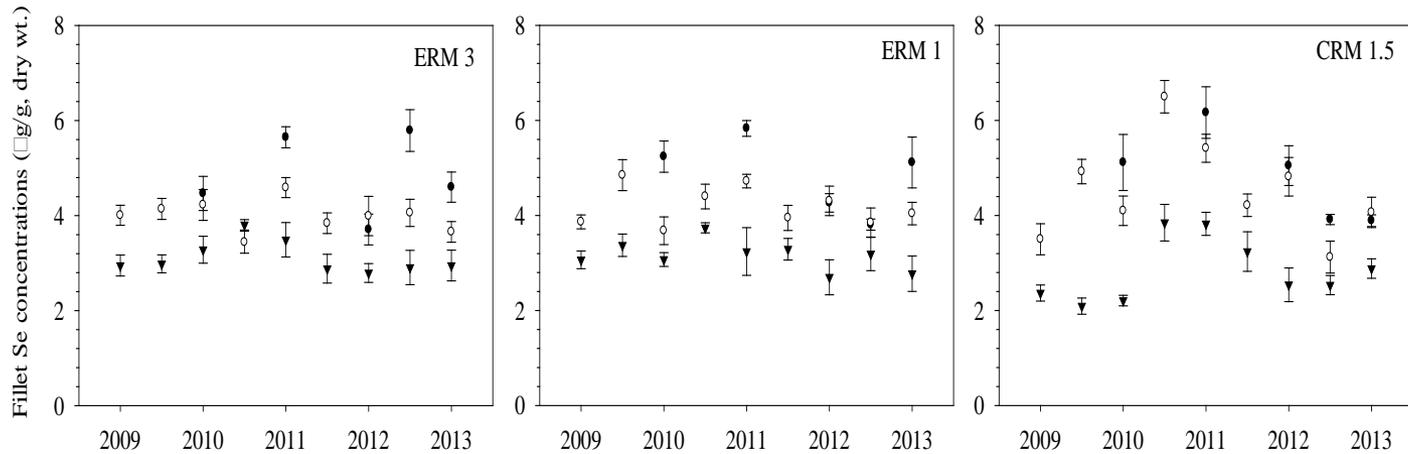
- Ash affected sites: ERM 4.5, ERM 3.5, ERM 0.9, CRM 1.5
- Reference sites: ERM 8, LERM 2, CRM 8

Selenium Results

Are concentrations higher at ash affected sites?



Are concentrations increasing over time?



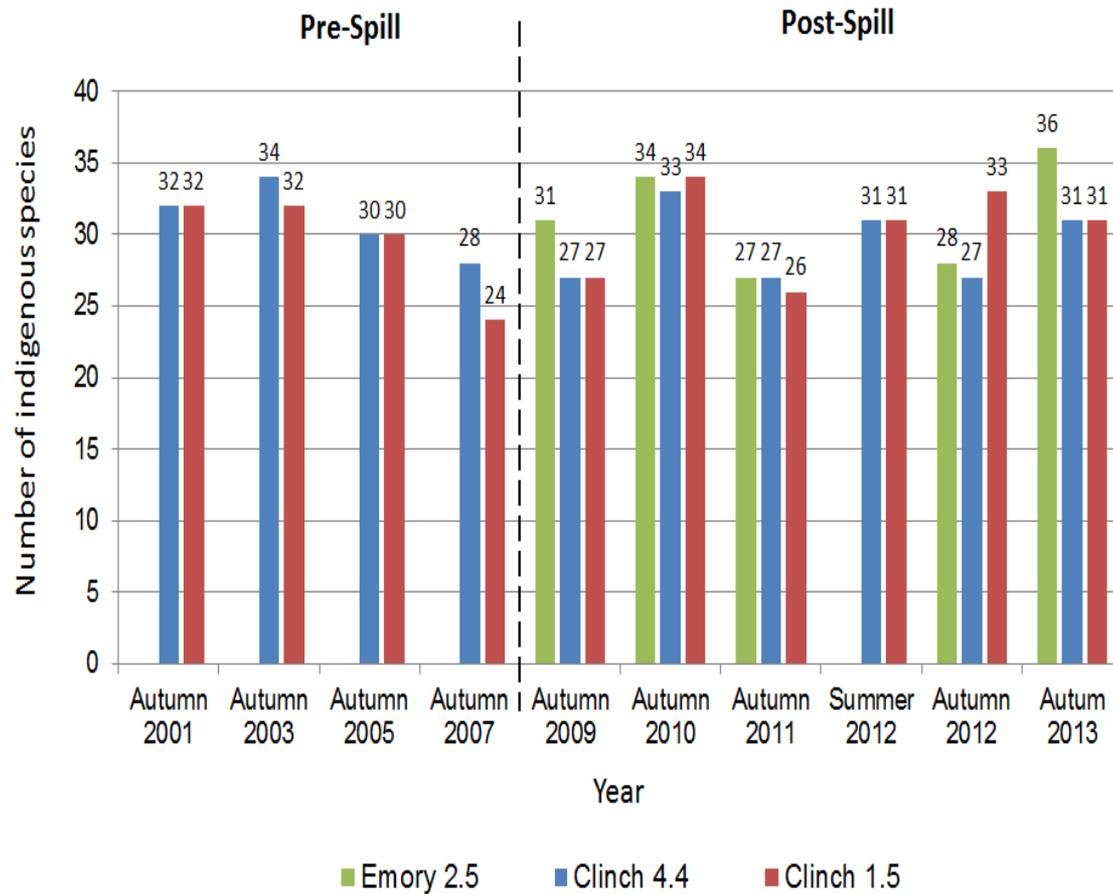
- Redear
- Bluegill
- ▼ Largemouth bass



Fish Community Survey

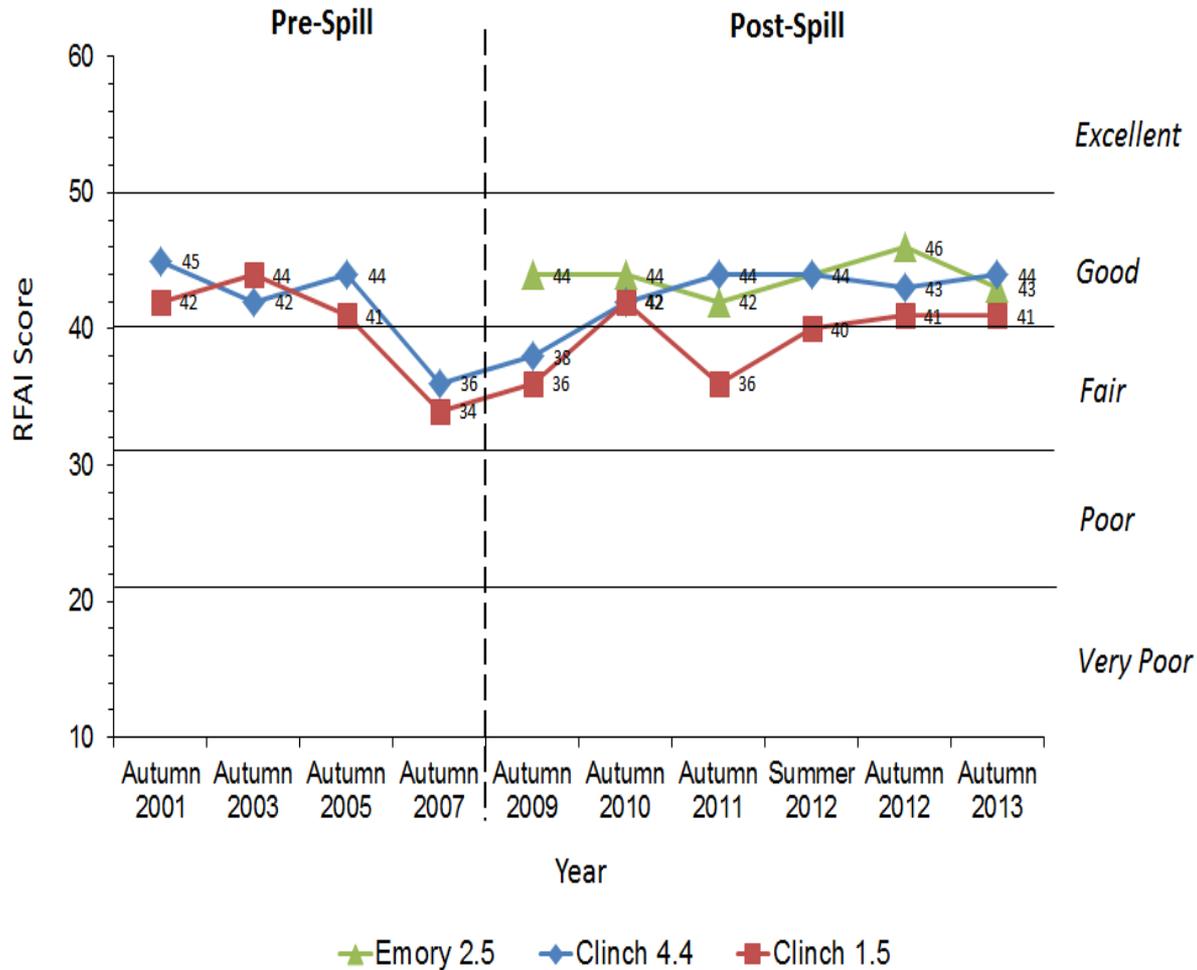
Fish Species Richness

2001-2013



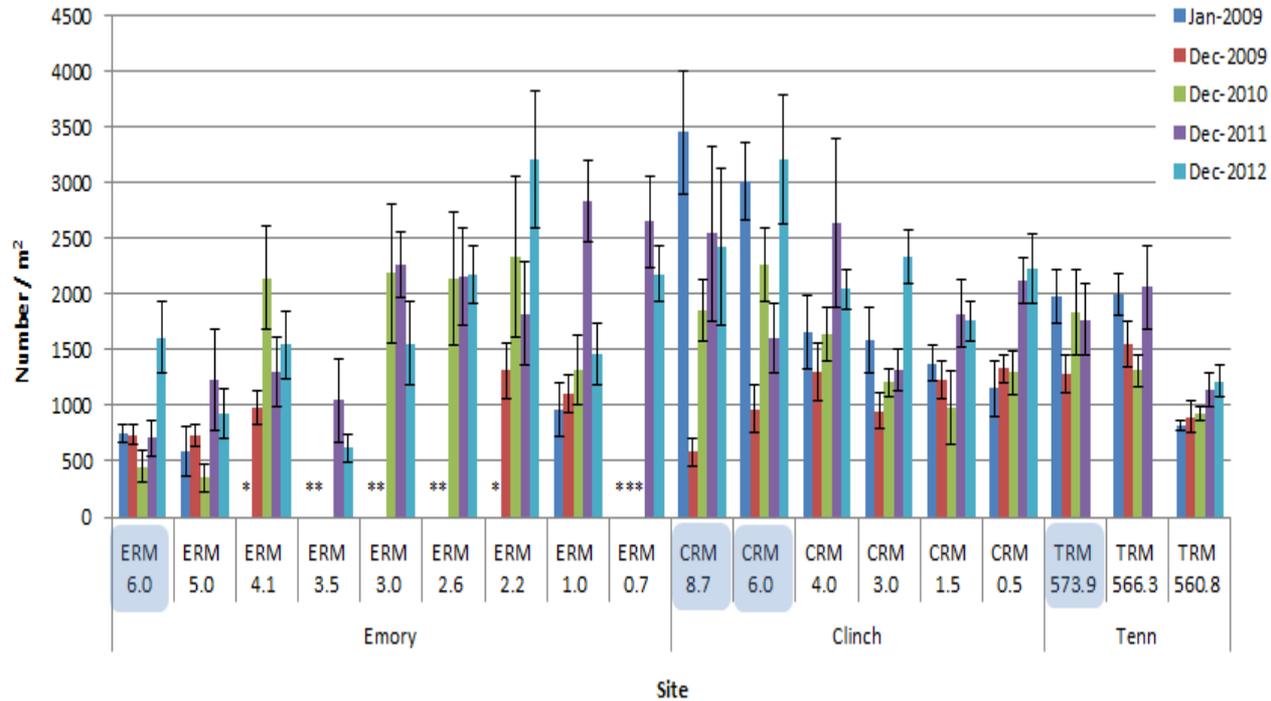
Fish Community Survey

Reservoir Fish Assemblage Index
Scores 2001-2013



Benthic Invertebrate Community

Mean Density of Invertebrates (2009-2012)

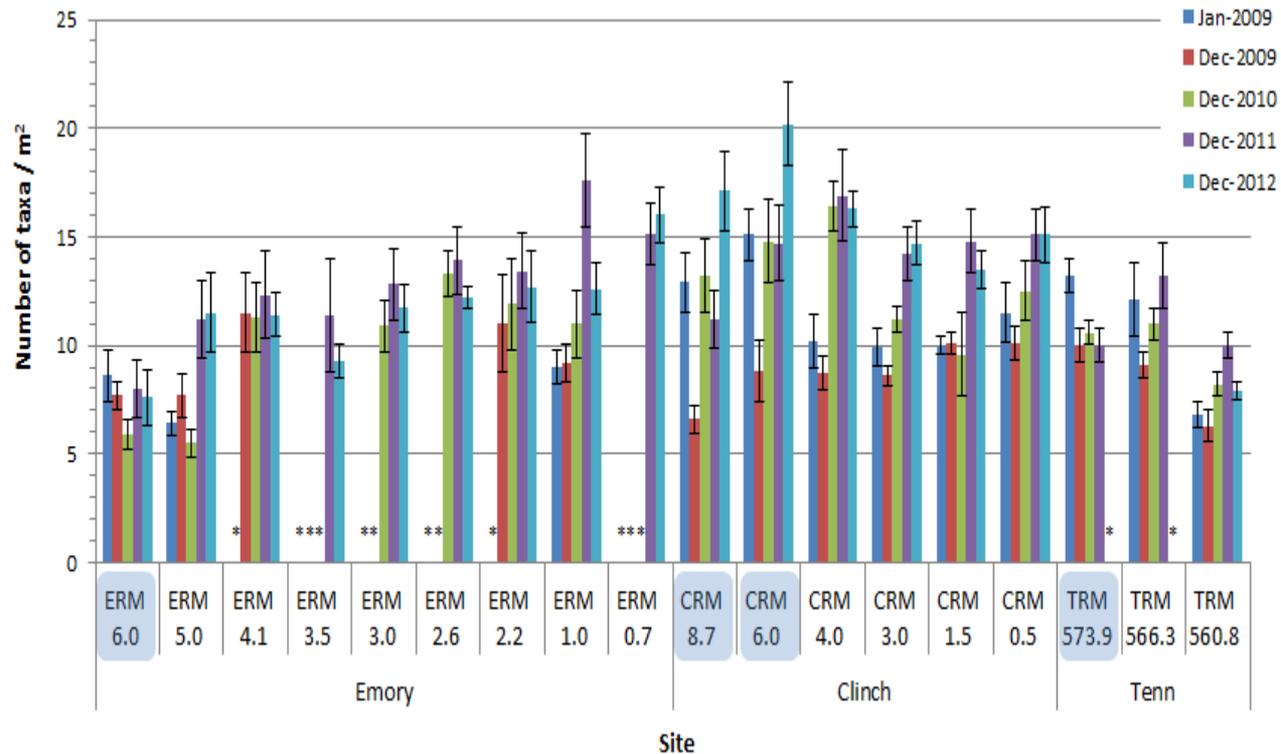


Reference

Sites
* Indicates sampling event(s) a site was not sampled

Benthic Invertebrate Community

Mean Taxa Richness (2009-2012)



Reference

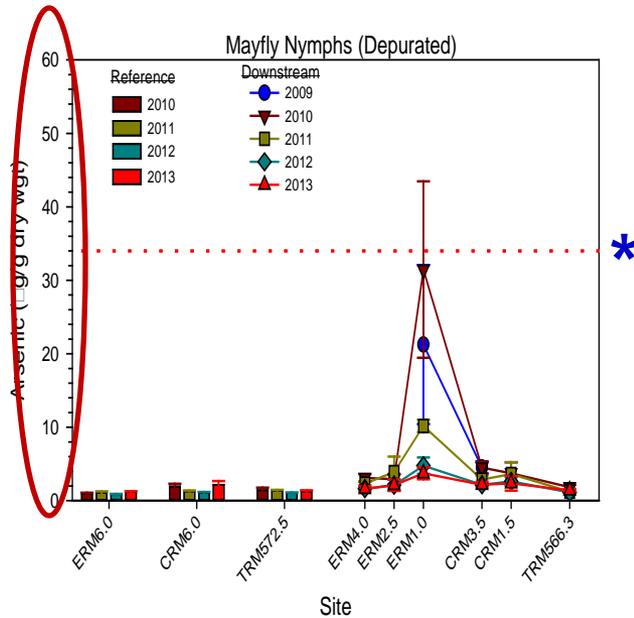
Sites

* Indicates sampling event(s) a site was not sampled

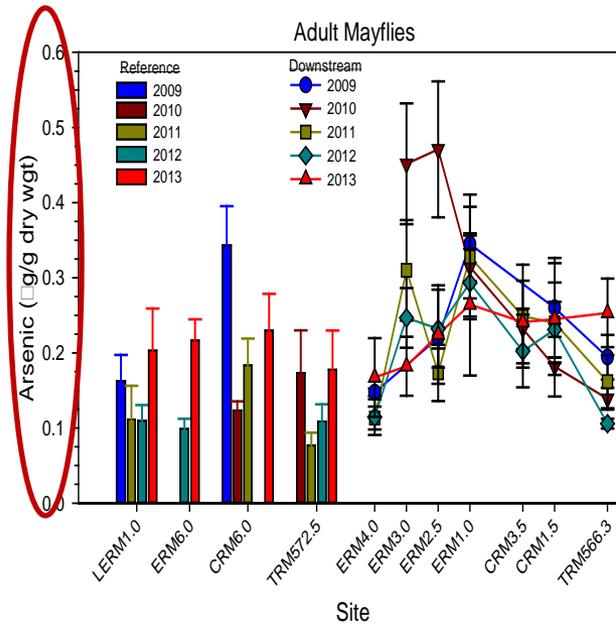
Arsenic

Mayflies: Nymphs (depurated) and Adults

Nymphs



Adults



- **Little change from 2012**
- **Well below EPA KIF tissue endpoint range.**

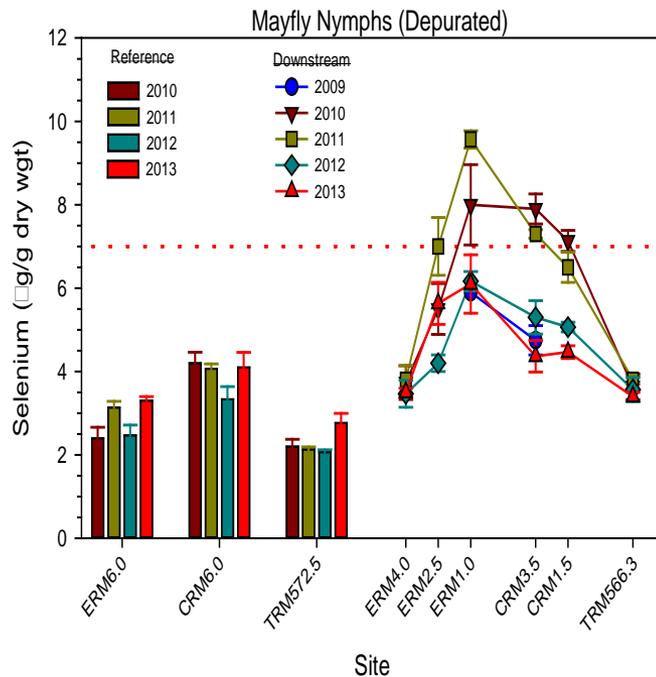
- **Arsenic remains extremely low in adults**

* Red dashed line = lower end of range for EPA's arsenic tissue endpoint for KIF

Selenium

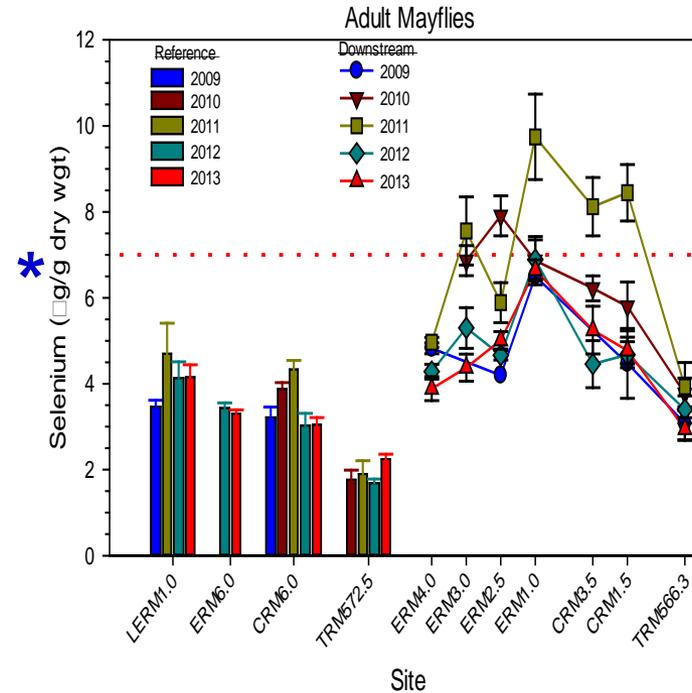
Mayflies: Nymphs (depurated) and Adults

Nymphs



- No change from 2012
- Highest concentration at ERM 1.0

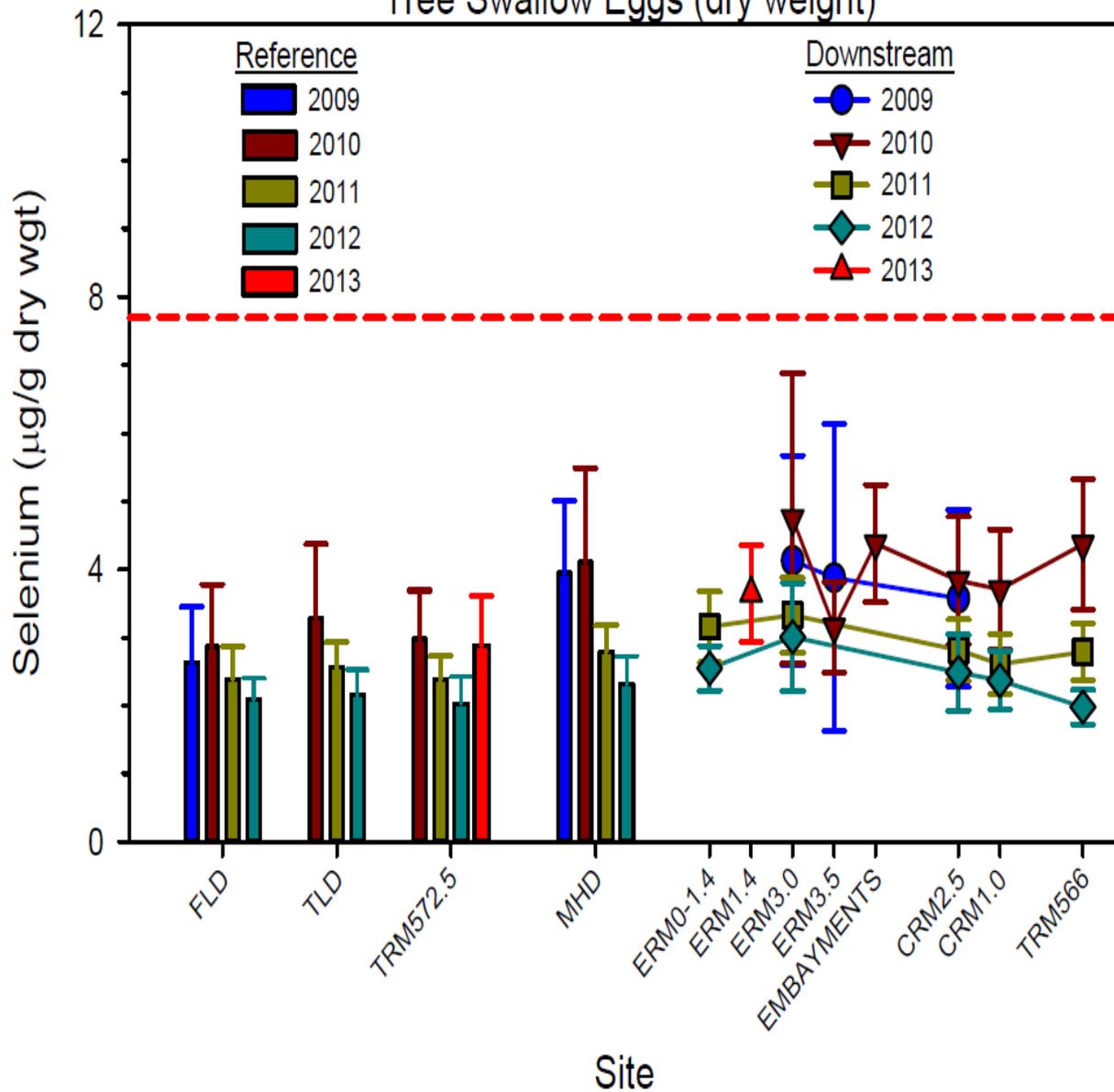
Adults



- No change from 2012
- Highest concentration at ERM 1.0

* Red dashed line = EPA's selenium tissue endpoint for KIF

Tree Swallow Eggs (dry weight)



2014 LTM Summary

Sample Task	Sample Point	Sample Frequency	Analytical
Bathymetry and Sediment Transport Modeling		Re-run model for storm events >110,000 cfs as needed	Modeling
Ash Deposit Characterization (Sampling to support sediment transport modeling)		As needed for confirmation of depositional areas after >110,000 cfs storm events. Sampling at the direction of Steve Scott (ERDC).	Ash thickness % ash (offsite lab) Grain size distribution Metals (As and Se only)
Sediment Contaminant Monitoring Discrete, co-located sediment samples. 10 points per transect, co-located with each benthic community sample.	ERM 1.0 ERM 0.7	10 samples/transect; two transects (where suitable benthic invertebrate substrate is present)	% ash (offsite lab)
Sediment Contaminant Monitoring Composite sediment samples. Multiple ponar samples per transect area. (left, center, right - where possible of upper 6" of sediment) focused on areas with suitable benthic habitat.	ERM 1.0 ERM 0.7	Up to 3 samples/transect; two transects	% ash (offsite lab) Grain Size Distribution Metals (As and Se only)
Benthic Invertebrate Community Sampling Benthic invertebrate population abundance and diversity. 10 discrete points per transect.	ERM 1.0 ERM 0.7	10 samples/transect; two transects	Population abundance and diversity
Benthic Invertebrate Bioaccumulation Mayfly nymphs (depurated and non-depurated) composited at 3 points per transect (right, center, left).	ERM 1.0	3 samples/transect; one transect	Metals (TVA list of 13 metals)
Benthic Invertebrate Bioaccumulation Mayfly adults composited at 3 points per transect (right, center, left) of each male and female and imagos and subimagos.	ERM 1.0	Up to 12 samples/transect (3 samples/transect of each; male imago, male subimago, female imago, and female subimago); one transect	Metals (TVA list of 13 metals)
Aerial-feeding Insectivores Bioaccumulation Tree swallow monitoring at two locations (35 boxes at each location).	ERM 1.0 TRM 572	25 egg samples/site; two locations Reproductive competence: clutch size, hatching & fledgling success	Metals (TVA list of 13 metals) Field Observations
Fish Bioaccumulation Monitoring Collection of 6 female of each species per site. Test fillets, ovaries, and liver.	ERM 1.0	6 females of each species; 1 site (analysis of fillets, ovaries, and livers)	Metals (TVA list of 13 metals)



Kingston Recovery Site Before and After Photos



Dredge Cell Then



Dredge Cell Now



North Embayment Then



North Embayment Now



Emory River Then



Emory River Now



East Embayment Then



East Embayment Now