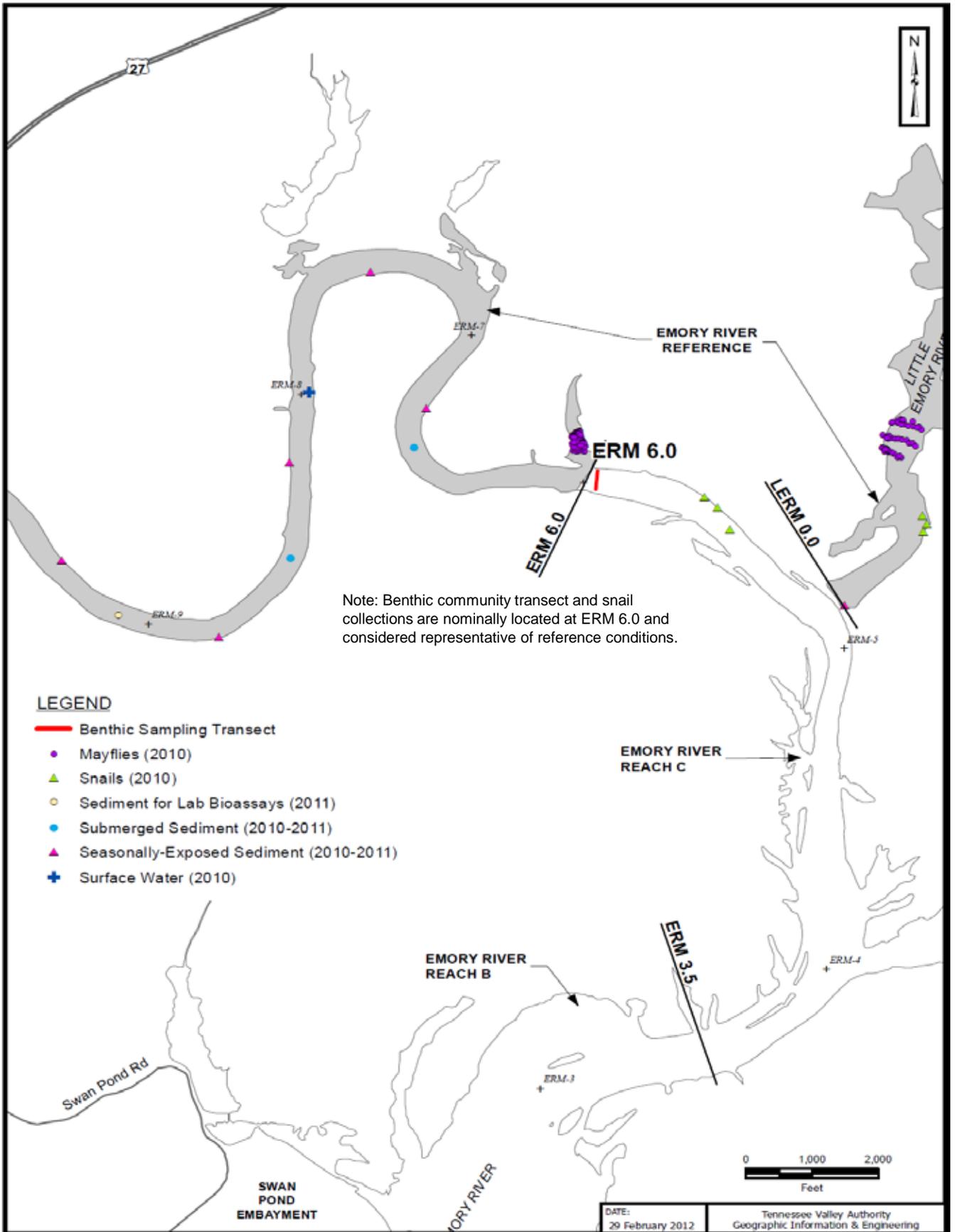
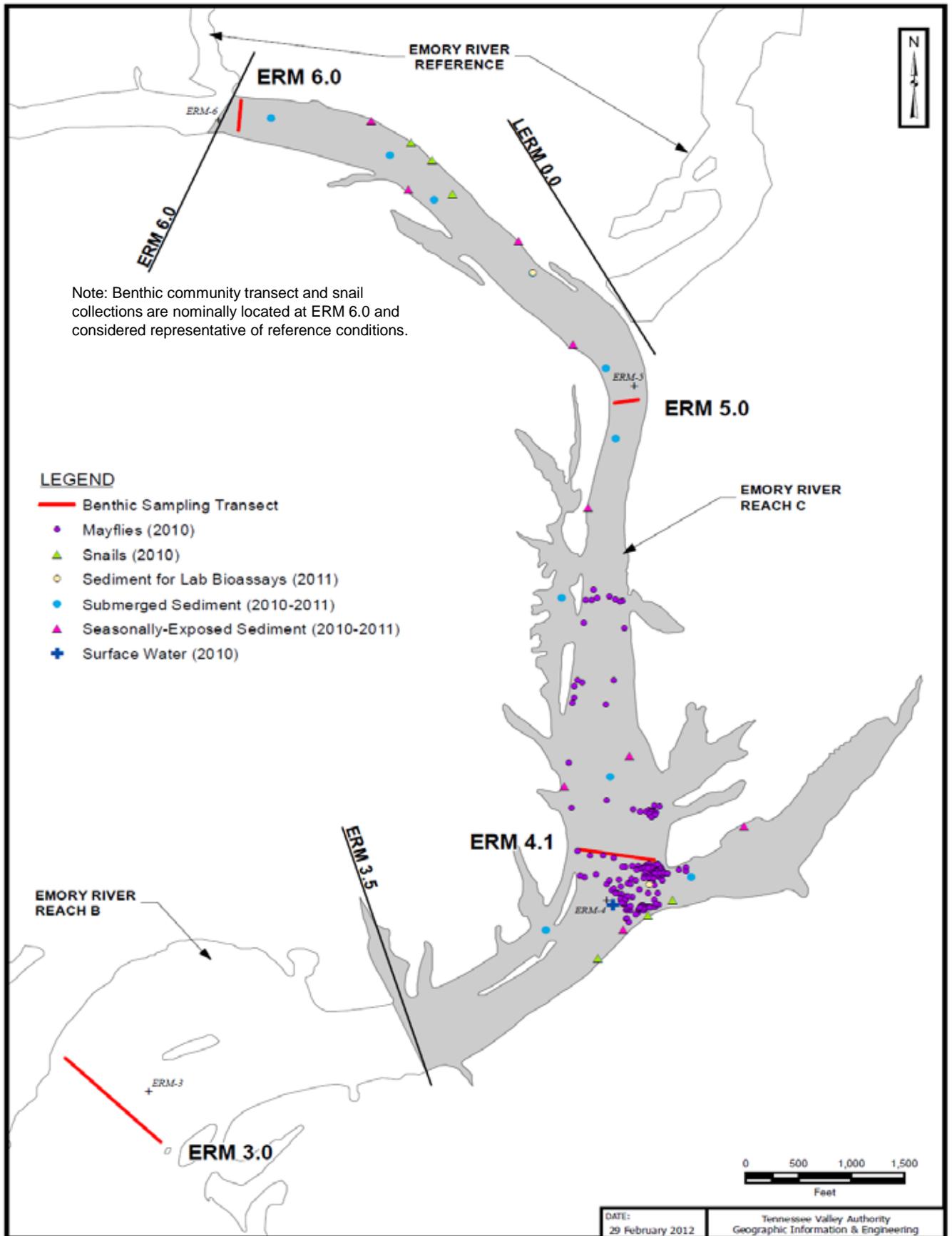


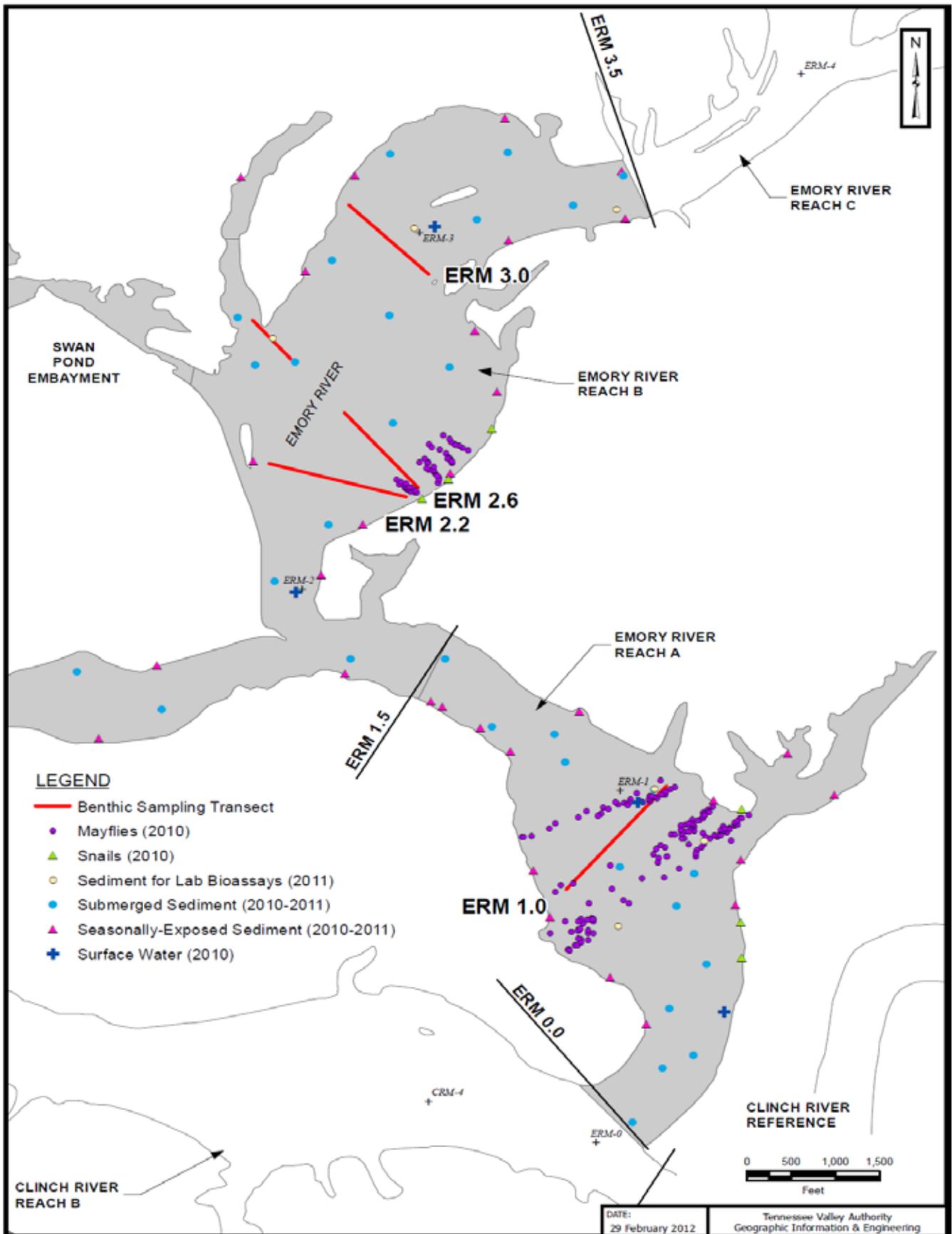
Benthic Sediment, Water, and Biota Sampling Overview
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



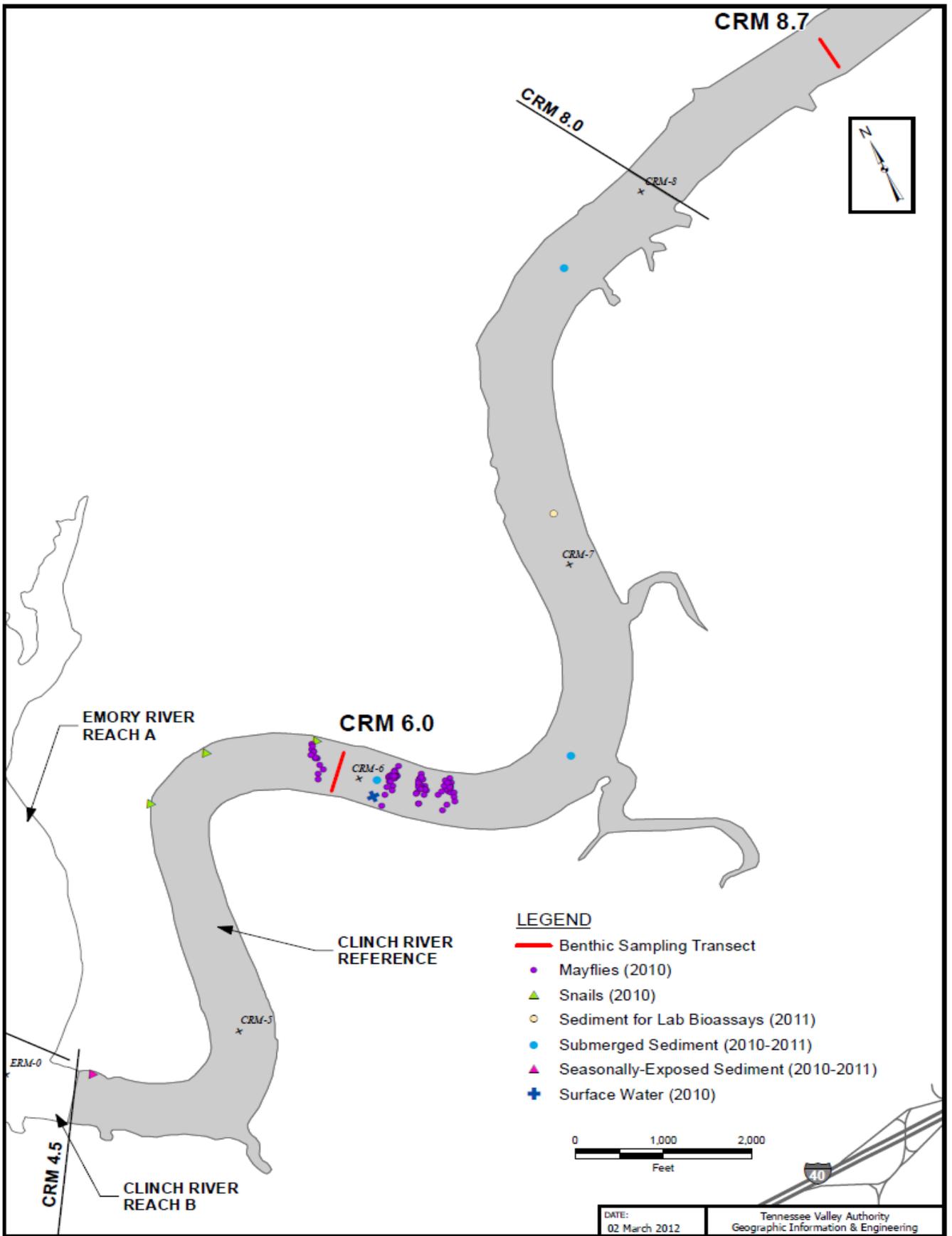
Benthic Sampling Locations – Emory River Reference and Reach C
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



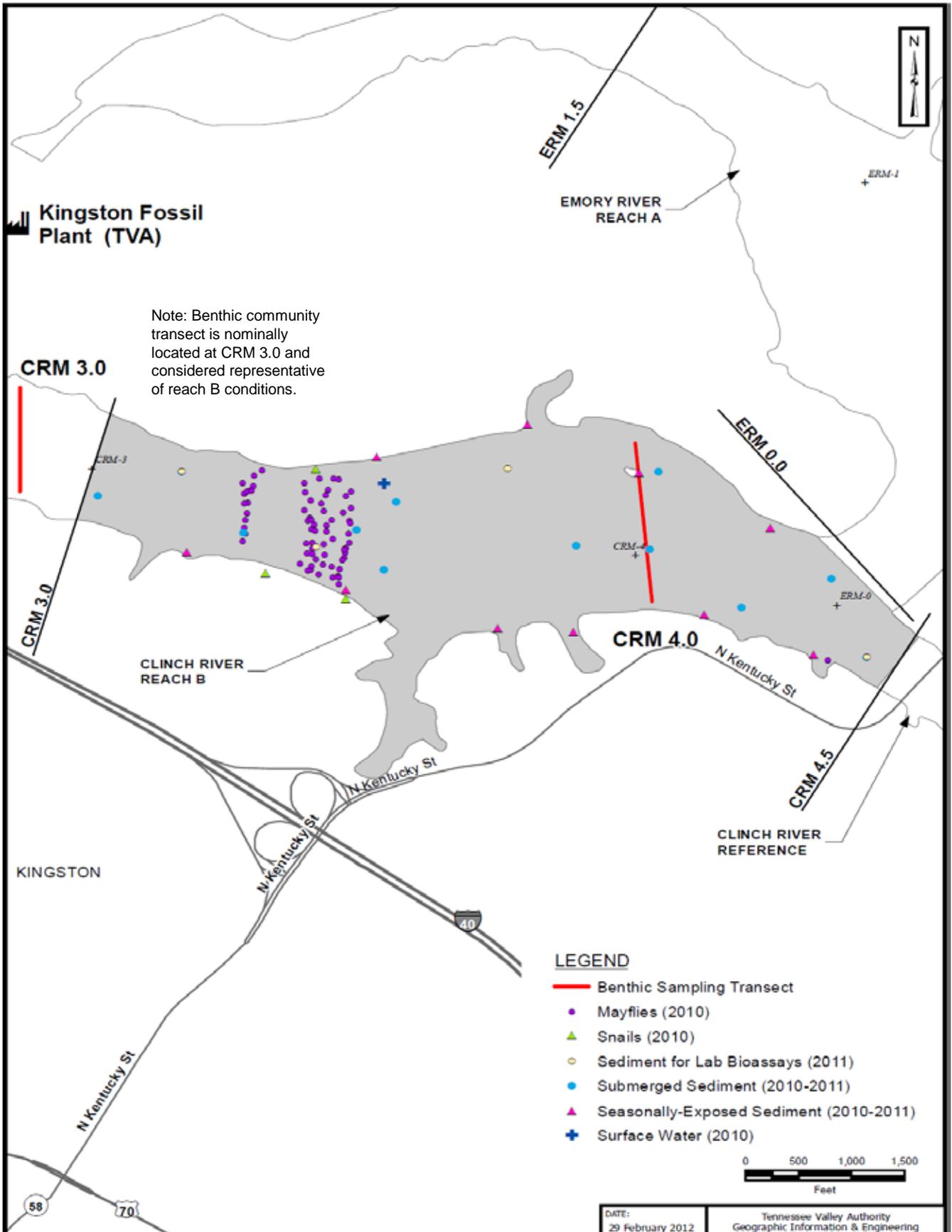
Benthic Sampling Locations – Emory River Reach B
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



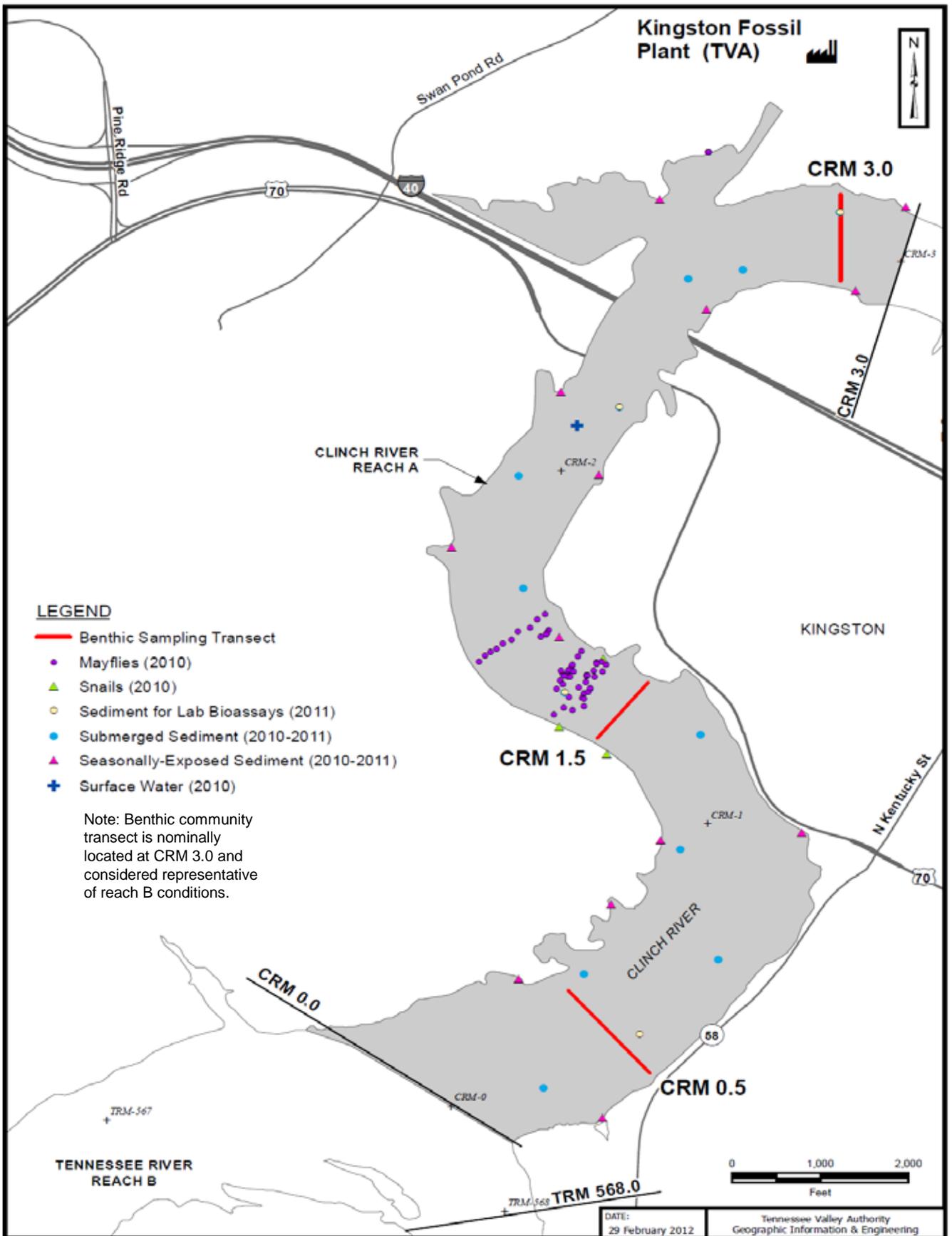
Benthic Sampling Locations – Emory River Reach A
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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Benthic Sampling Locations – Clinch River Reference Reach
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

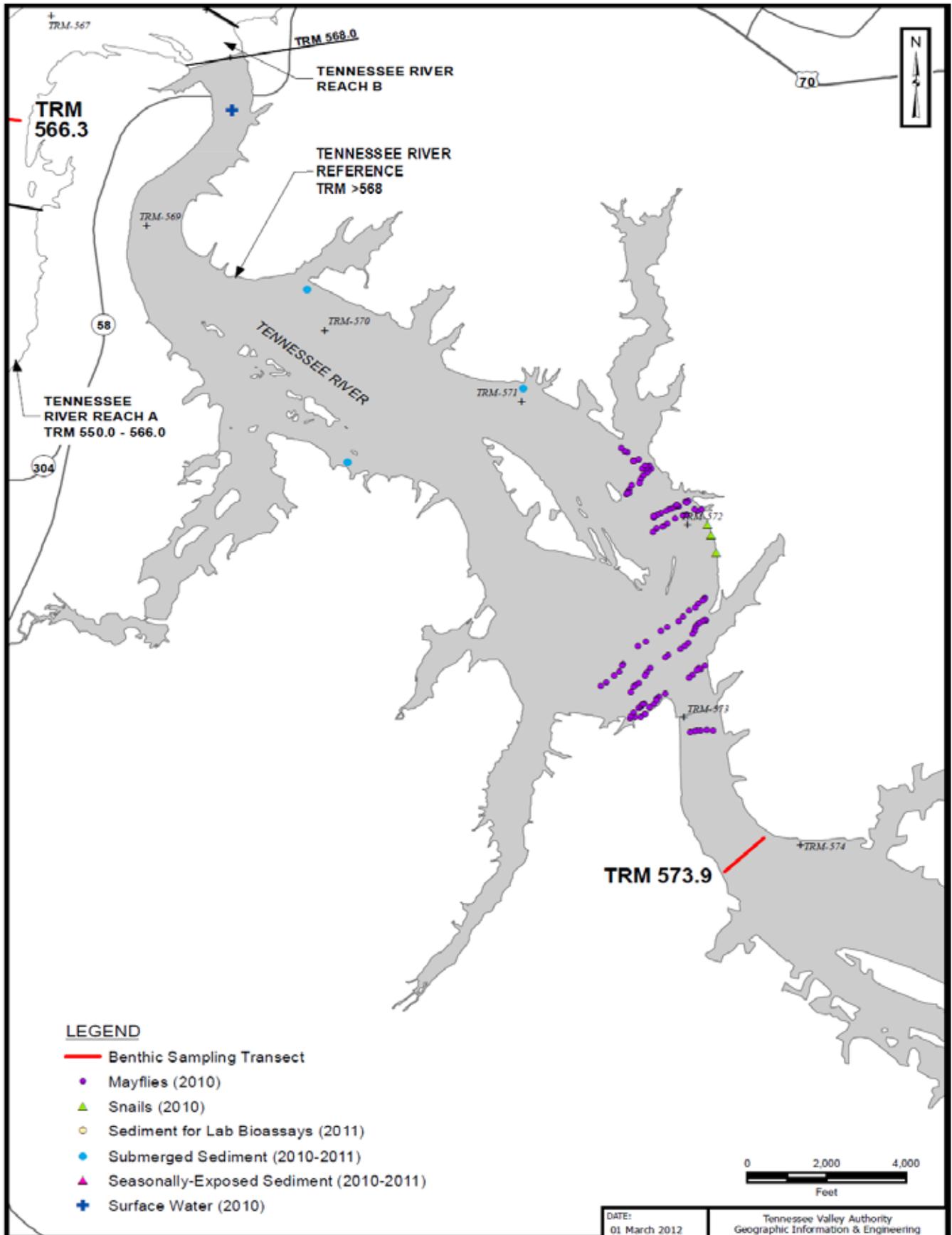


Benthic Sampling Locations – Clinch River Reach B
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

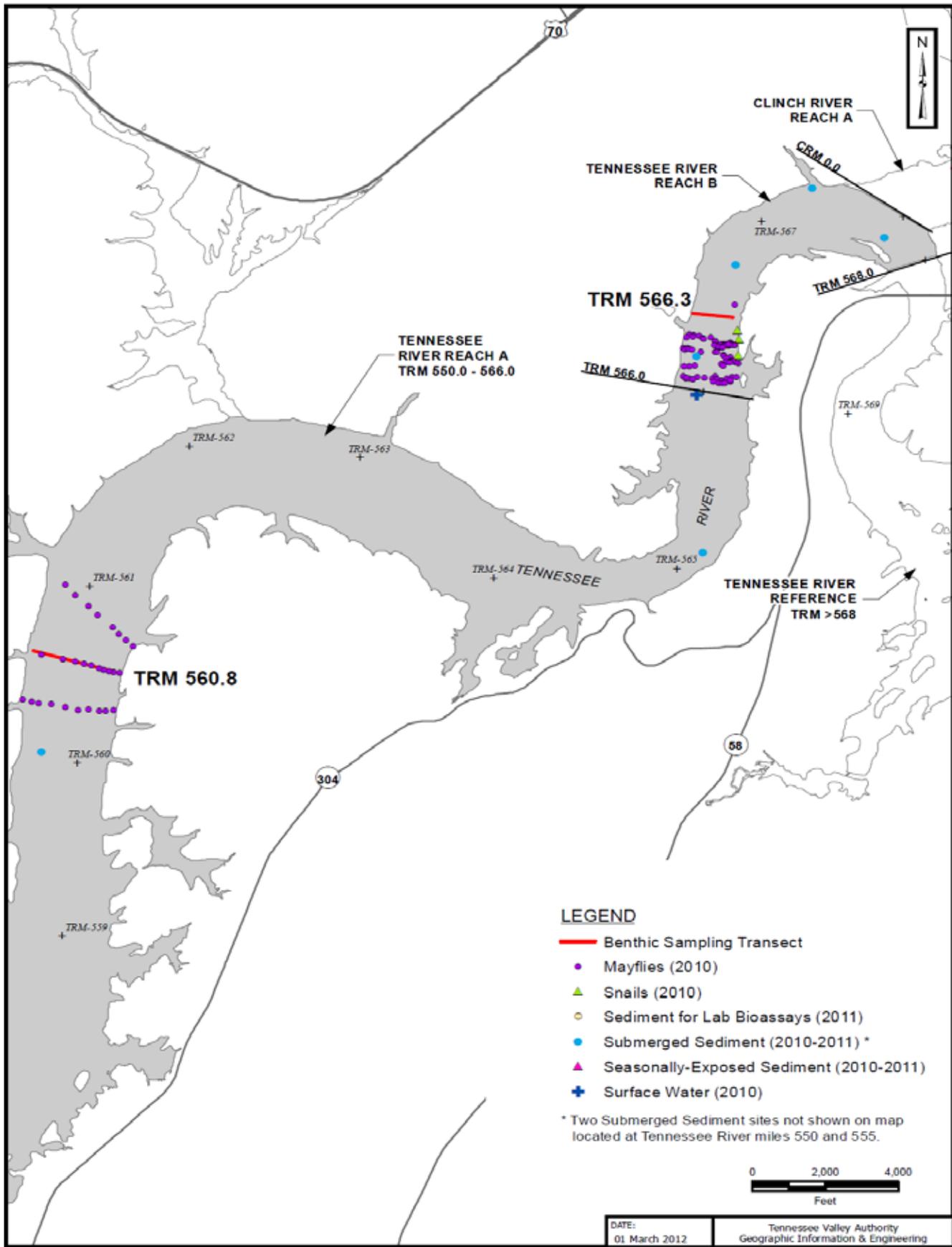


Benthic Sampling Locations – Clinch River Reach A
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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FIGURE
 4-7



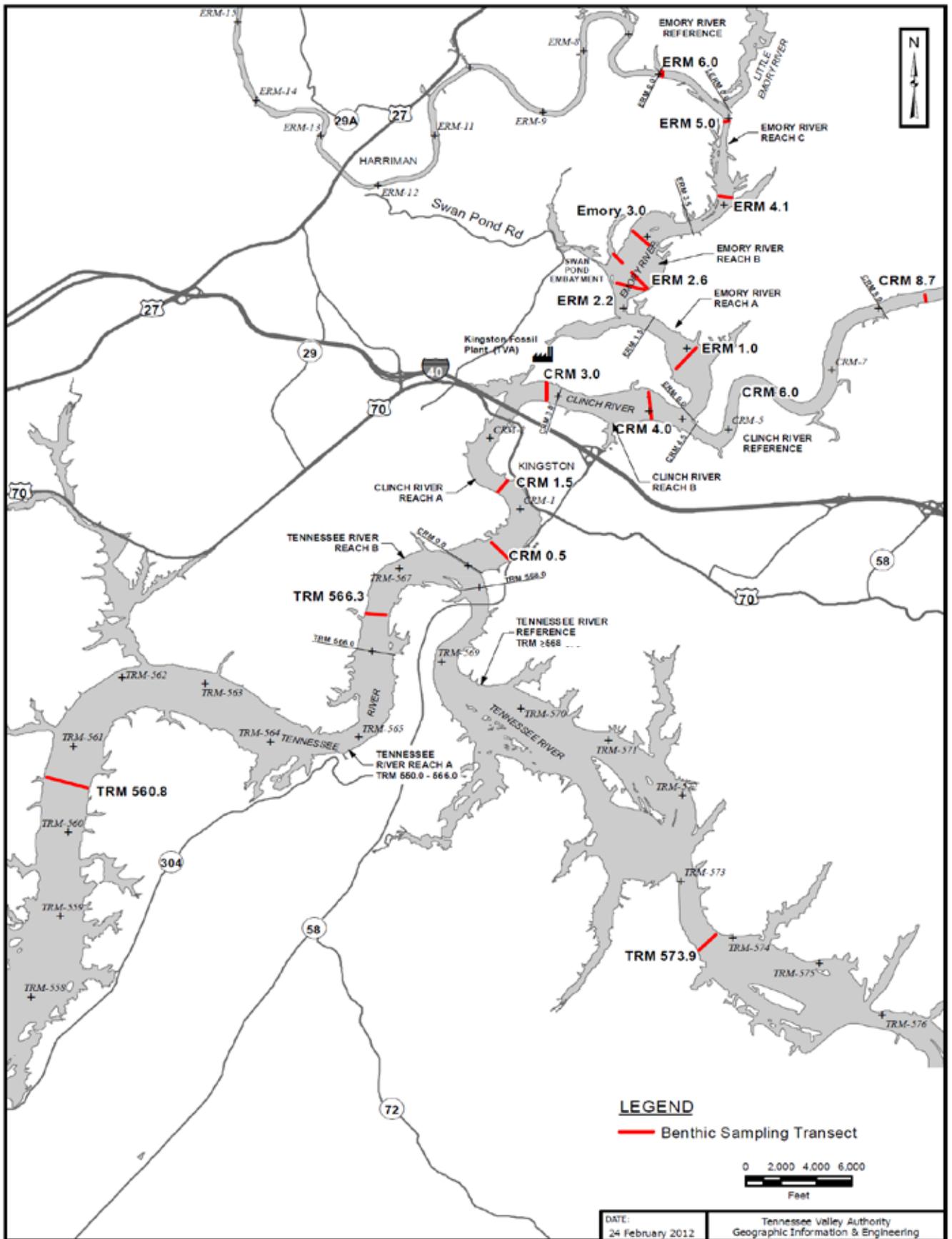
Benthic Sampling Locations – Tennessee River Reference Reach
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



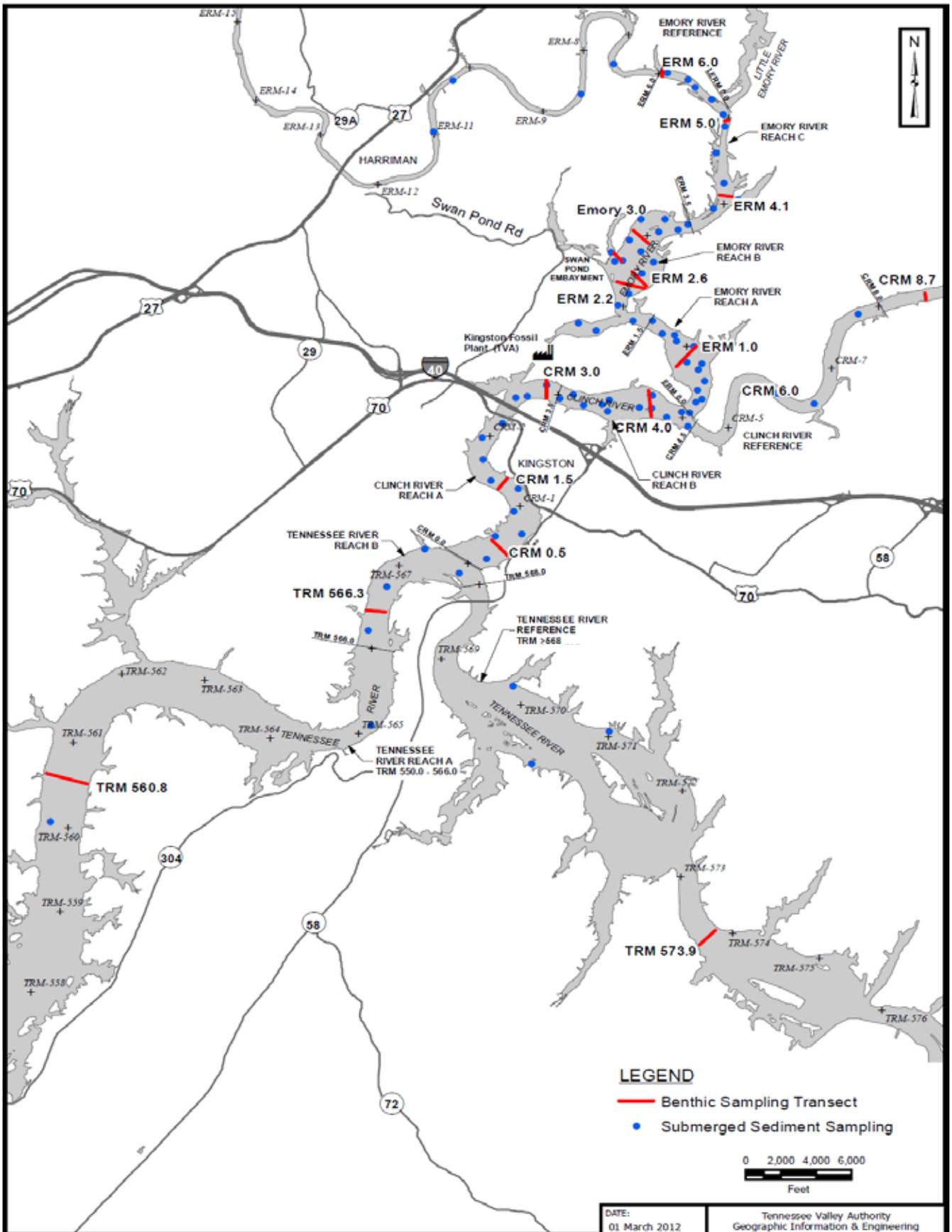
Benthic Sampling Locations – Tennessee River Reach A and B
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

FIGURE
4-9

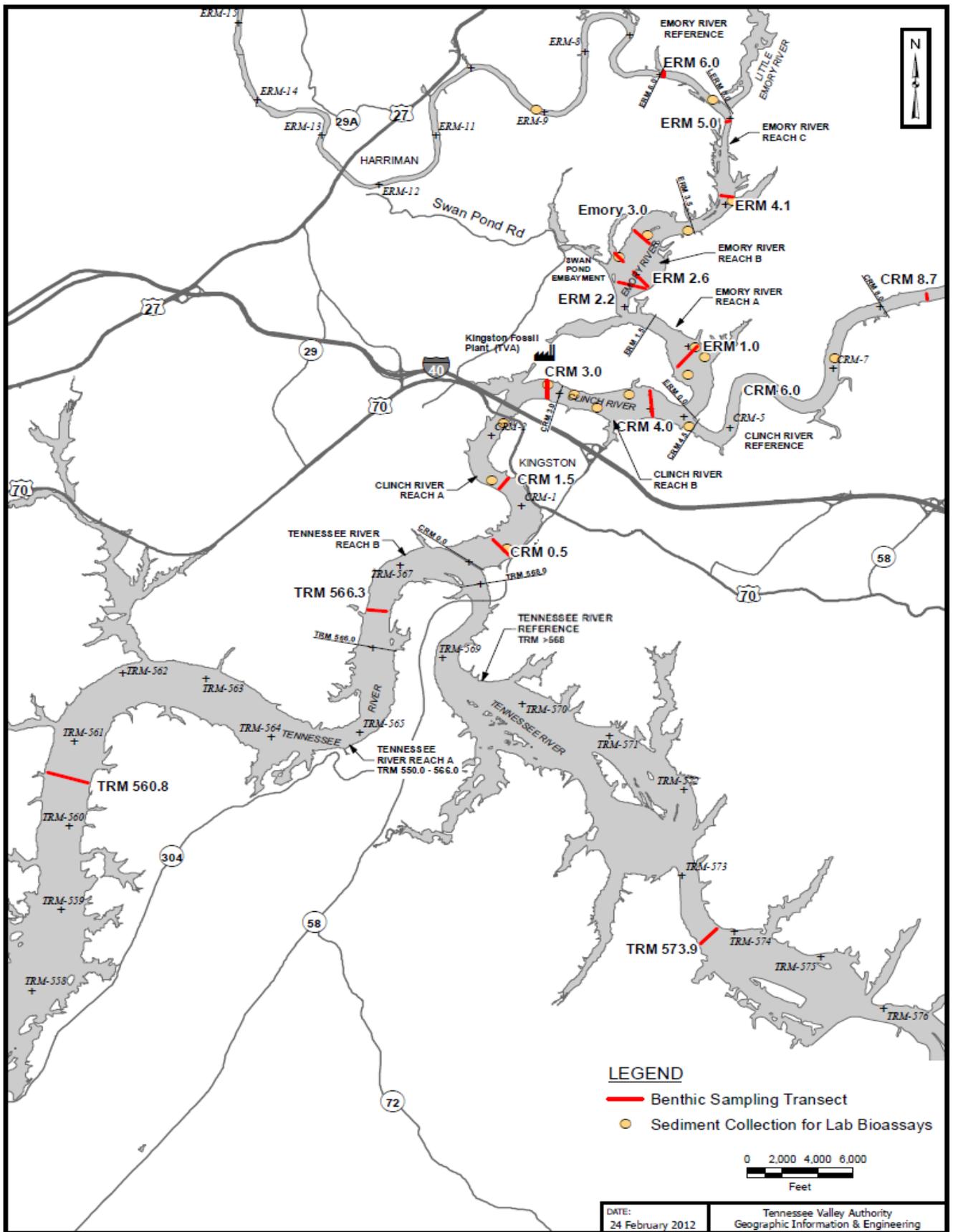




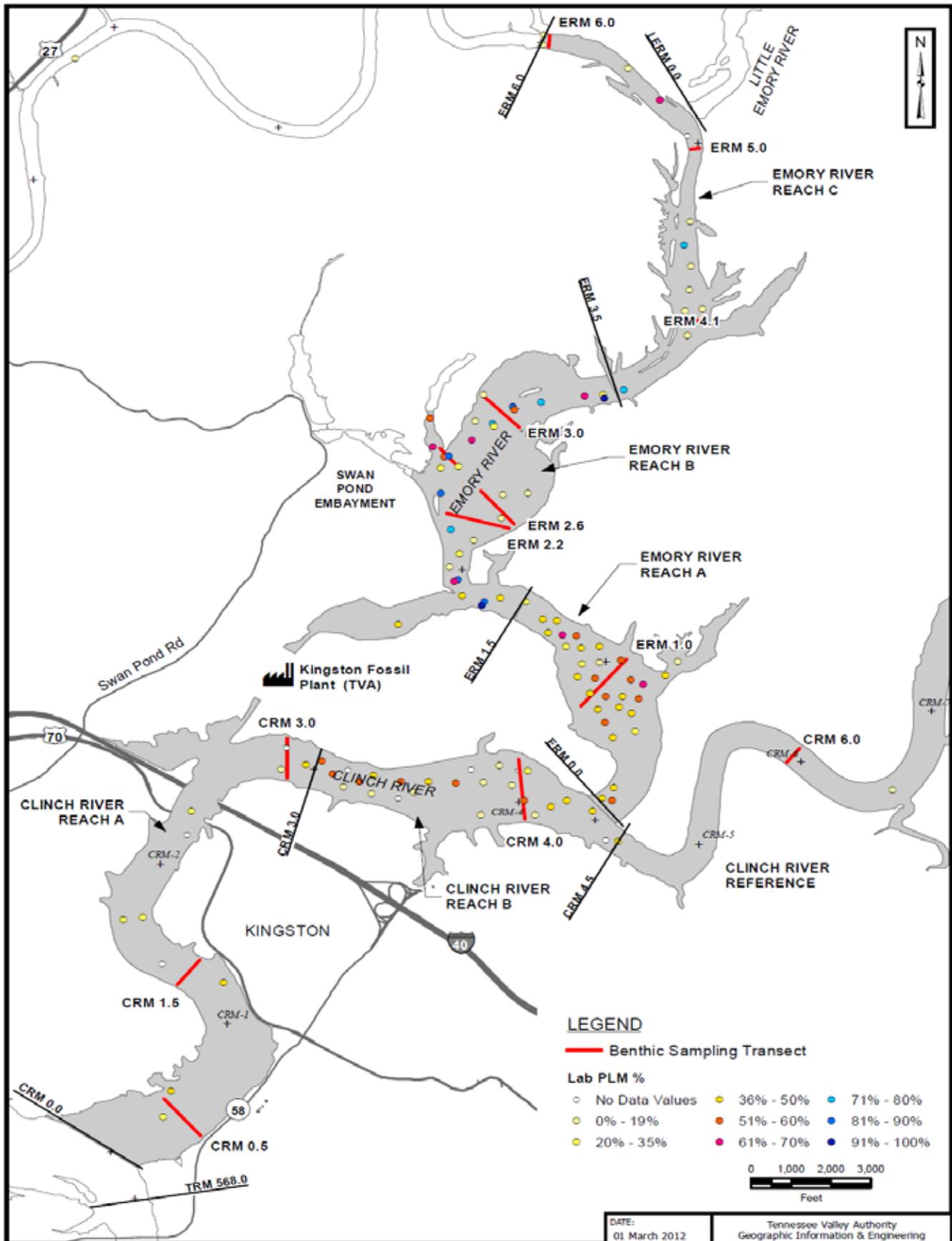
Benthic Invertebrate Community Transects
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



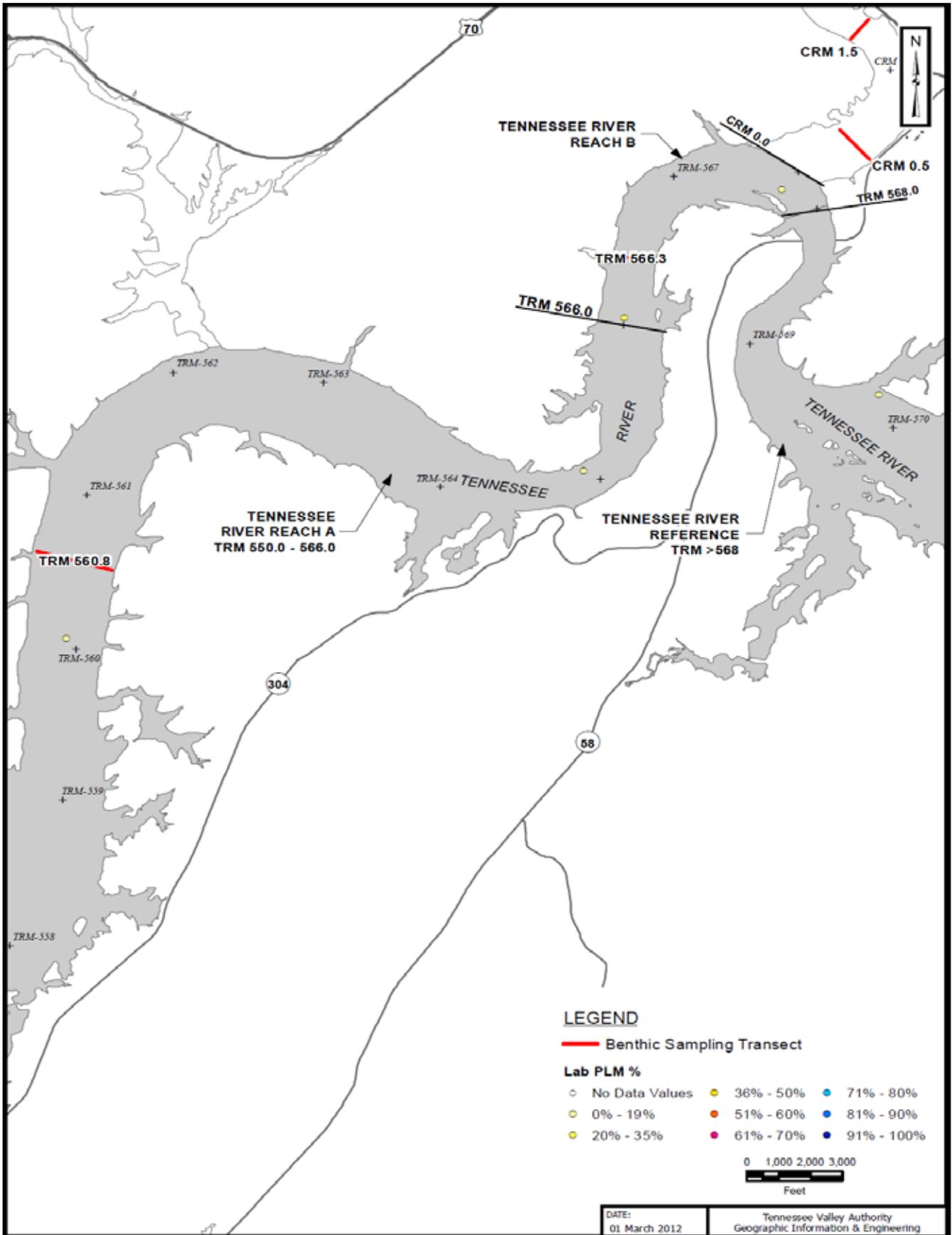
Benthic Invertebrate Community and Submerged Sediment Sampling Locations
 Baseline Ecological Risk Assessment
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Benthic Invertebrate Community and Bulk Sediment Sampling Locations
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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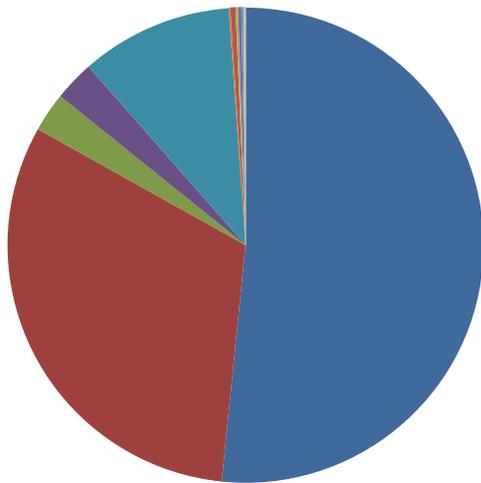


Benthic Invertebrate Community and % Ash in Samples – Emory and Clinch Rivers
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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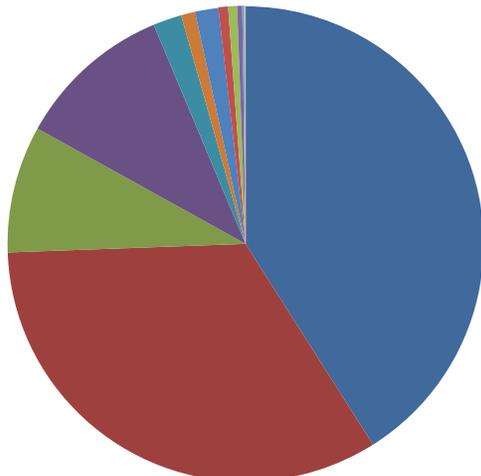


Benthic Invertebrate Community and % Ash in Samples – Tennessee River
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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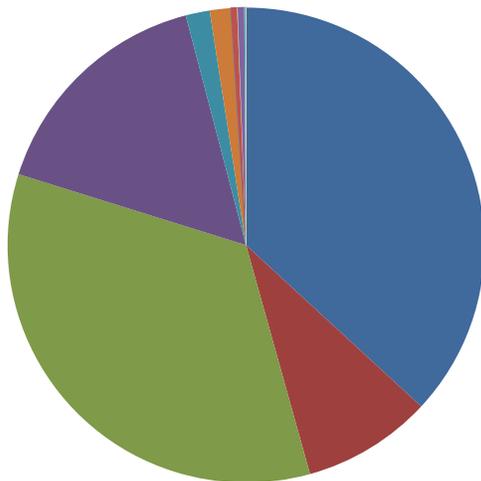
Emory River



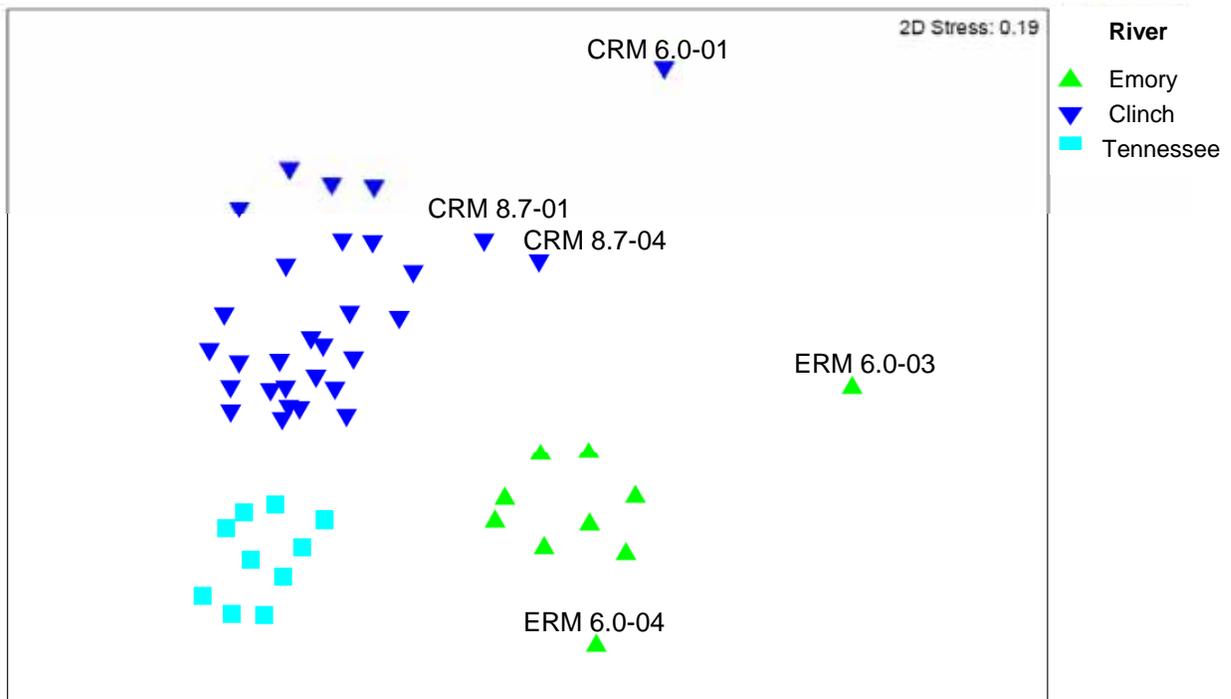
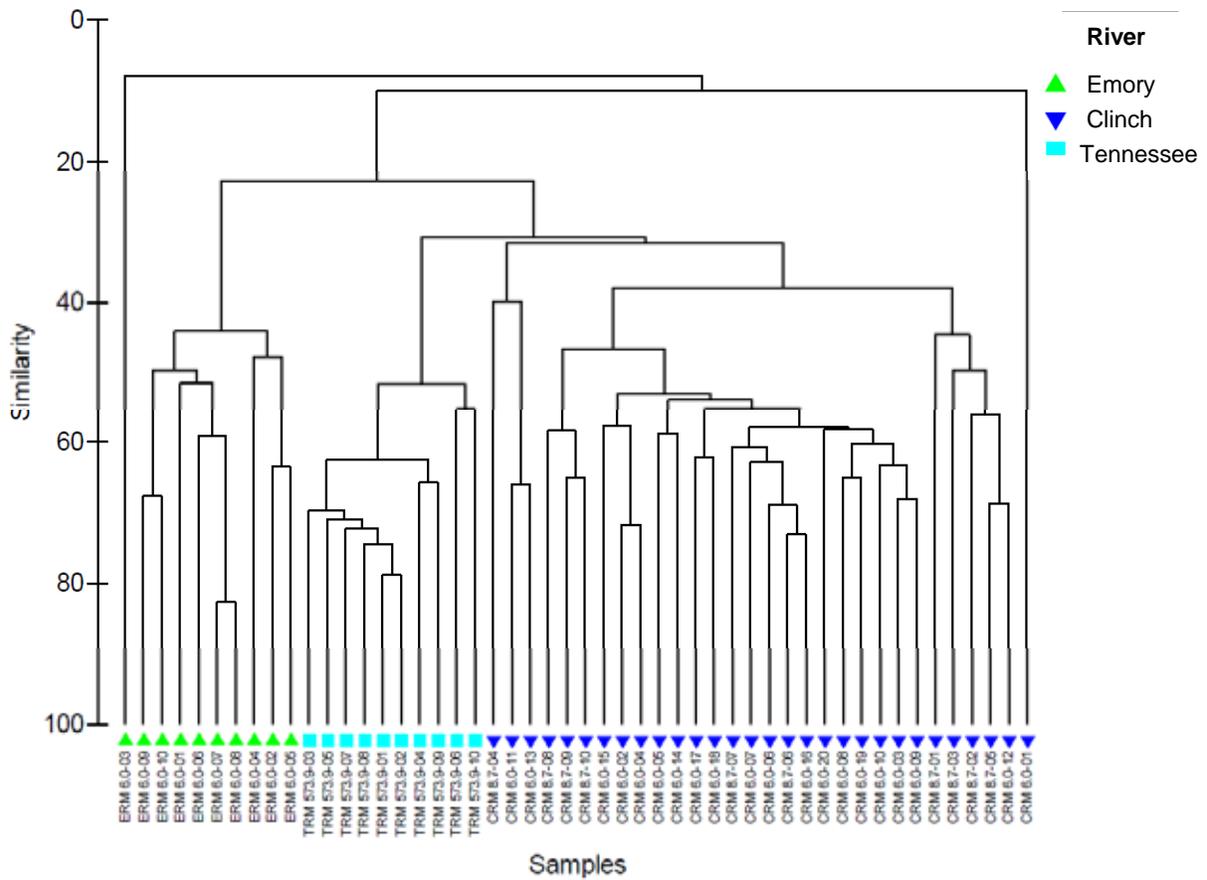
Clinch River



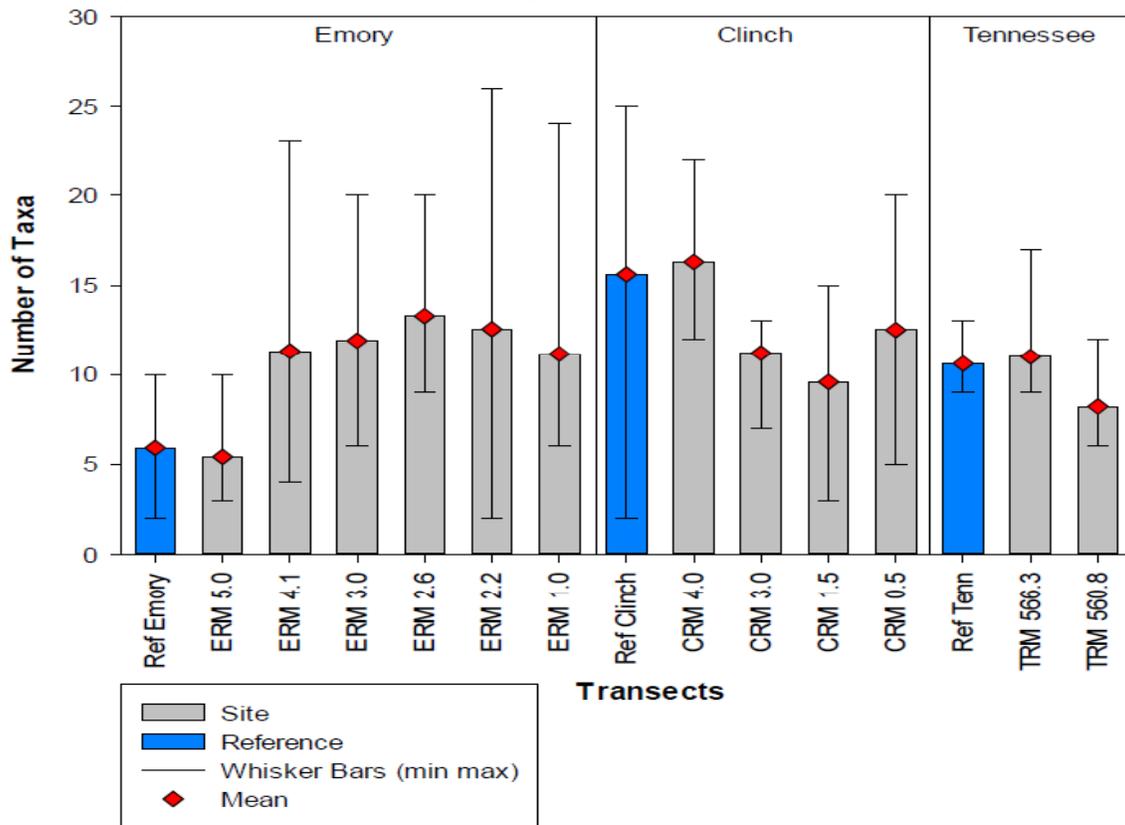
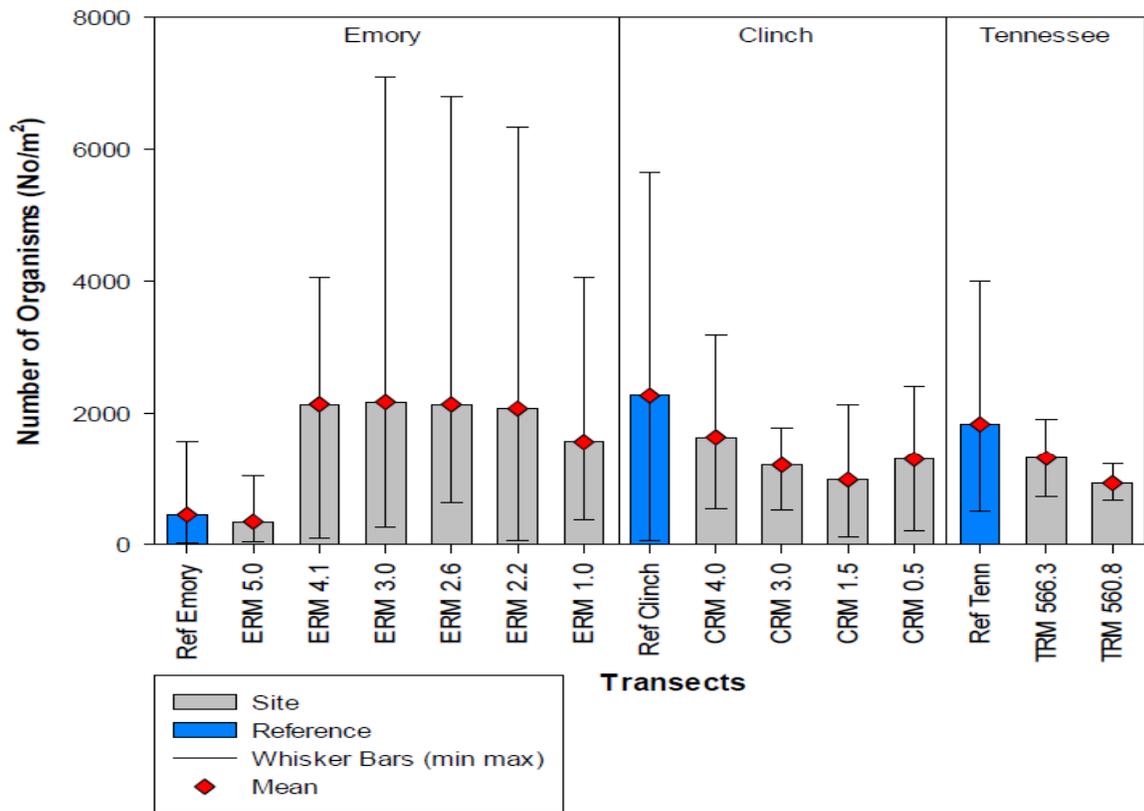
Tennessee River



- Chironomid (Midge)
- Oligochaete (Aquatic Worm)
- Bivalvia (Mussel/Clam)
- Ephemeroptera (Mayfly)
- Diptera (Fly)
- Hirudinea (Leech)
- Gastropoda (Snail)
- Acariform (Mite)
- Coleoptera (Beetle)
- Trichoptera (Caddisfly)
- Nematoda (Roundworms)
- Odonata (Dragon/Damselfly)
- Amphipoda (Scud)
- Plecoptera (Stonefly)
- Megaloptera (Alderfly)

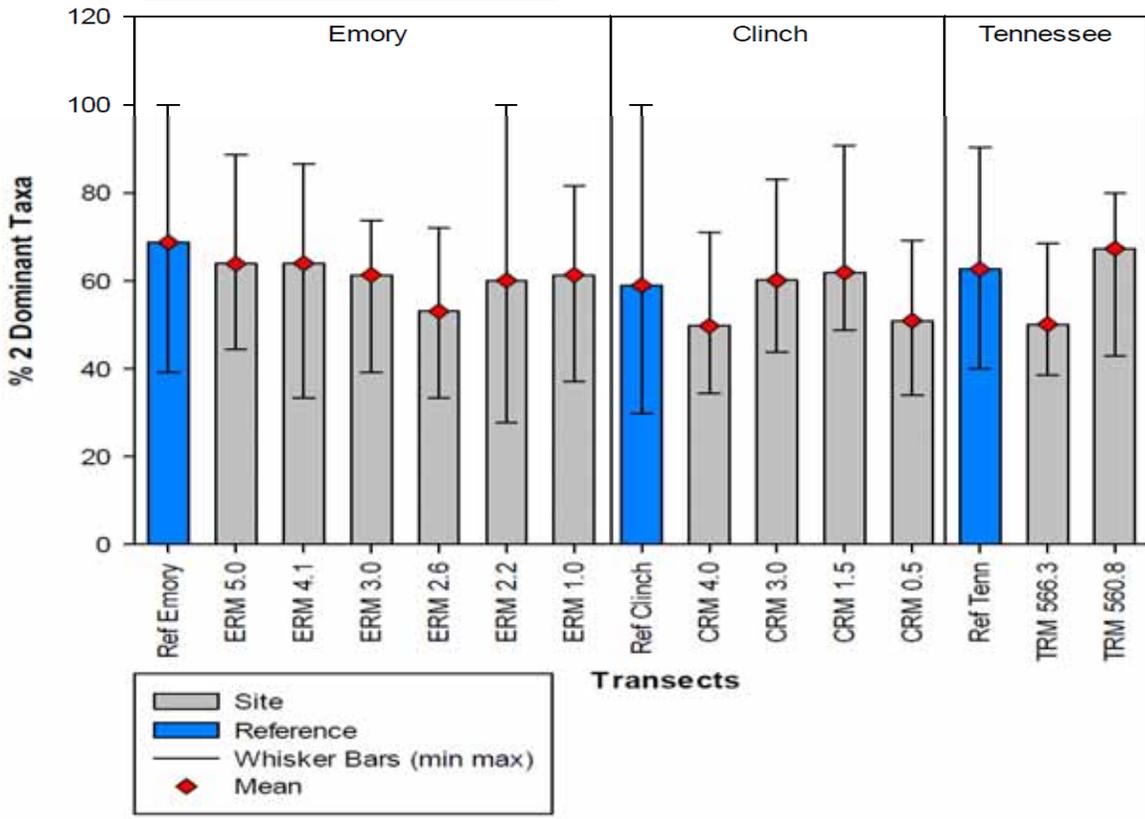
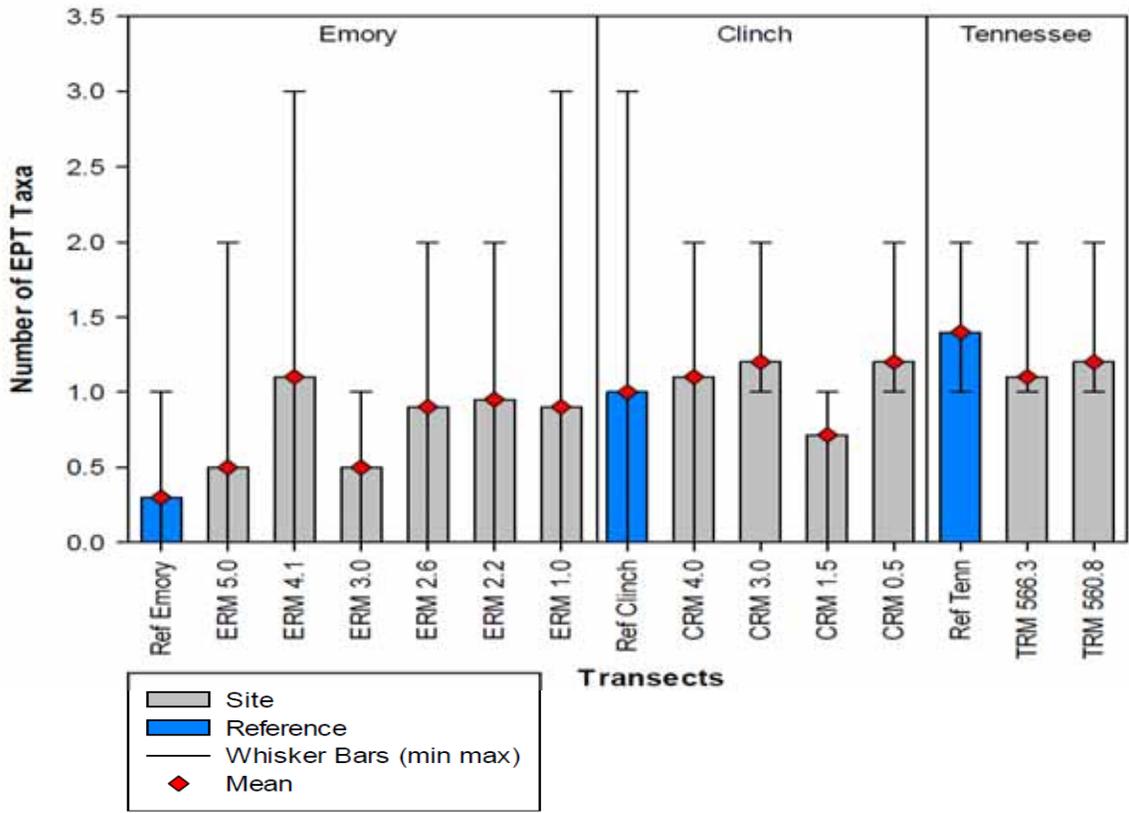


Notes: Labels are included for those data points which appear visually as outliers.
ERM = Emory River Mile; CRM = Clinch River Mile; TRM = Tennessee River Mile



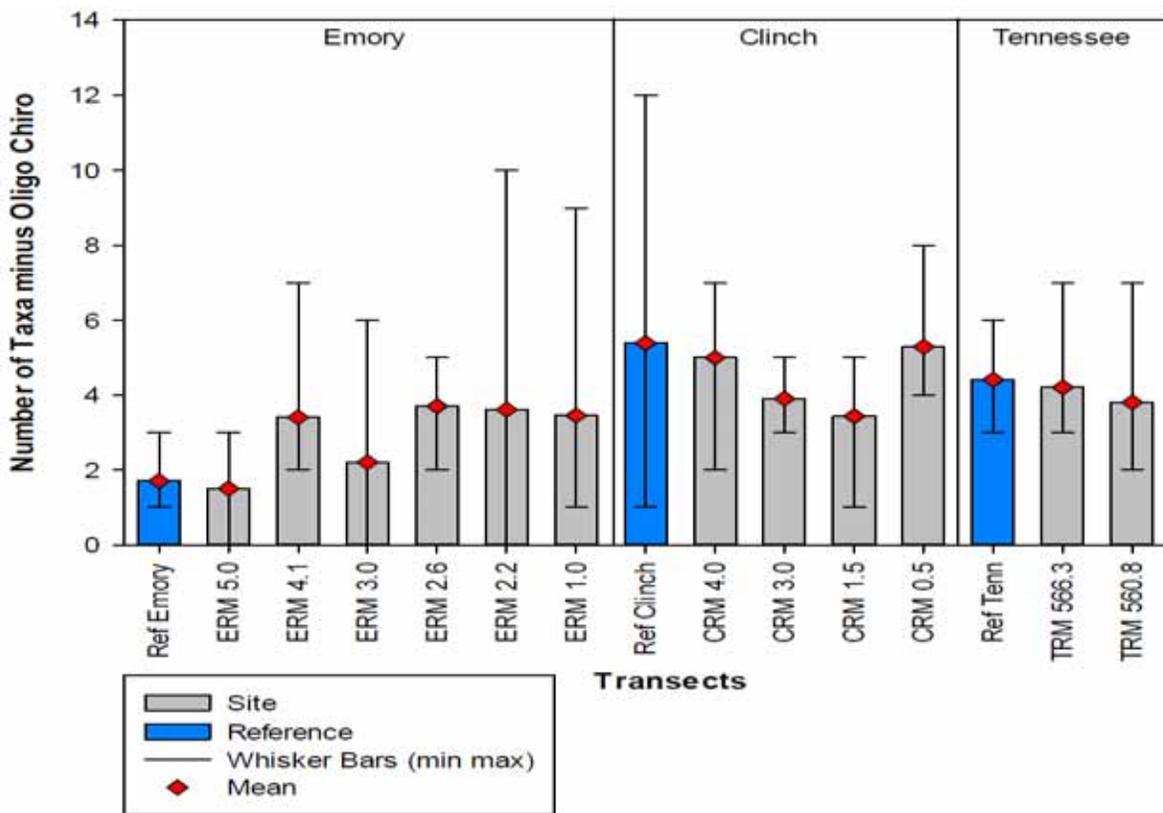
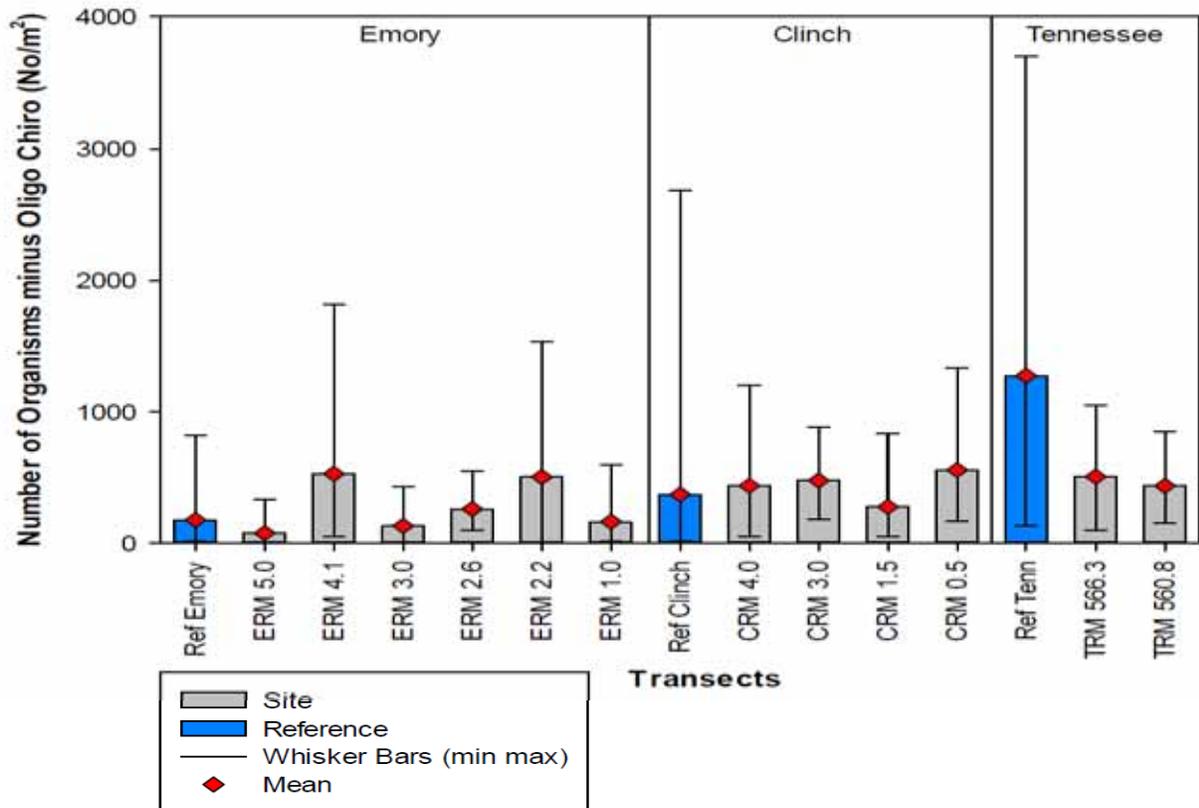
Notes:
 No = Number; m² = Meter squared; Ref = Reference
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile





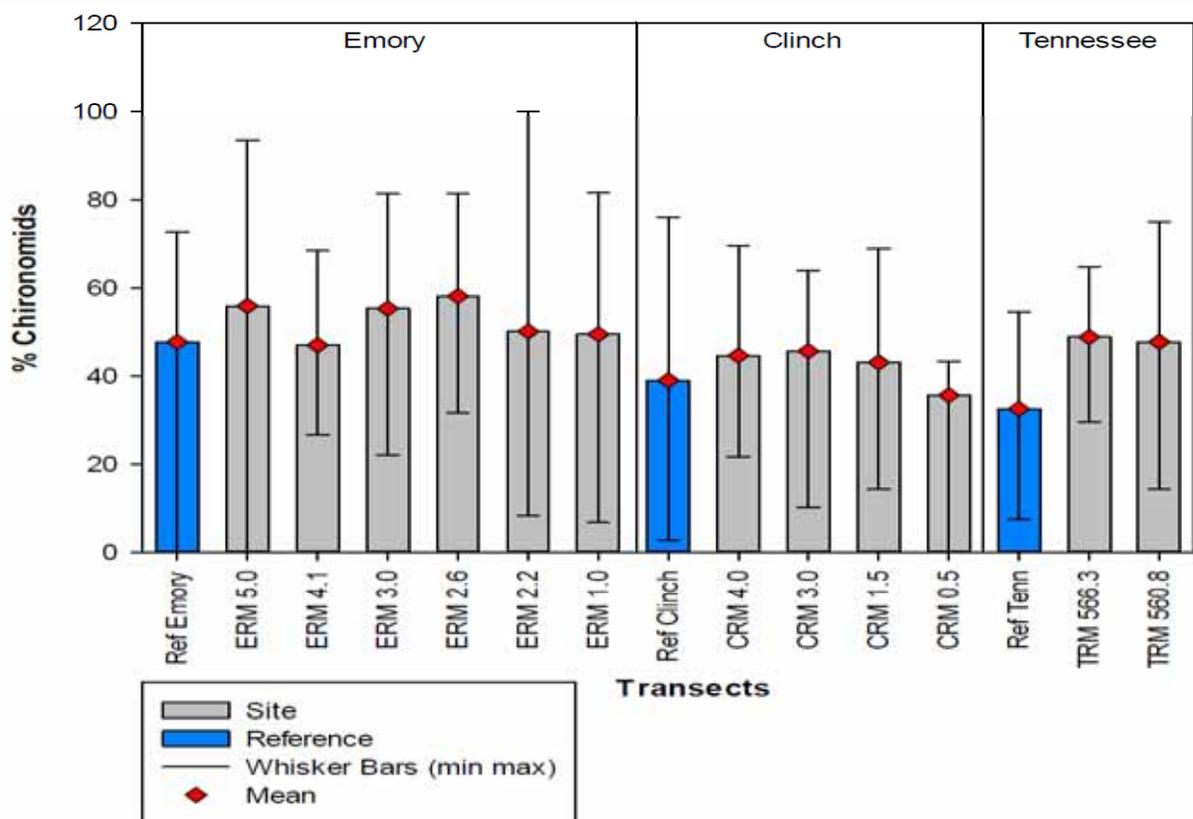
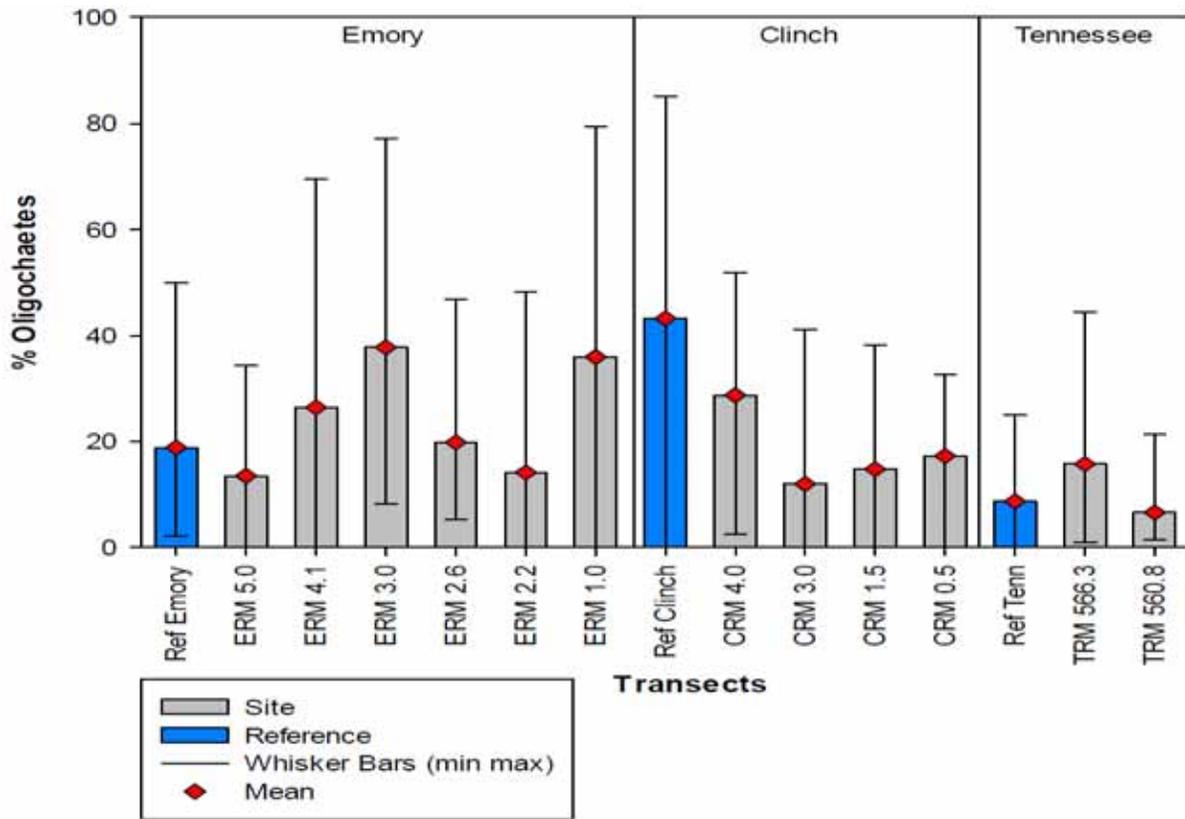
Notes:
 EPT= Ephemeroptera, Plecoptera, and Trichoptera; % = Percent; Ref = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile





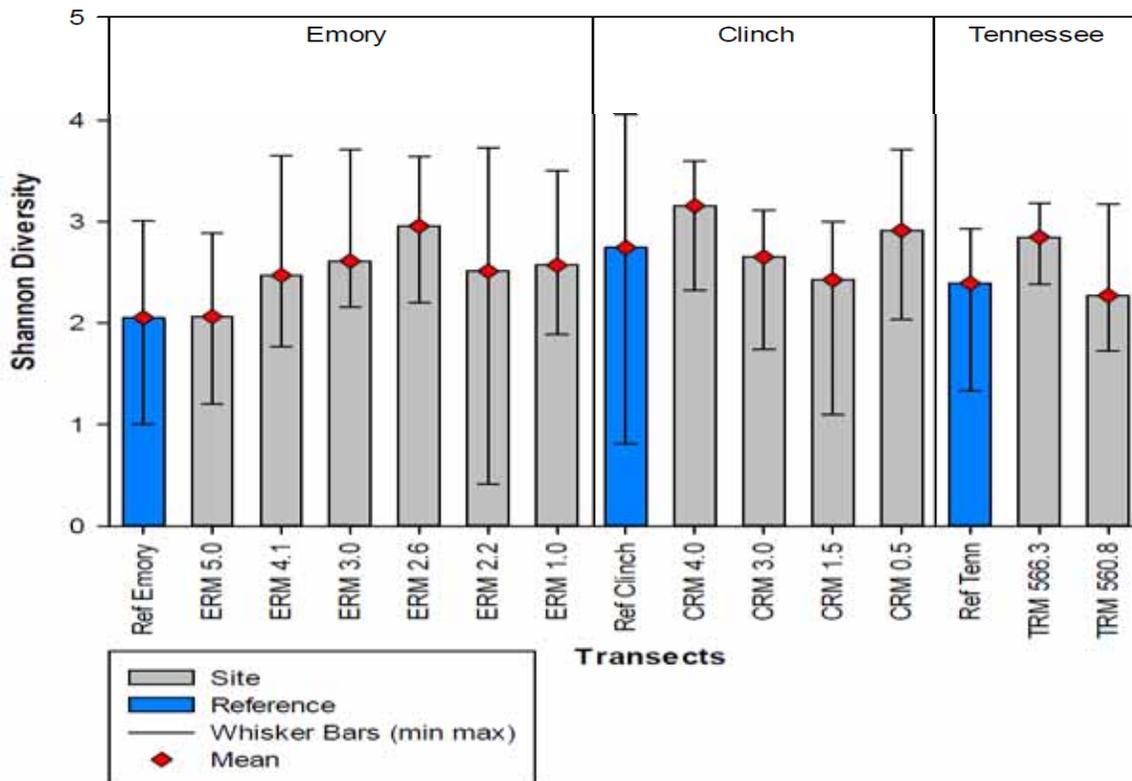
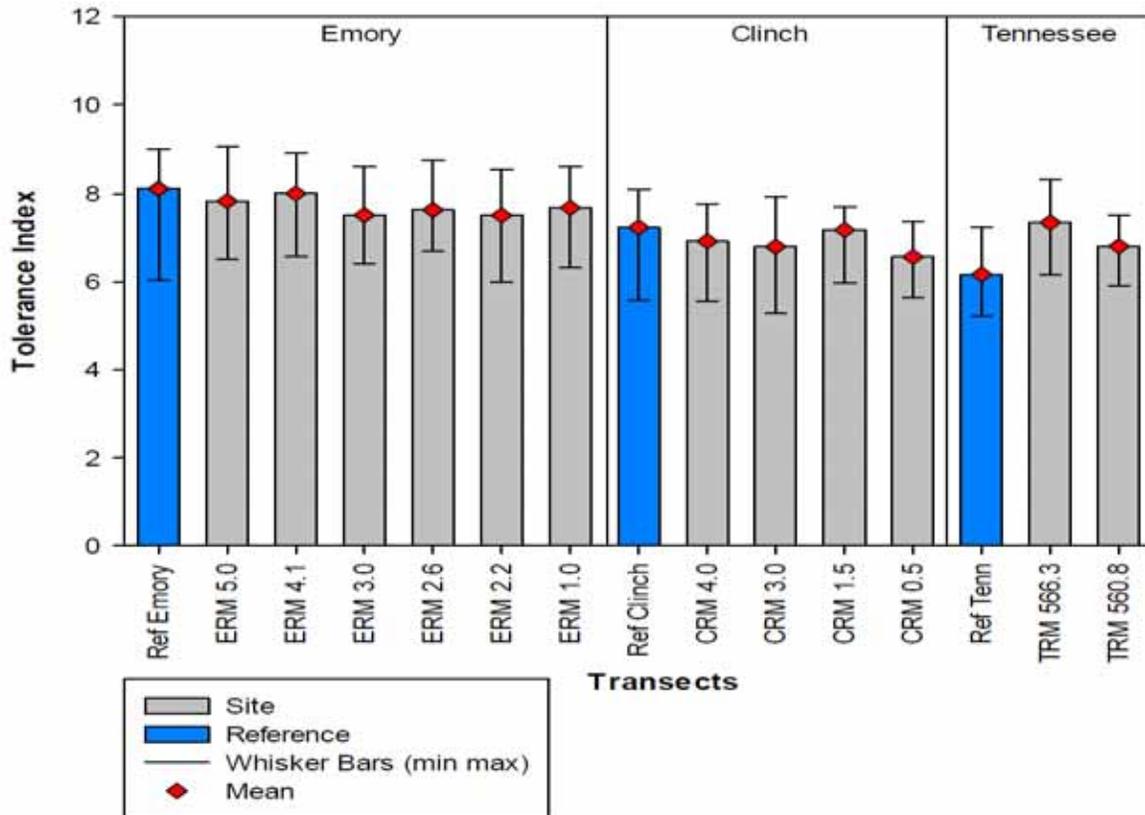
Notes:
 Oligo = Oligochaete; Chiro = Chironomid; No = Number; m² = Meter squared; Ref = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile





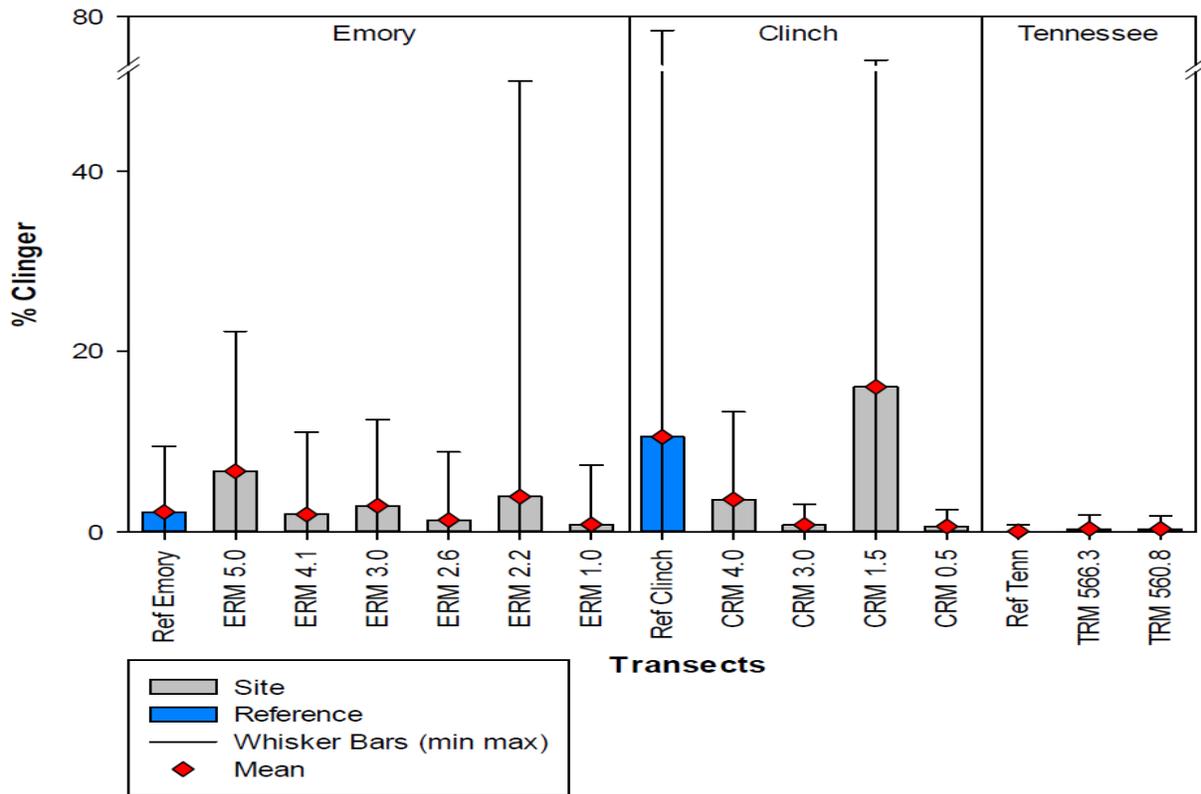
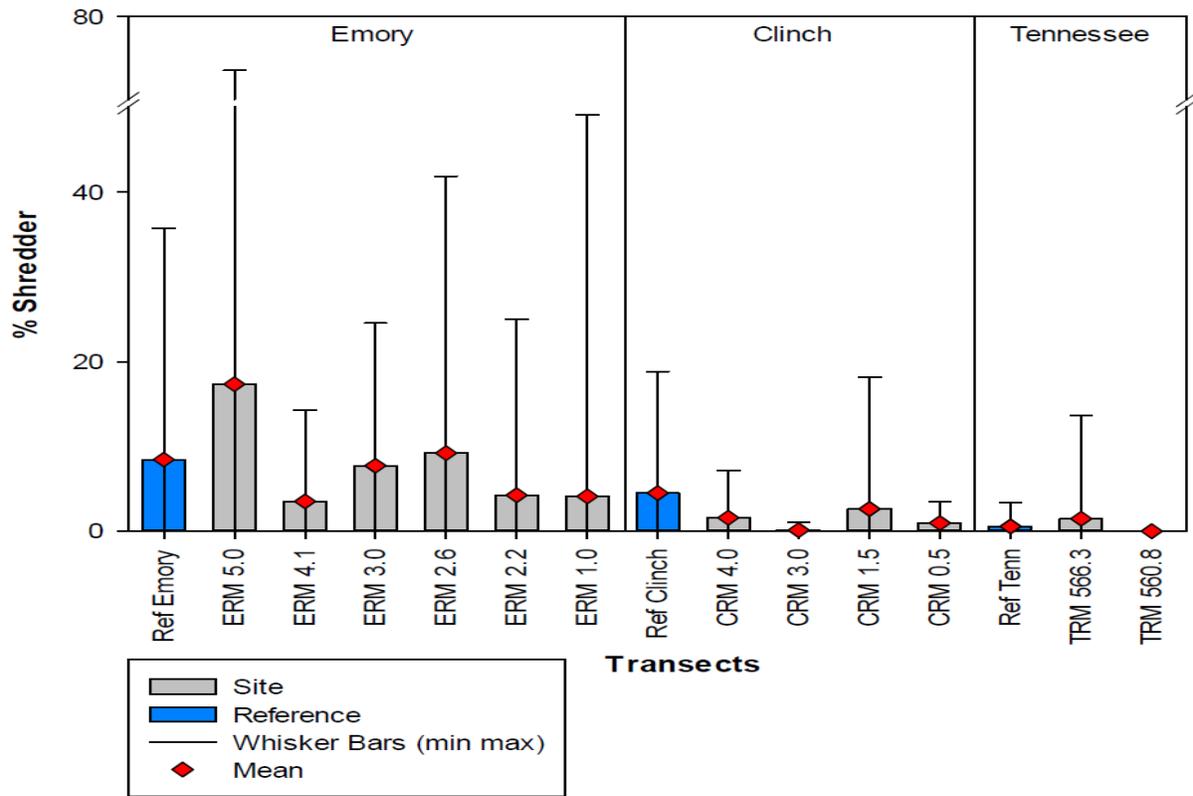
Notes:
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 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile





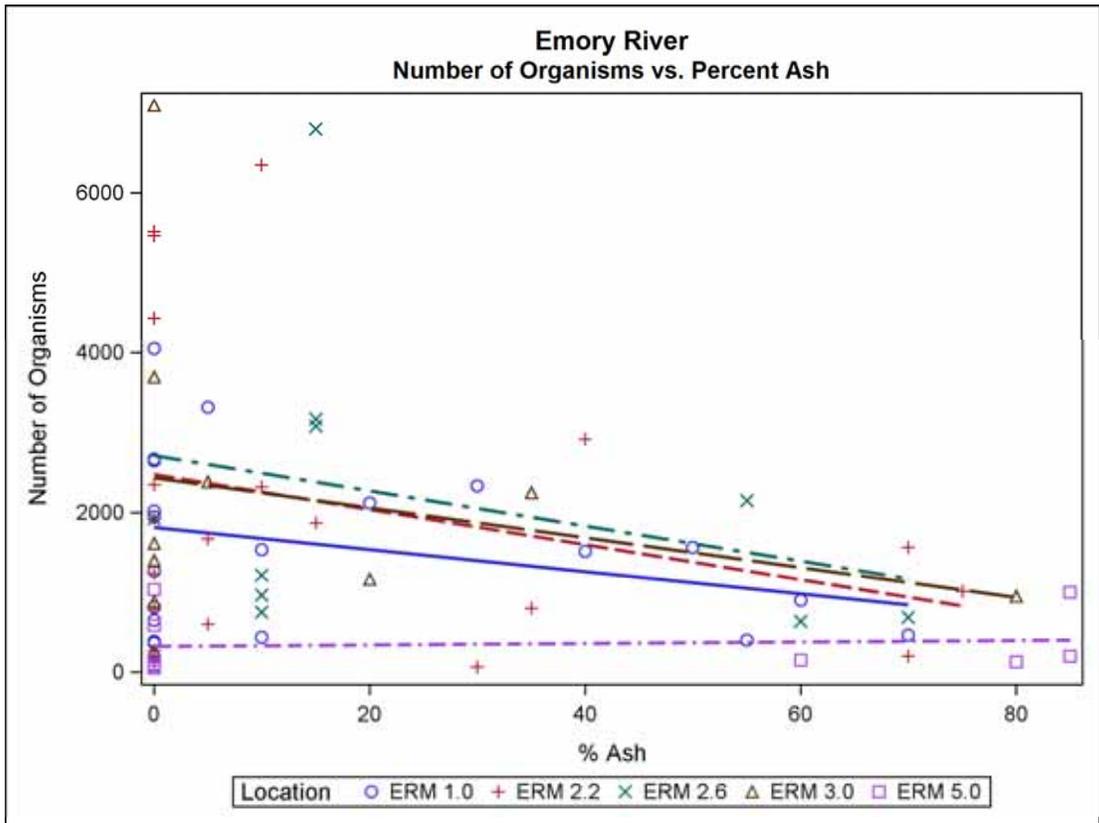
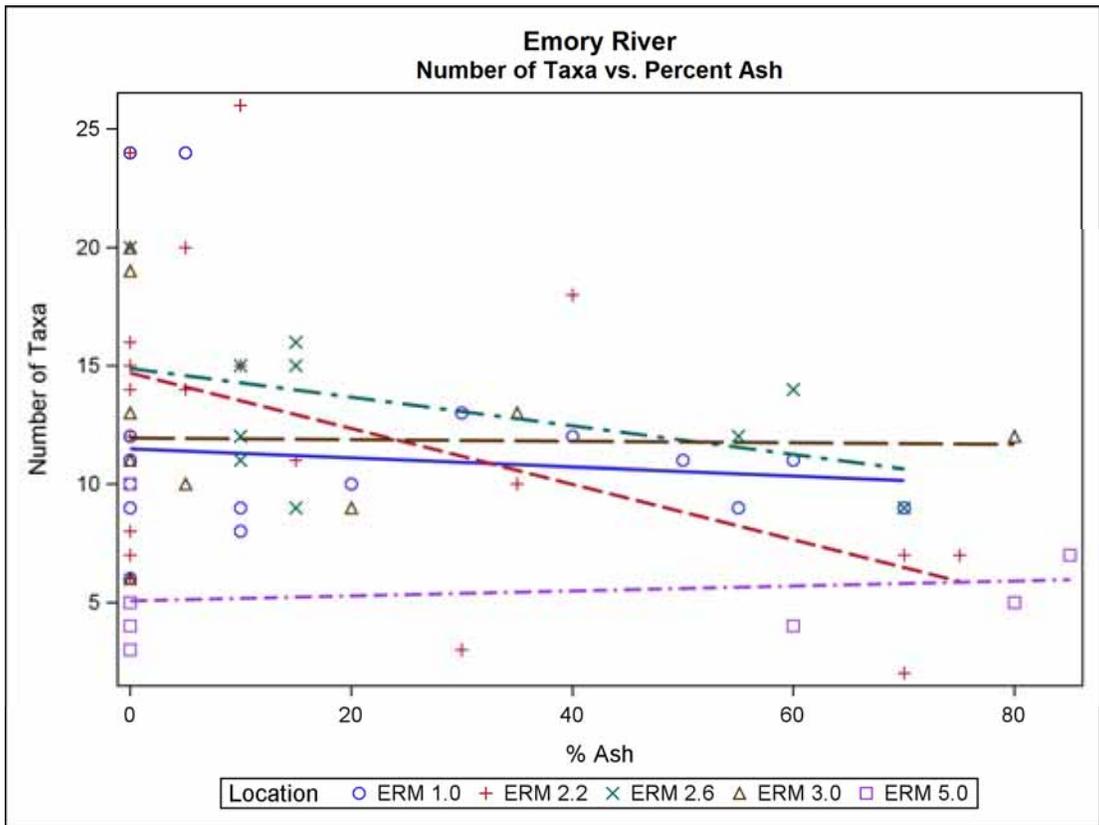
Notes:
 Ref = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile



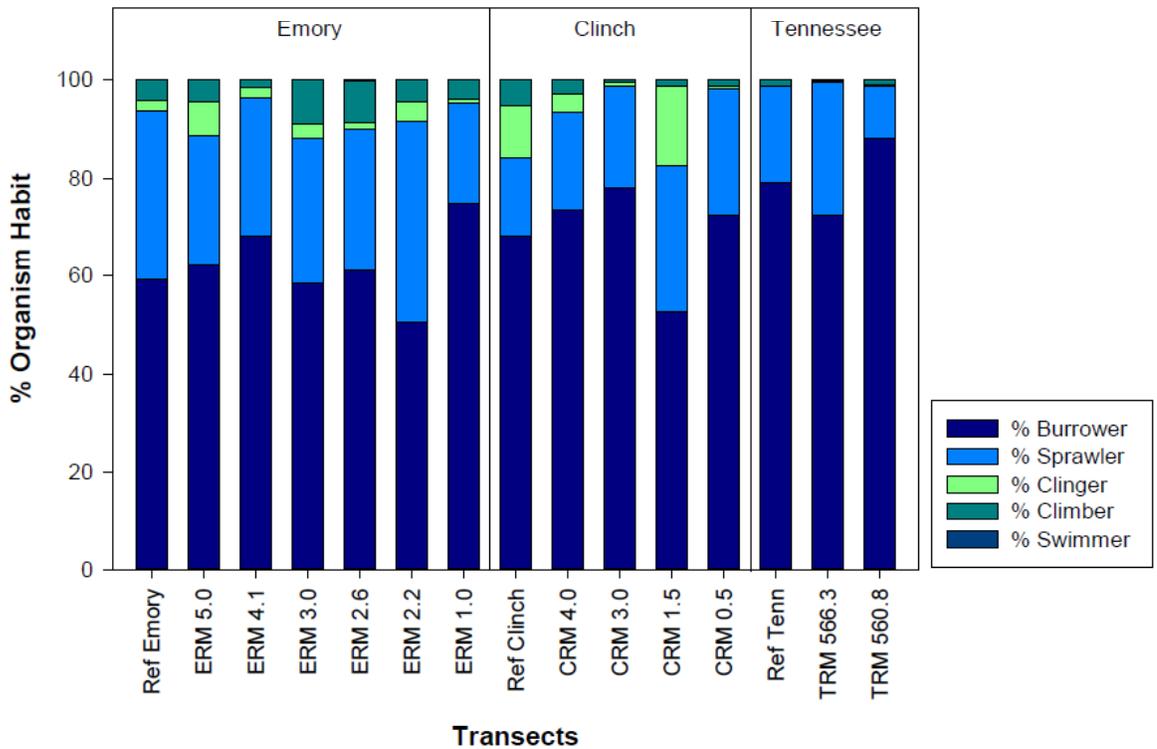
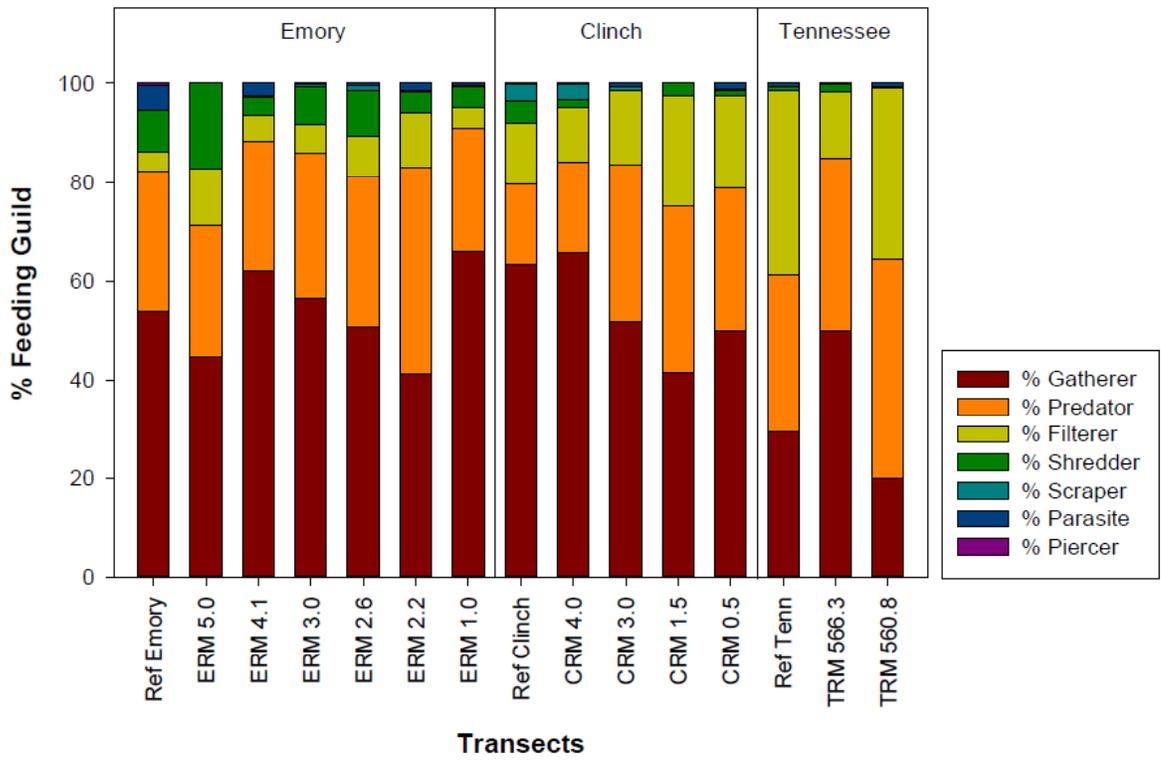


Notes:
 % = Percent; Ref = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile



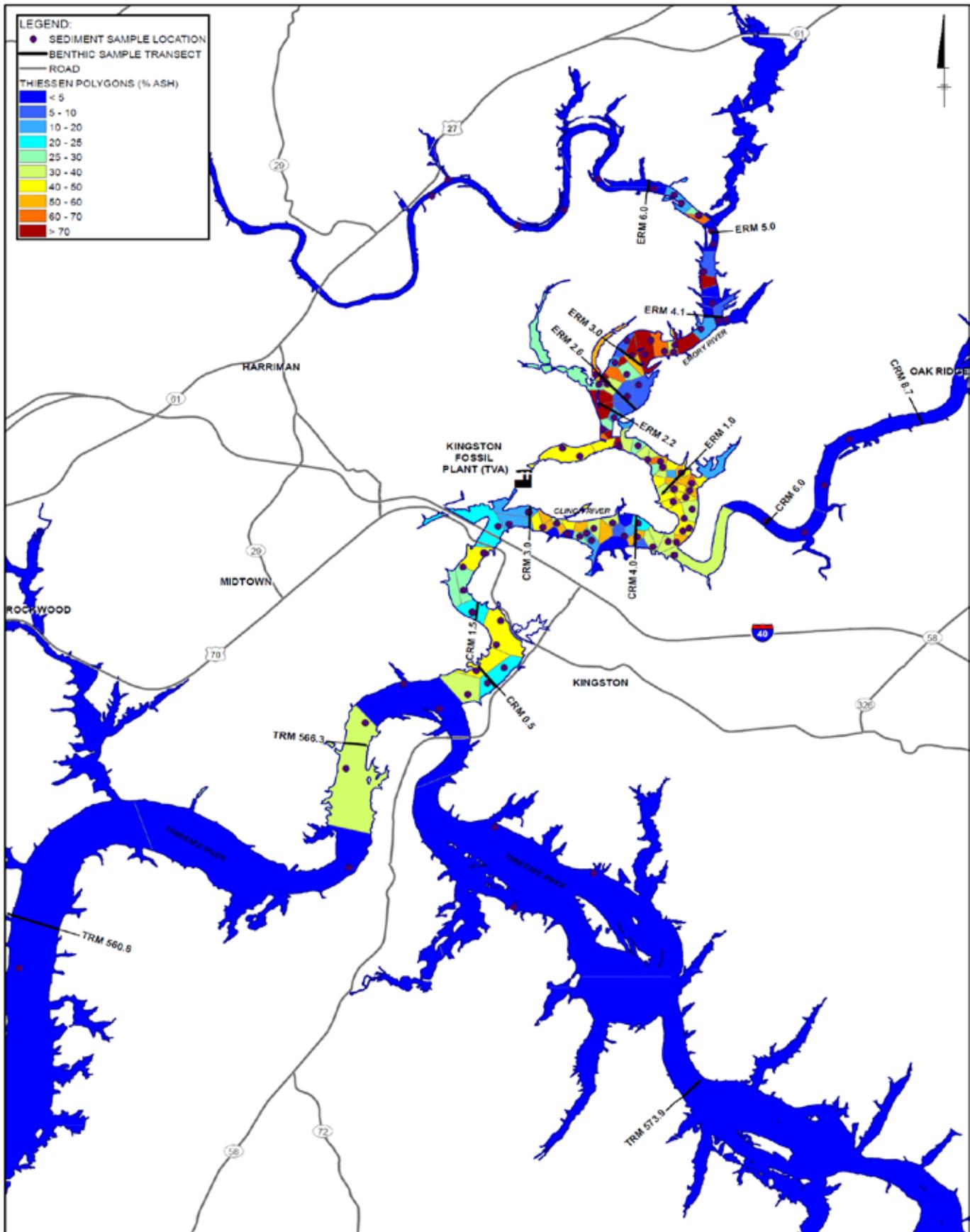


Notes:
ERM = Emory River Mile



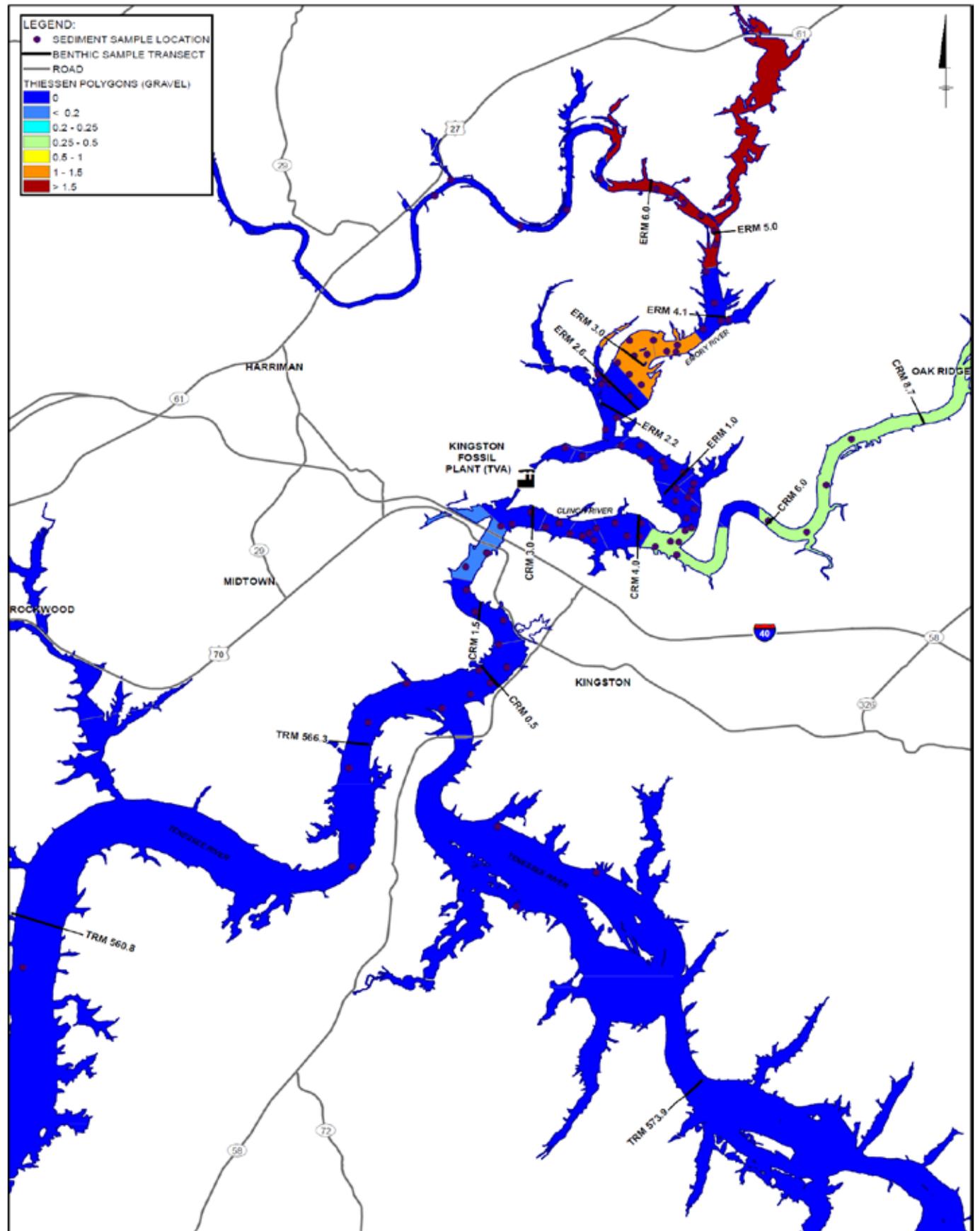
Notes:
 % = Percent; Ref = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile; TRM = Tennessee River Mile





Thienesen Polygons for Percent Ash Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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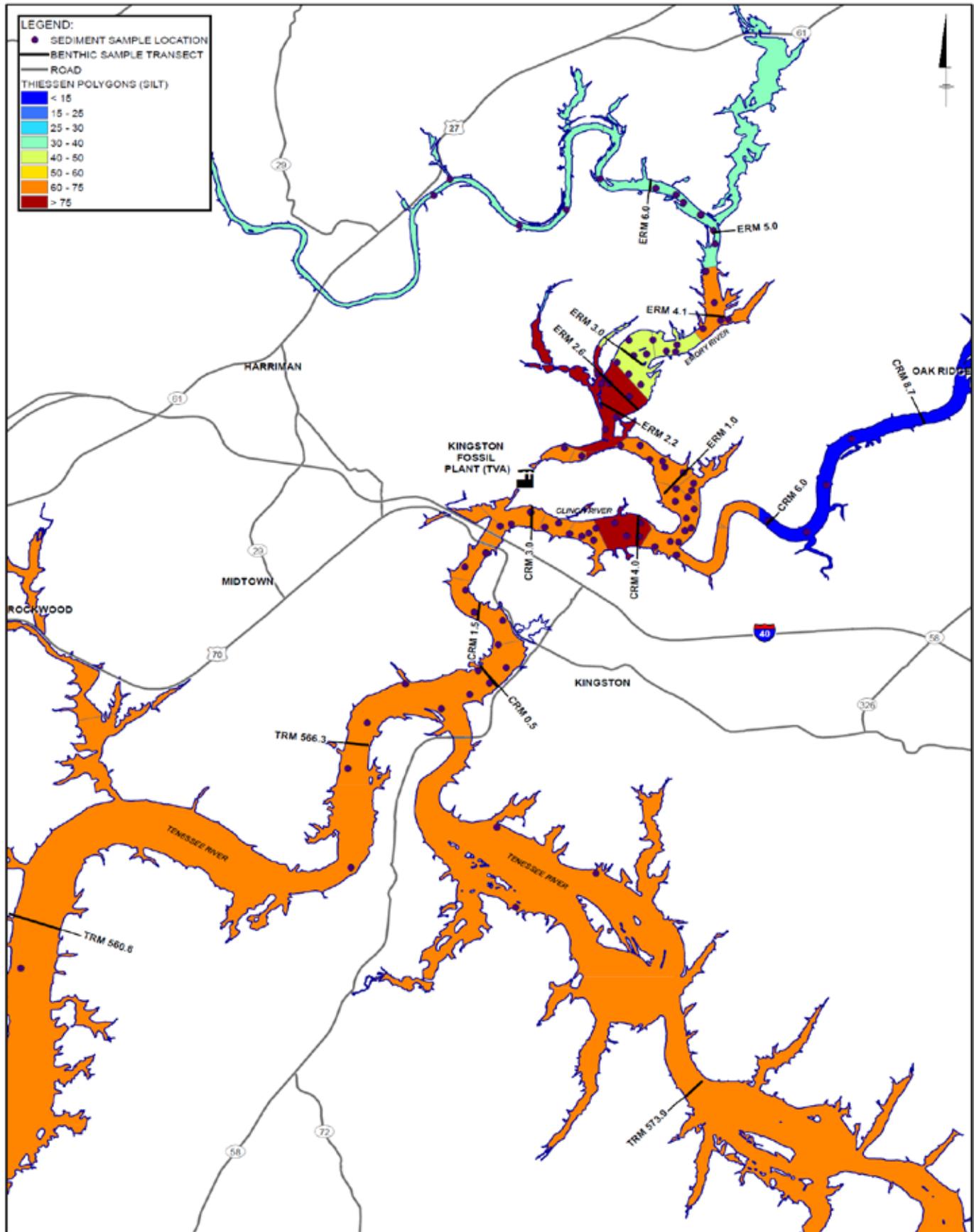
FIGURE
 4-25



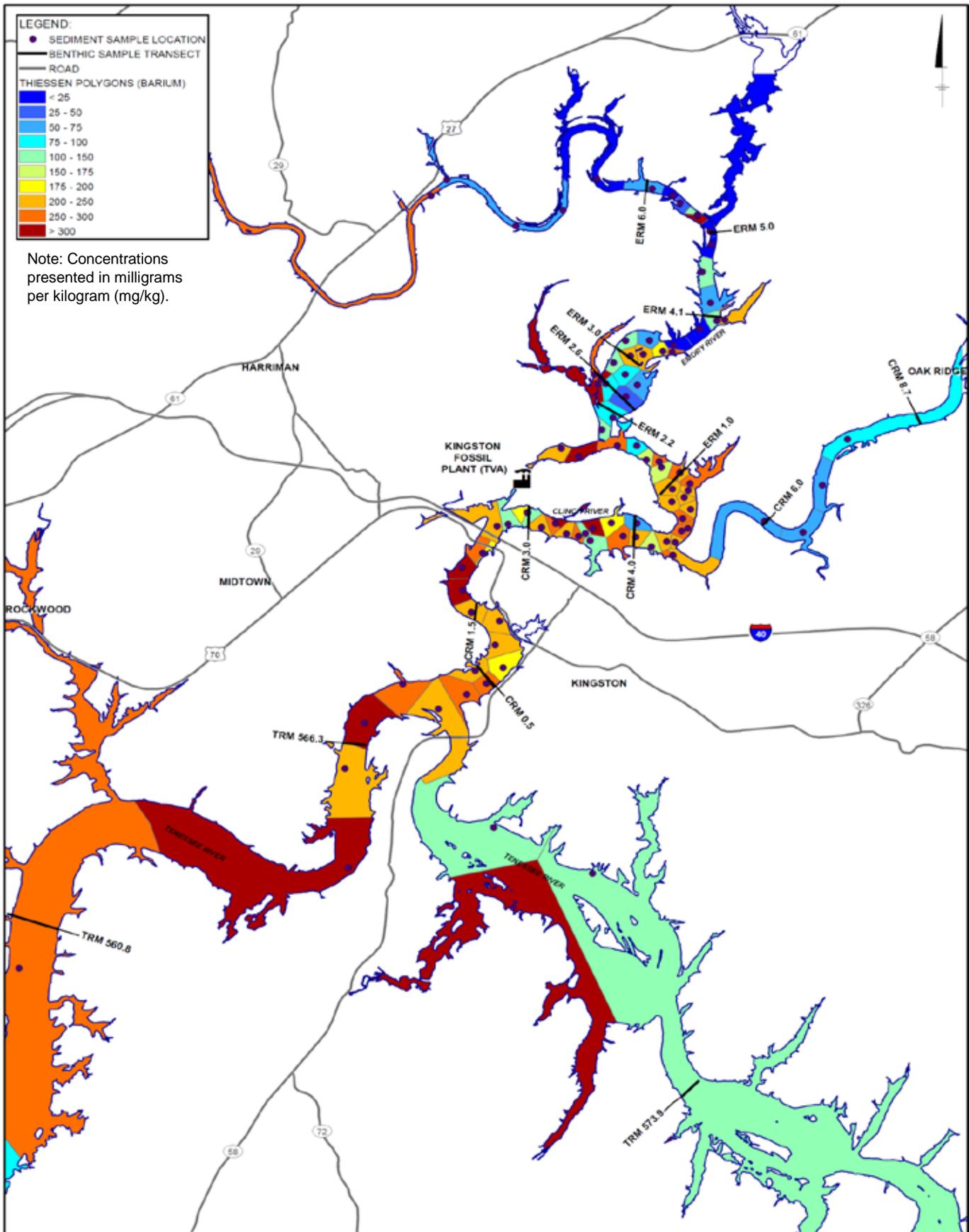
Thienesen Polygons for Gravel Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

FIGURE
 4-26

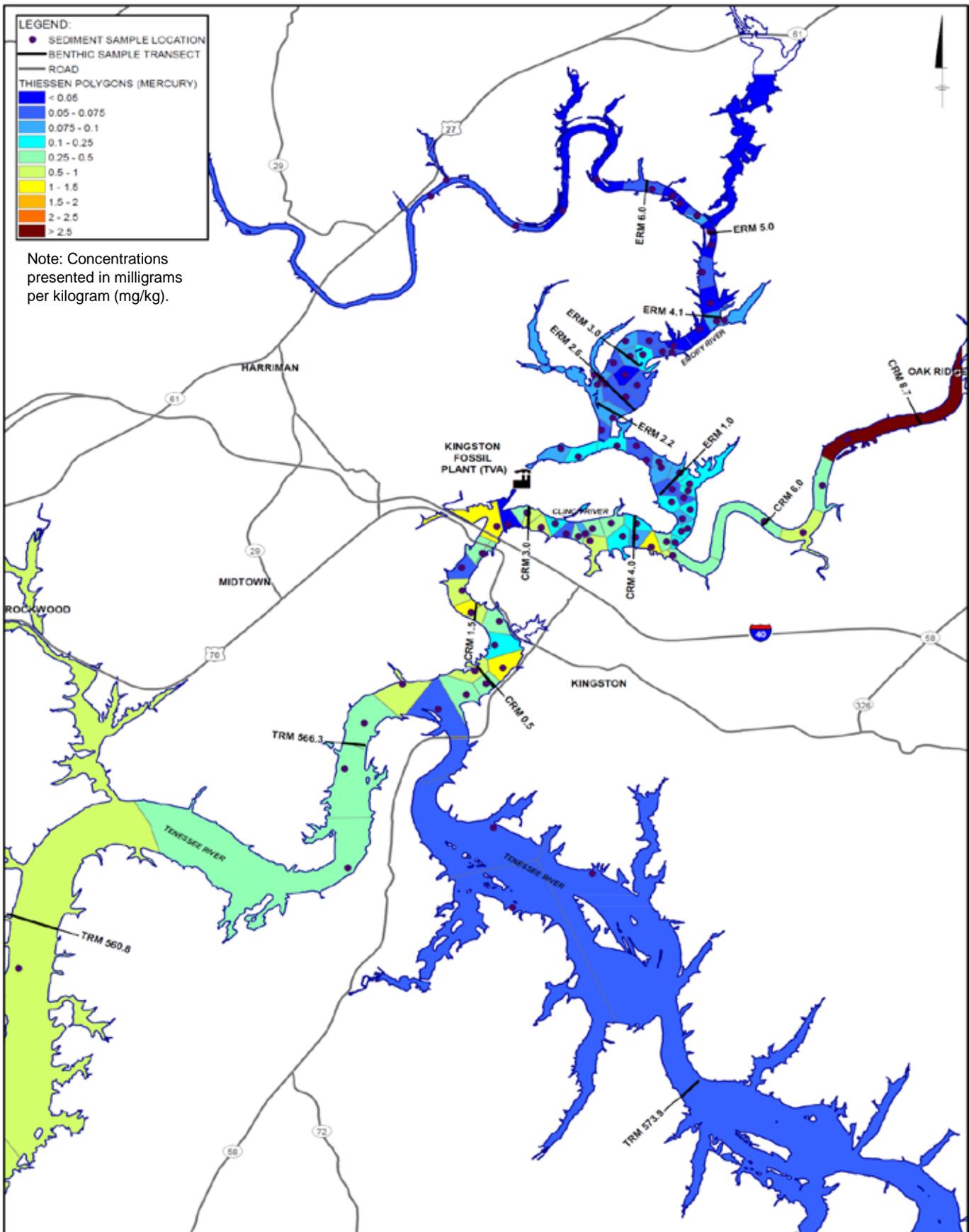




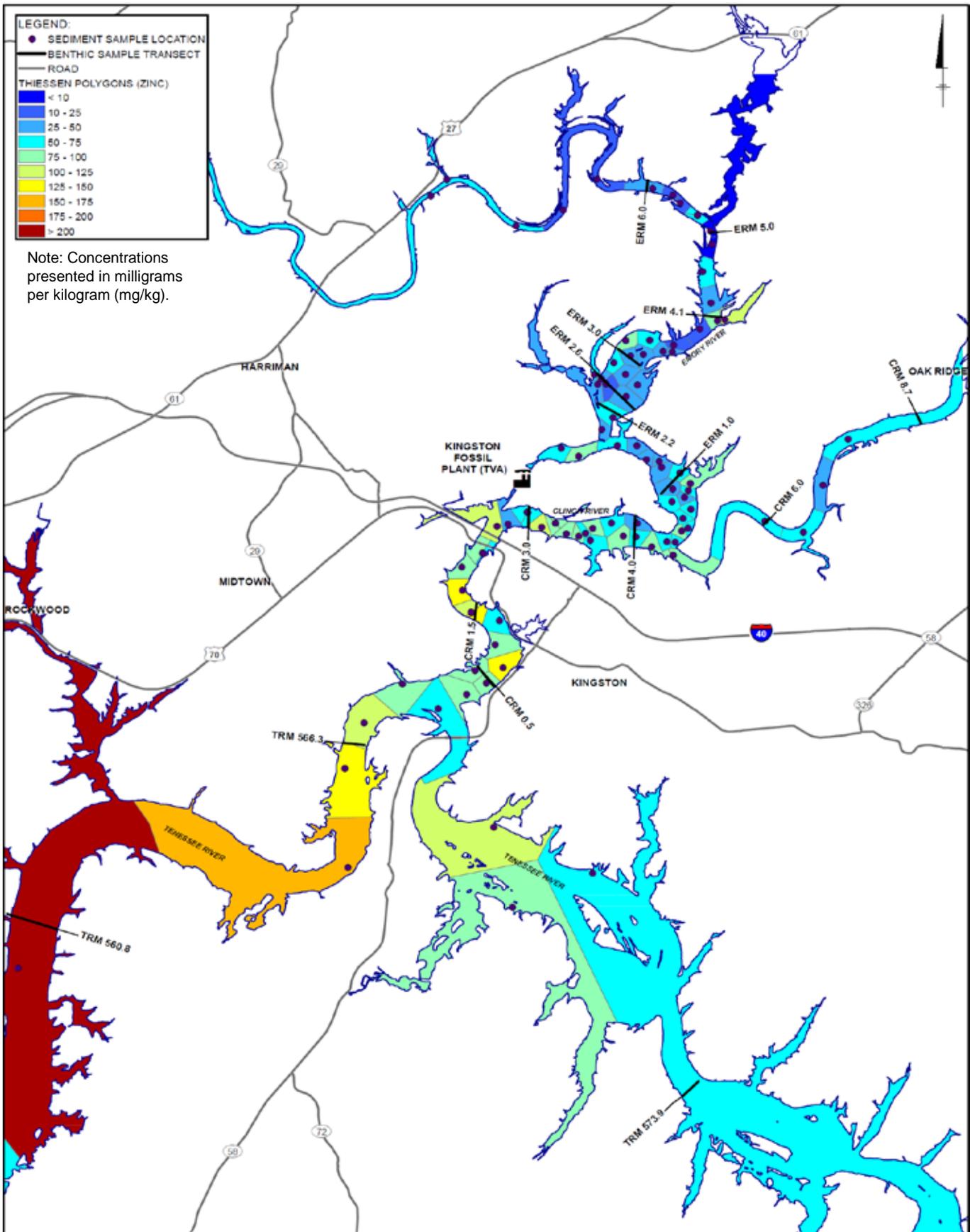
Thienesen Polygons for Silt Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



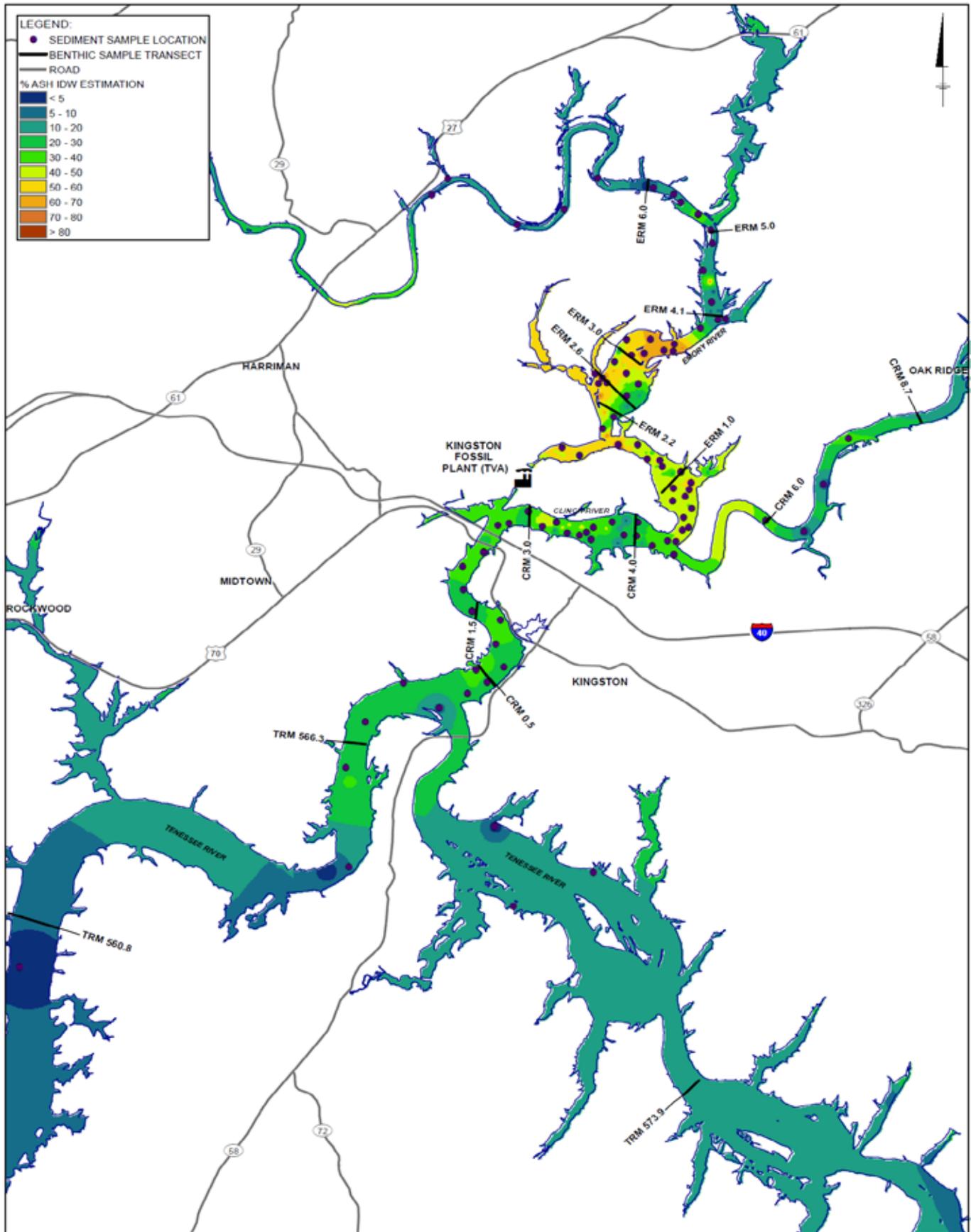
Thienesen Polygons for Barium Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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Thienesen Polygons for Mercury Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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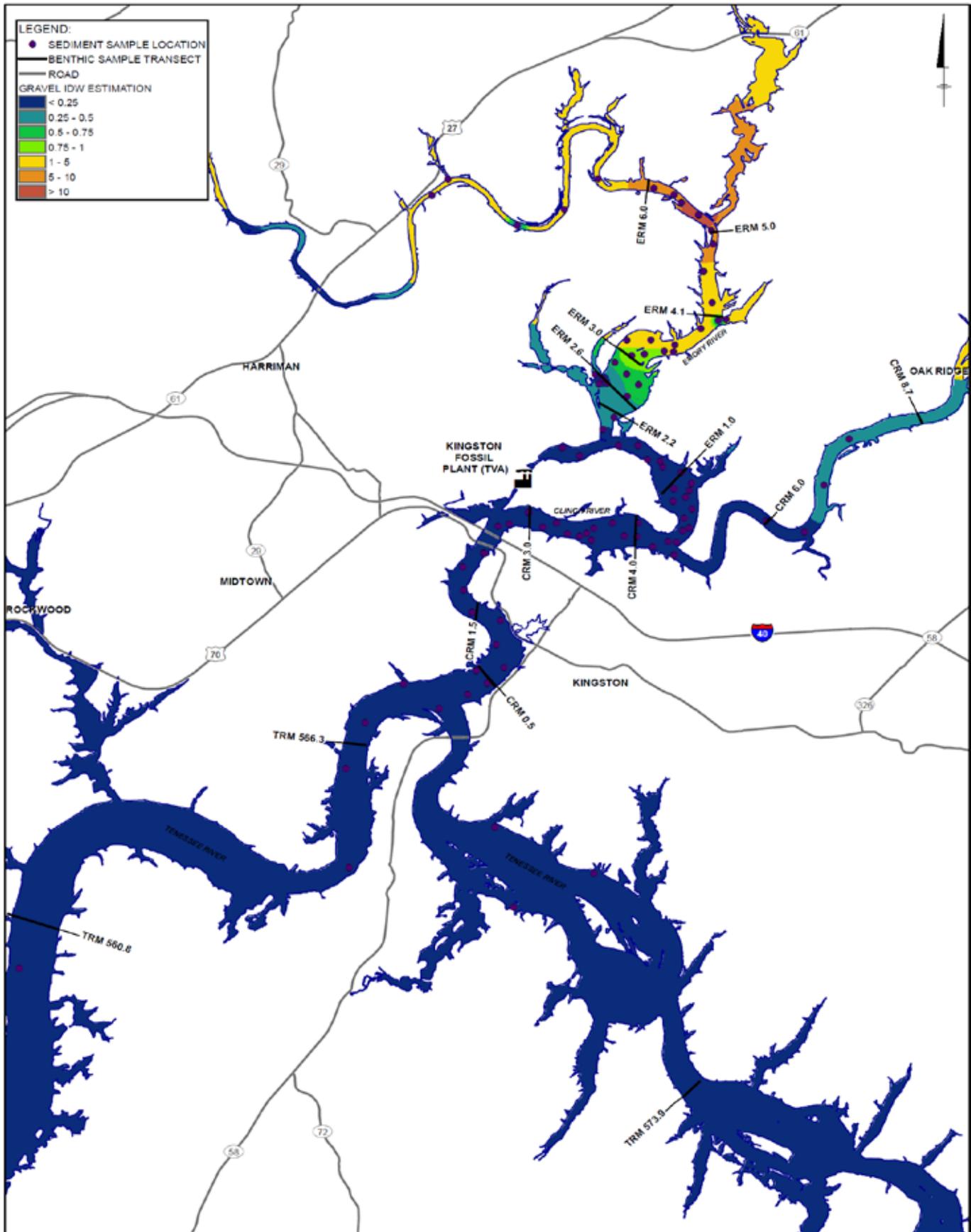


Thienesen Polygons for Zinc Concentrations in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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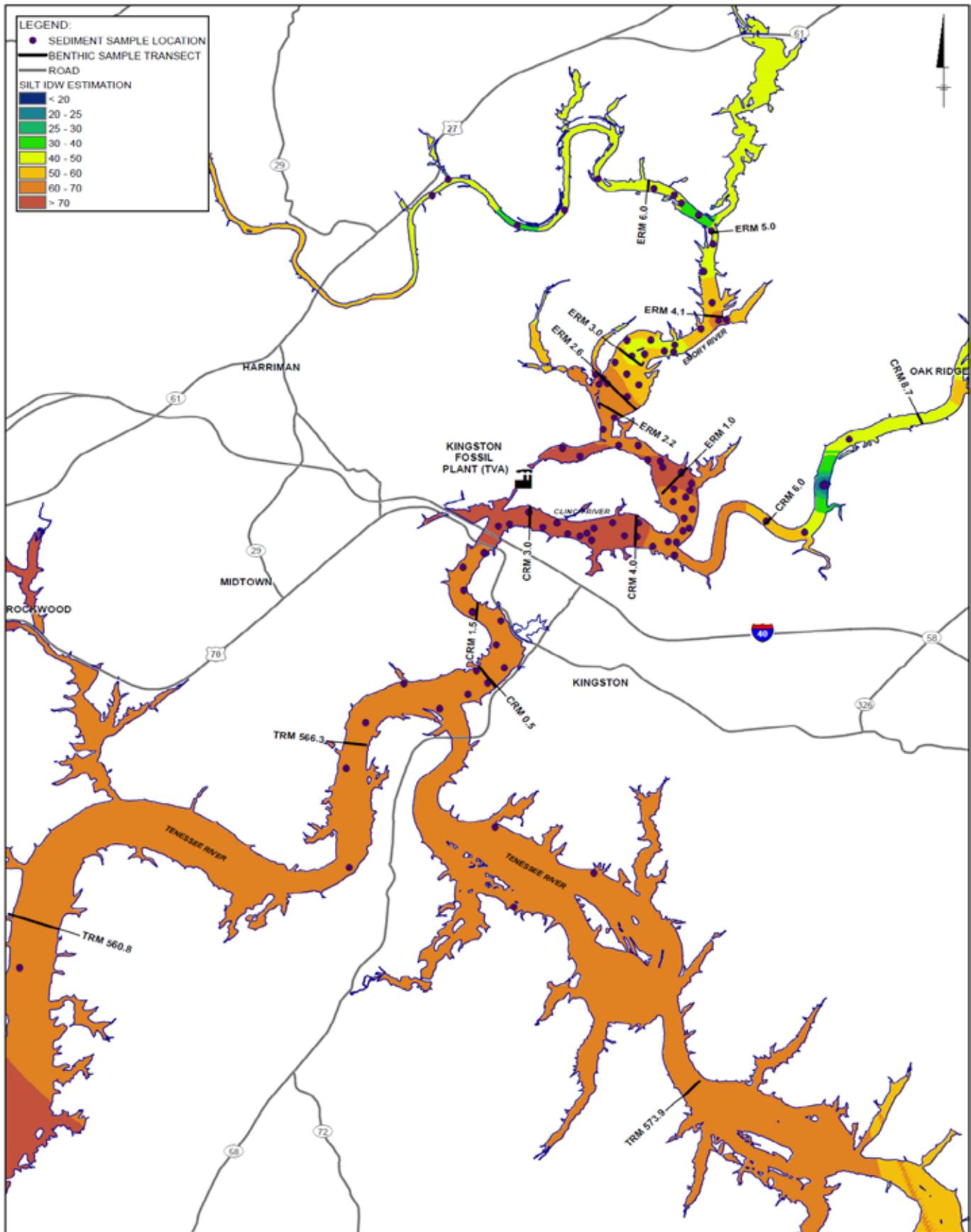


Inverse Distance Weighting Estimation for Percent Ash in Sediments
 Baseline Ecological Risk Assessment
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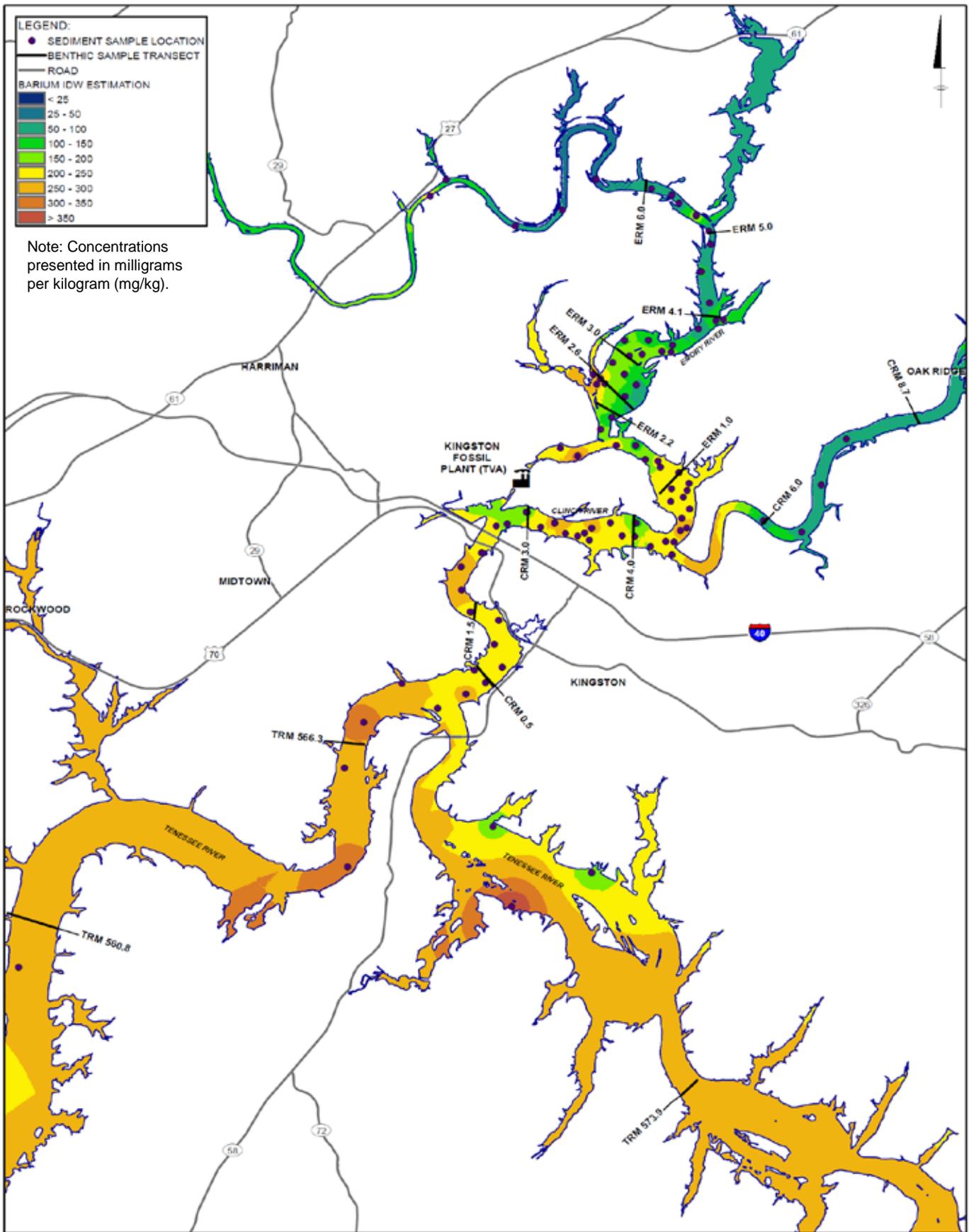
FIGURE
 4-31



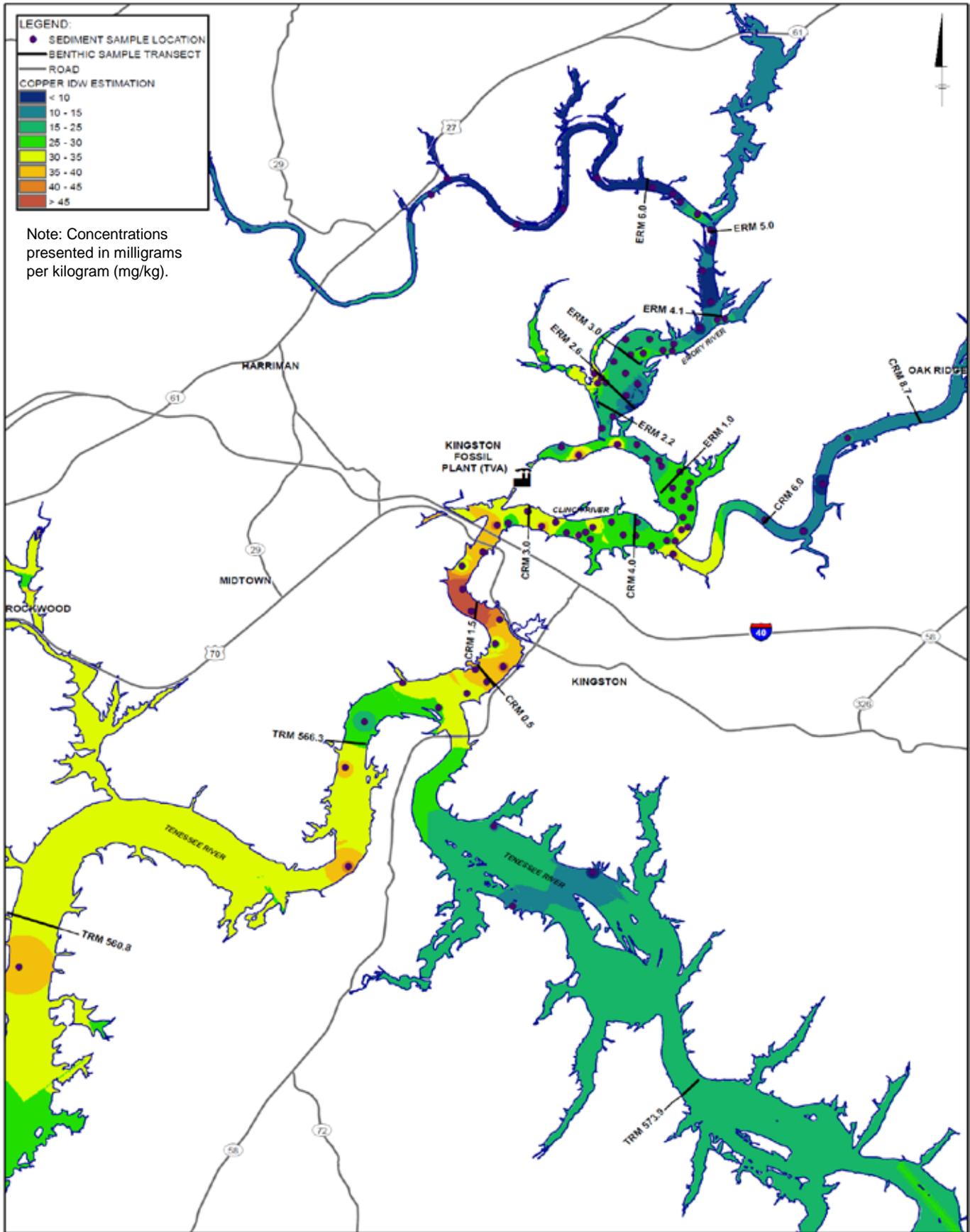
Inverse Distance Weighting Estimation for Gravel in Sediments
 Baseline Ecological Risk Assessment
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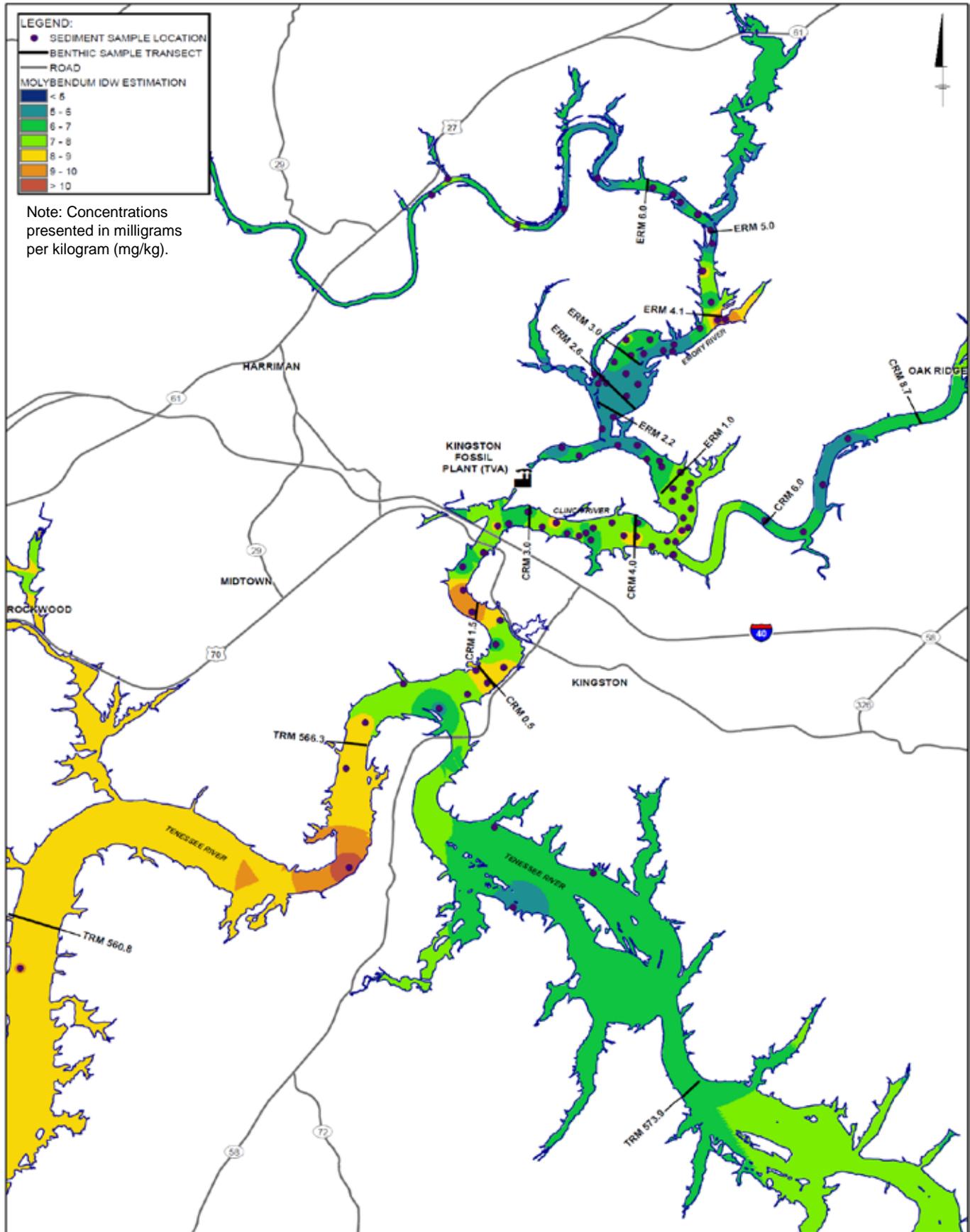
Inverse Distance Weighting Estimation for Silt in Sediments
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Inverse Distance Weighting Estimation for Barium in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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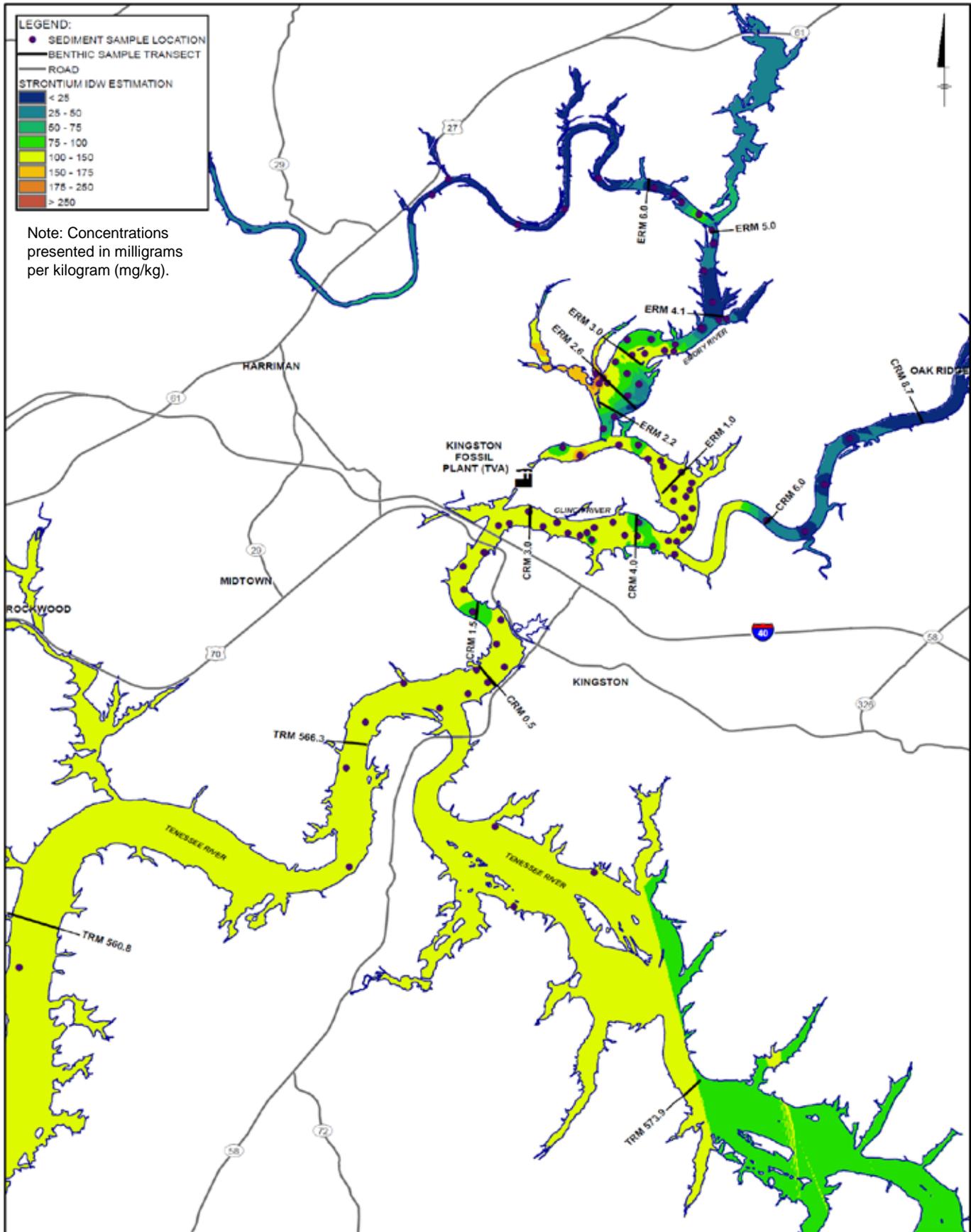


Inverse Distance Weighting Estimation for Copper in Sediments
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
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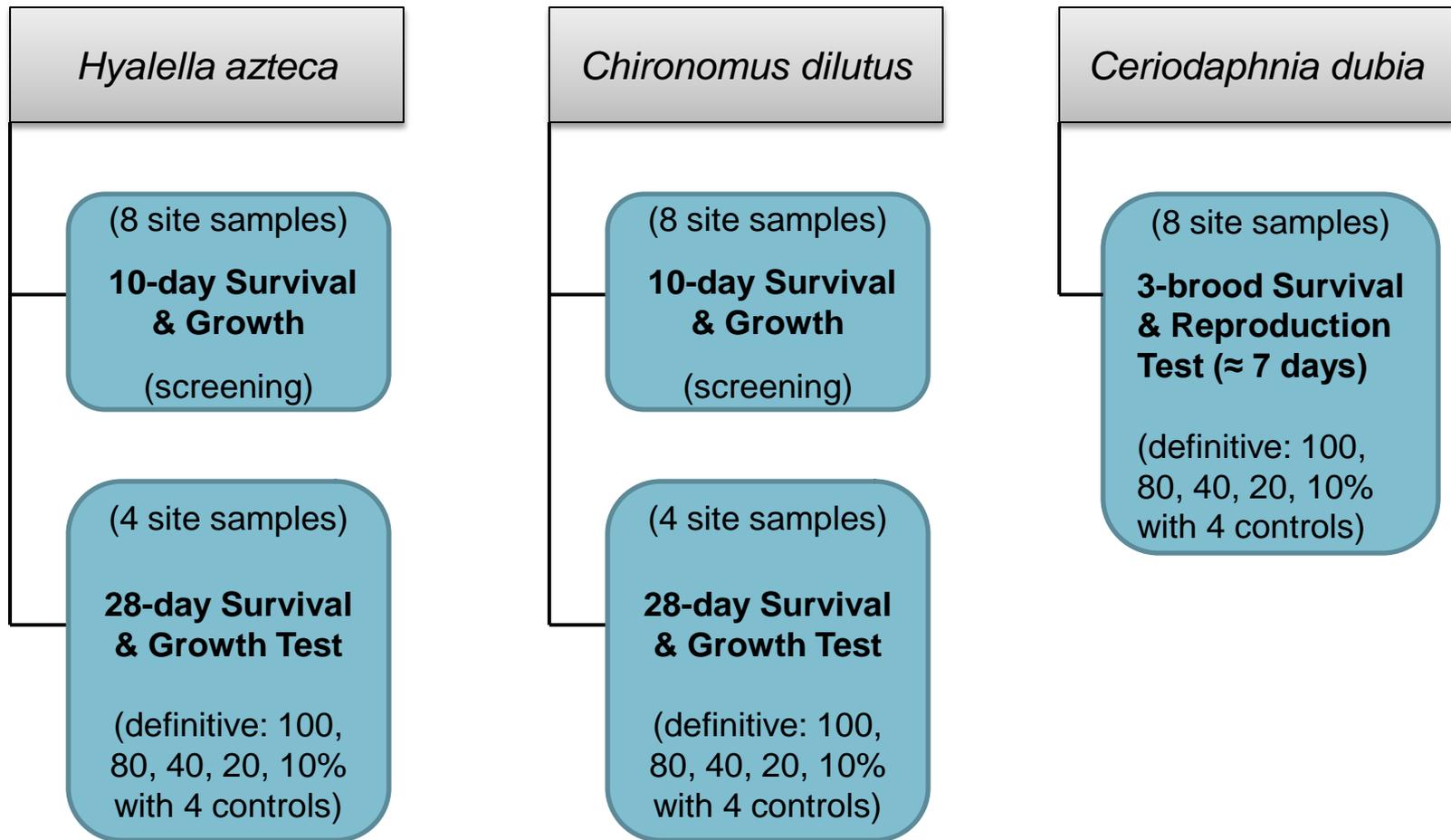


Inverse Distance Weighting Estimation for Molybdenum in Sediments
 Baseline Ecological Risk Assessment
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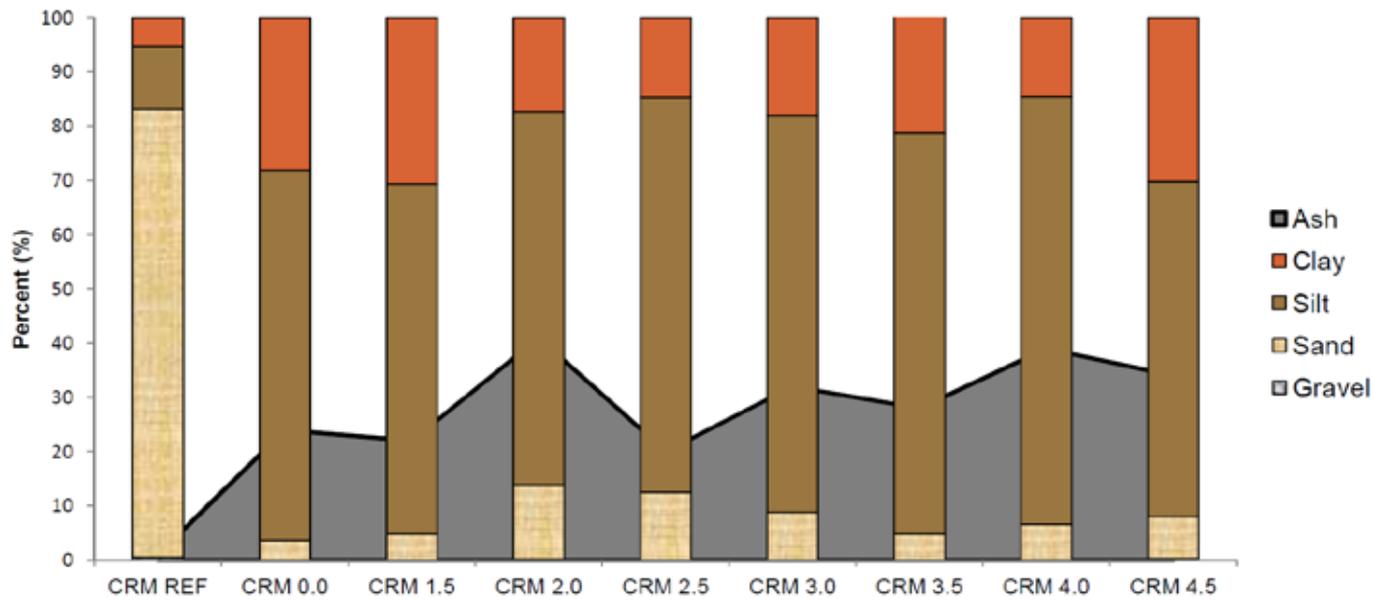
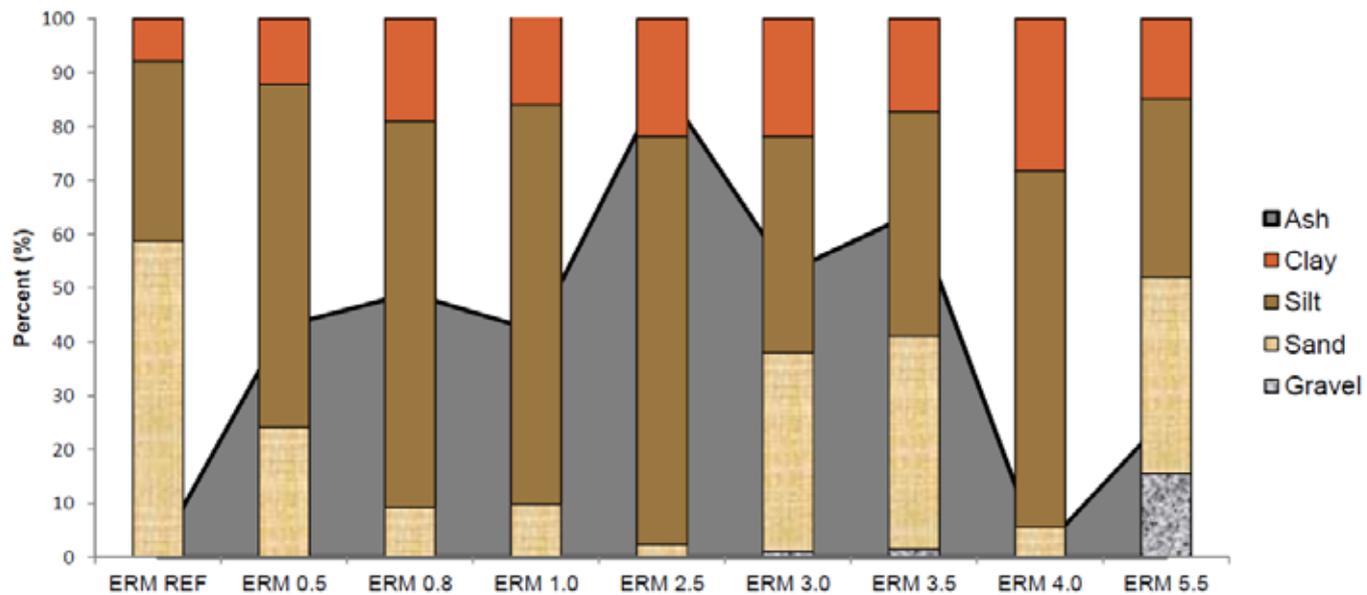
FIGURE
 4-36



Inverse Distance Weighting Estimation for Strontium in Sediments
 Baseline Ecological Risk Assessment
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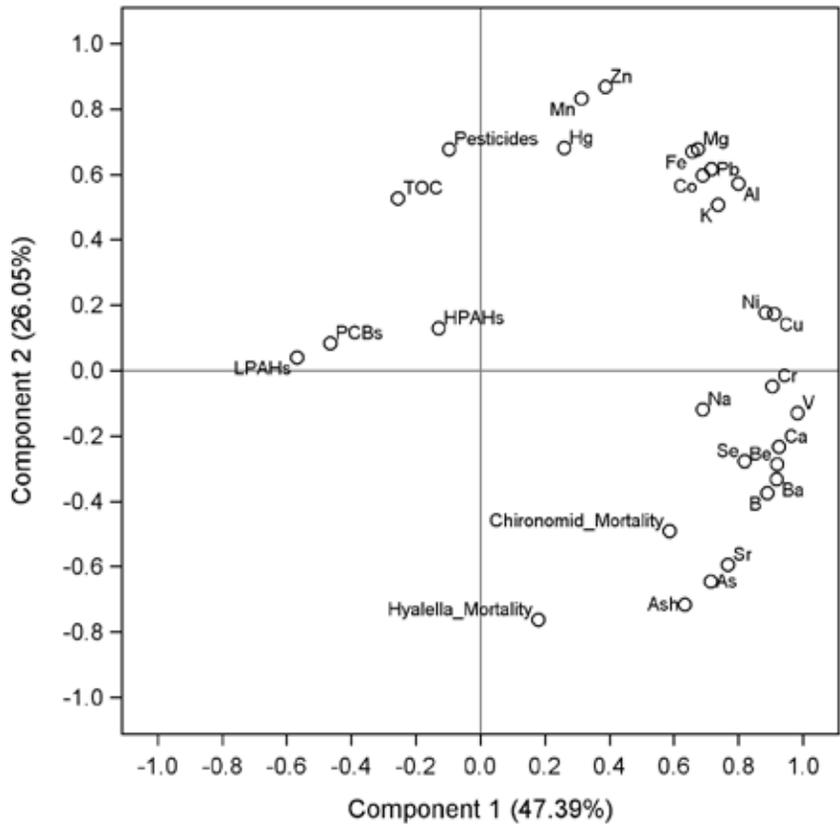
Source: Sherrard, R. 2010. TVA Fly Ash Release Environment Research Symposium. Harriman, TN. August 2-3.



Notes:
 % = Percent; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

Composition of Sediment Used in Emory (Top) and Clinch (Bottom) River Toxicity Tests
 Baseline Ecological Risk Assessment
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Component Pattern

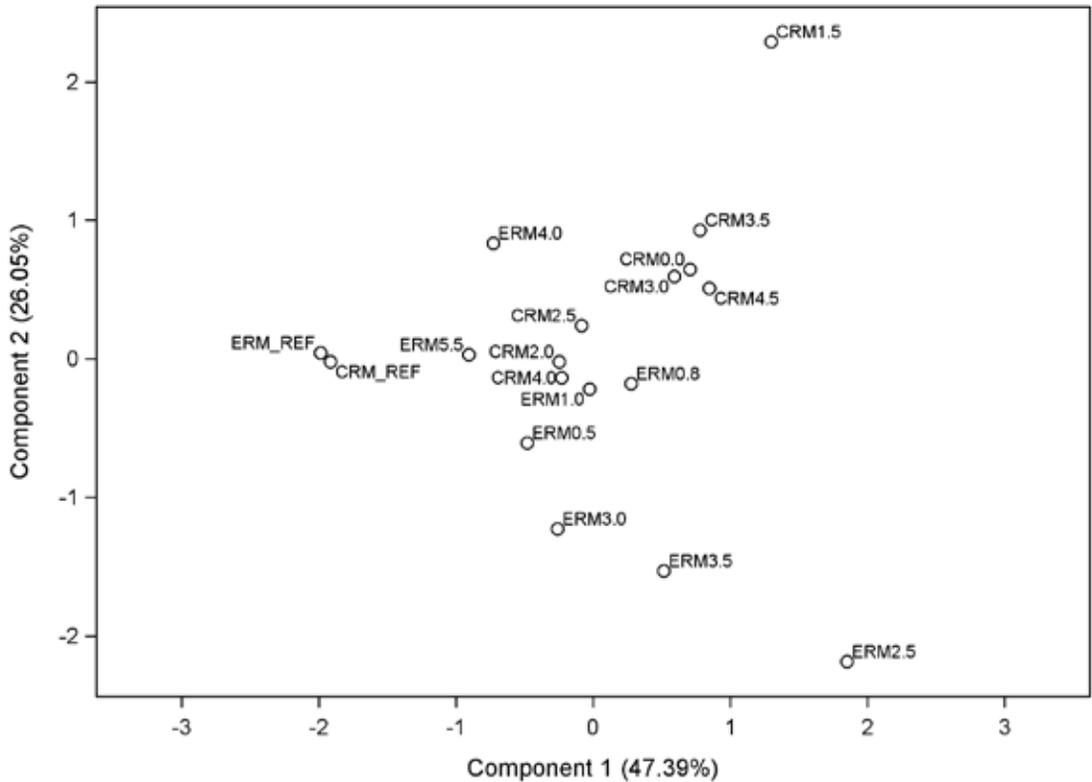


Notes: Principal component plots display laboratory test endpoints as raw percent mortality not normalized to reference.

Axis are the component percent of explained variability.

CRM = Clinch River Mile
ERM = Emory River Mile
REF = Reference

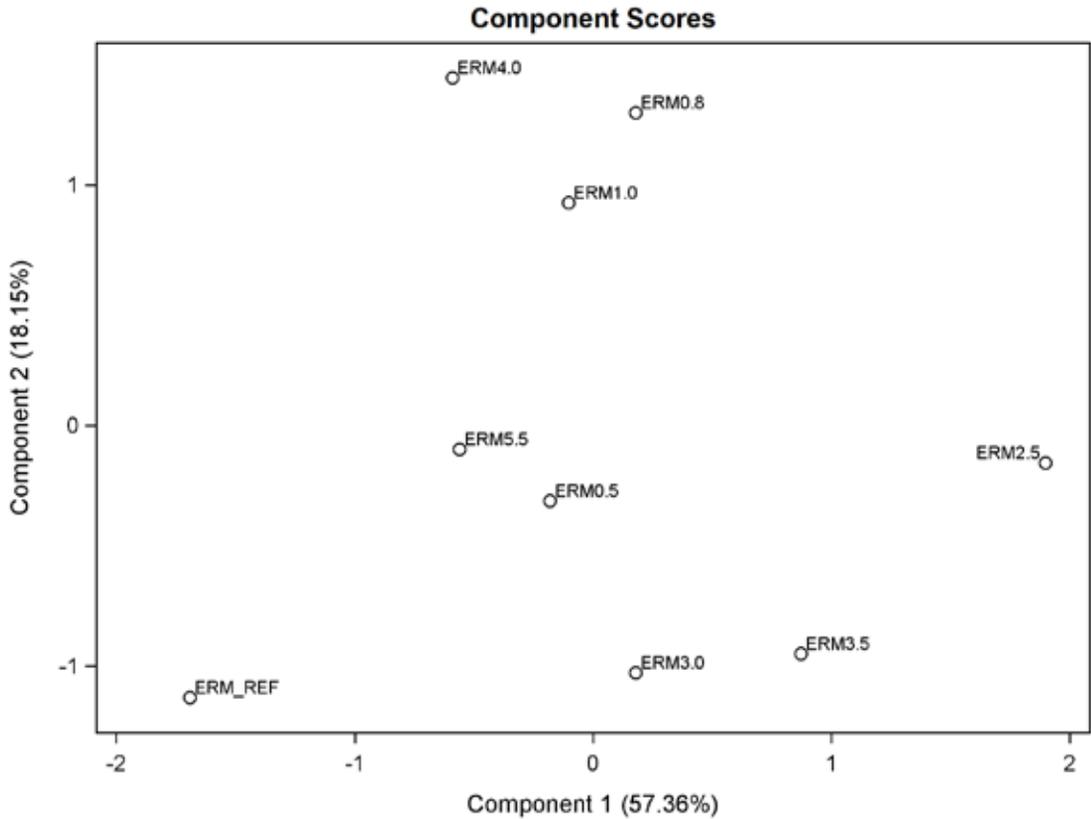
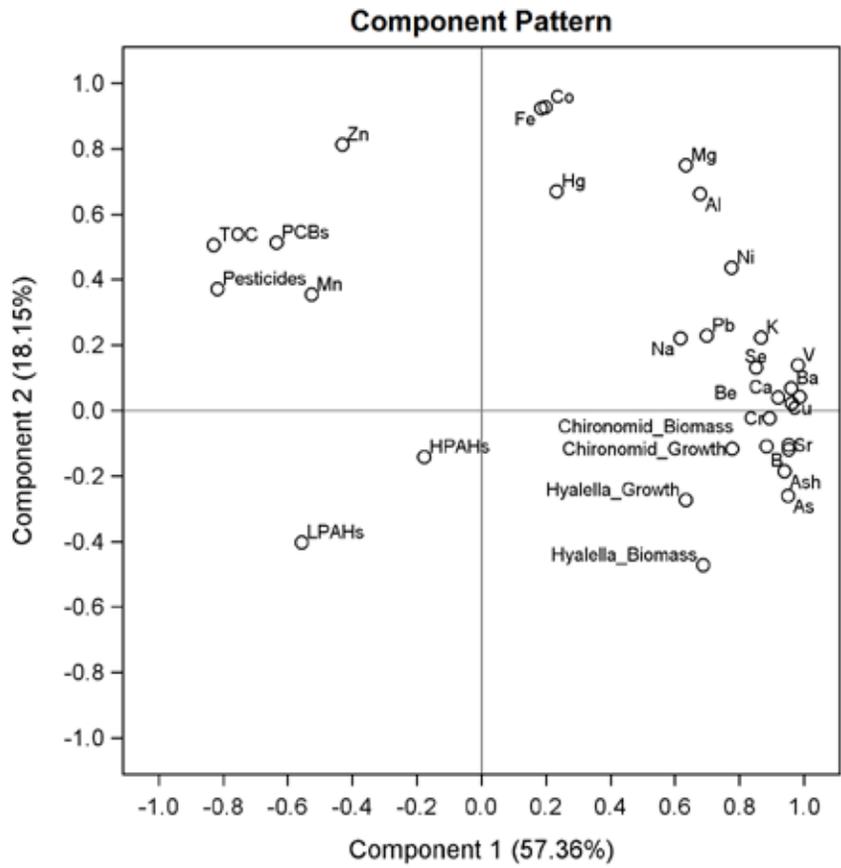
Component Scores



Notes: Principal component plots display laboratory test endpoints as percent reduction relative to the reference sample.

Axes are the component percent of explained variability.

CRM = Clinch River Mile
ERM = Emory River Mile
REF = Reference

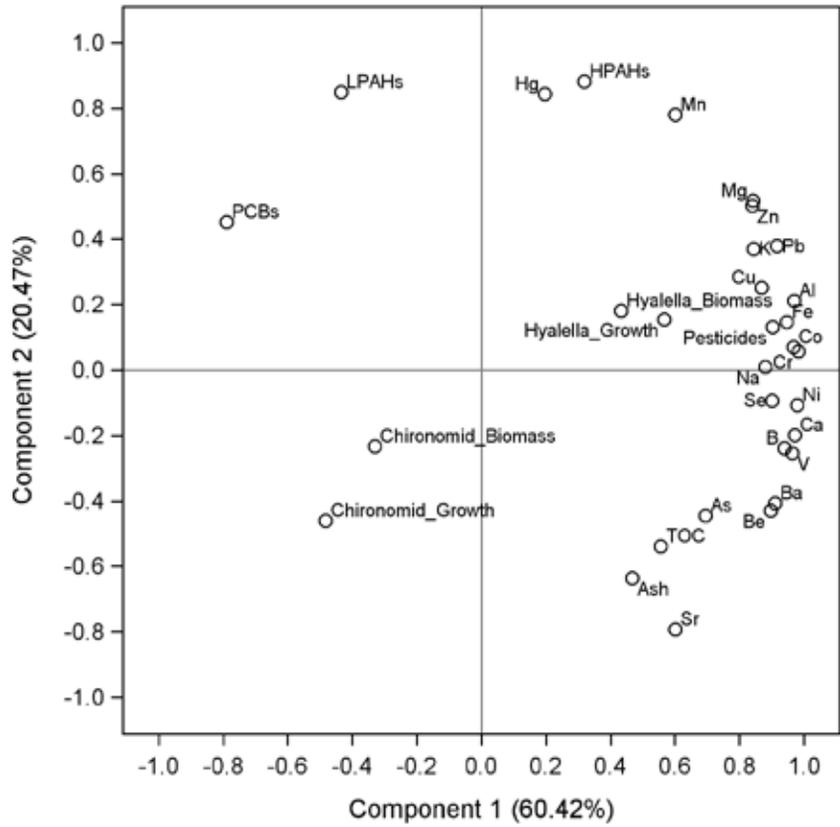


Notes: Principal component plots display laboratory test endpoints as percent reduction relative to the reference sample.

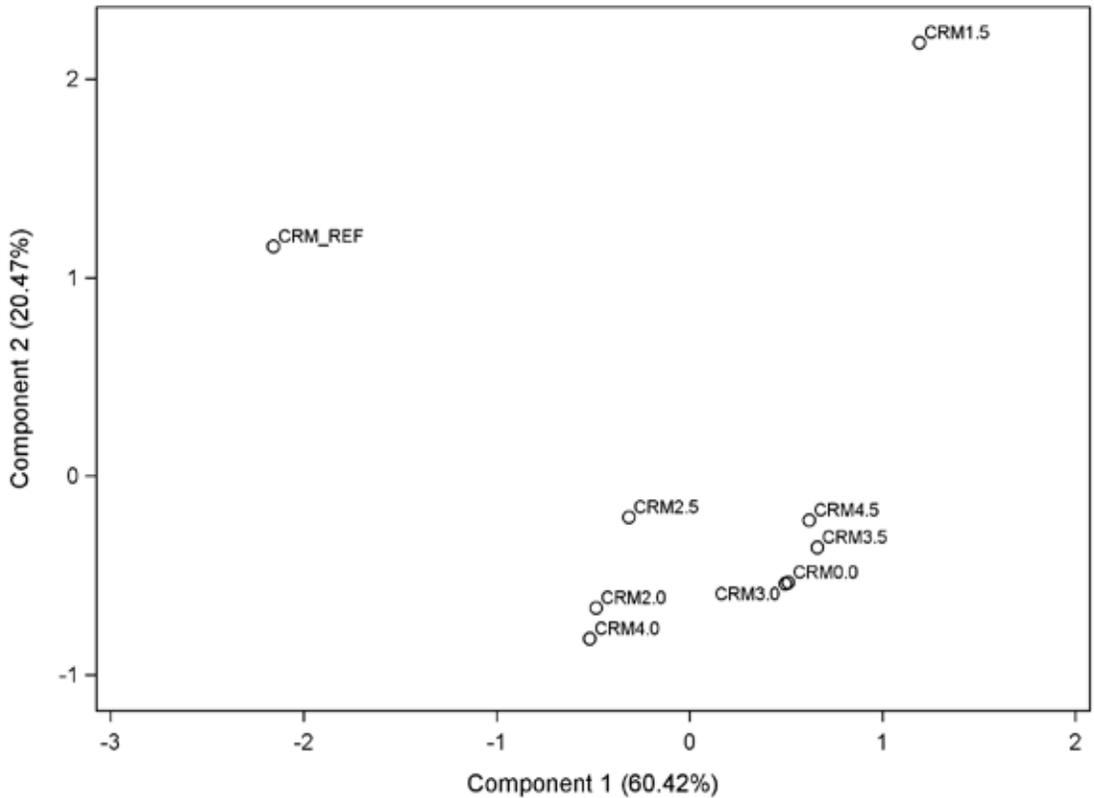
Axes are the component percent of explained variability.

CRM = Clinch River Mile
ERM = Emory River Mile
REF = Reference

Component Pattern



Component Scores

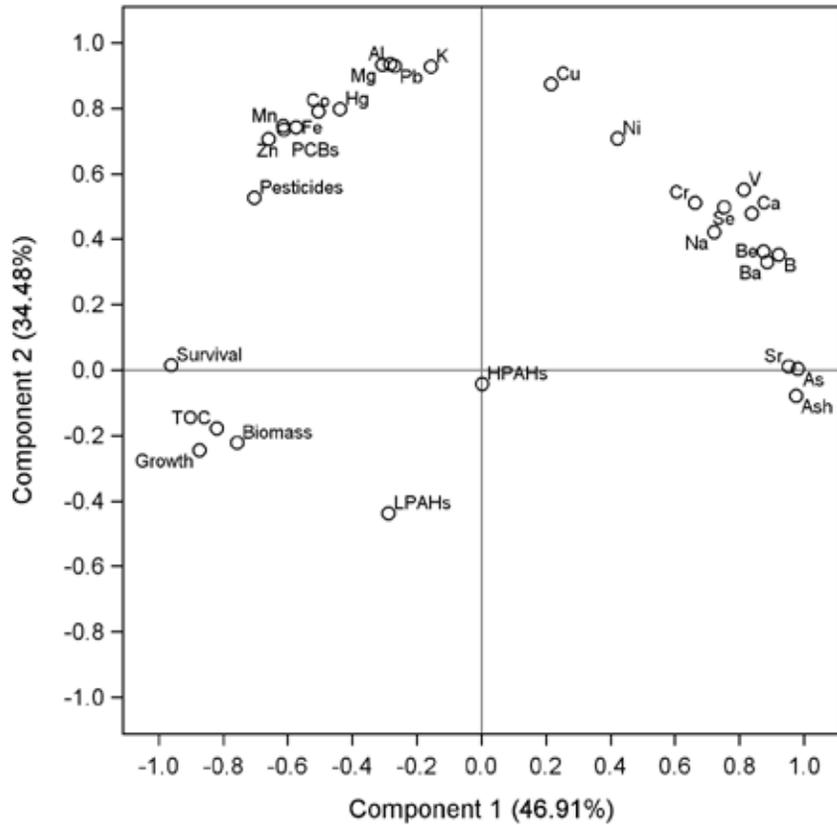


Notes: Principal component plots display *Hyalella azteca* long-term test endpoints as IC₂₅ of percent sediment where the lower the IC₂₅ translates to less site sediment required to elicit an effect.

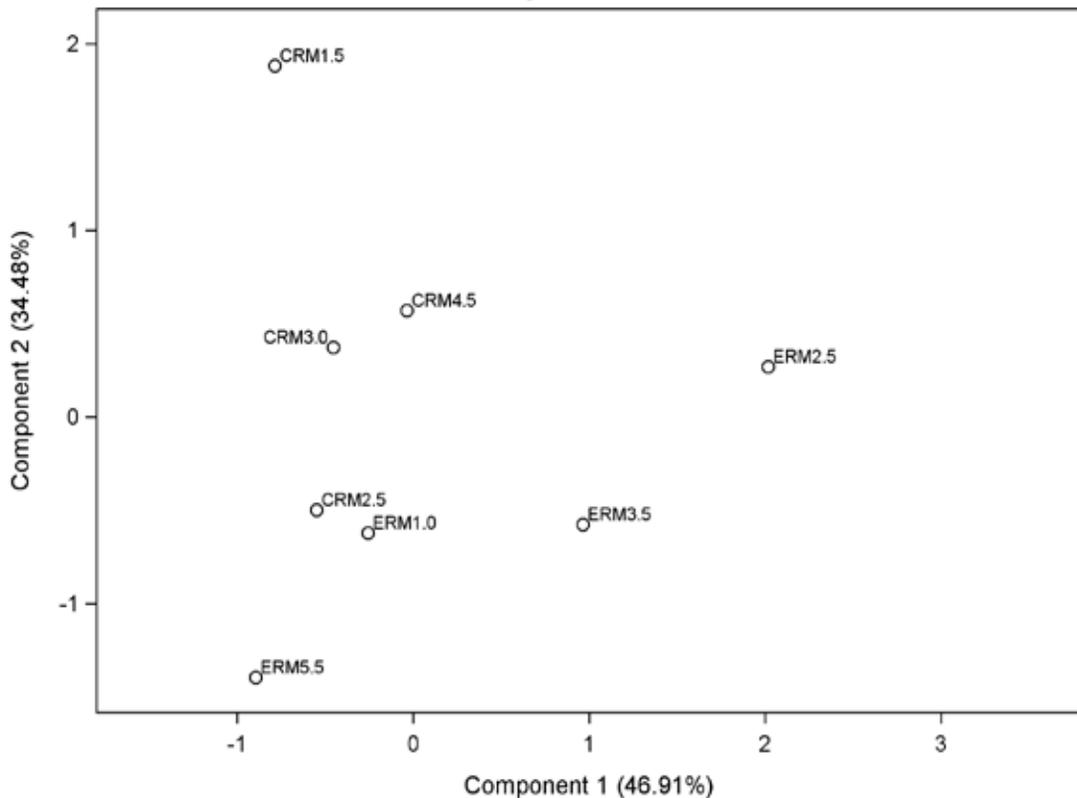
Axes are the component percent of explained variability.

CRM = Clinch River Mile
 ERM = Emory River Mile
 REF = Reference
 IC₂₅ = Concentration that inhibits 25% of test organisms

Component Pattern



Component Scores

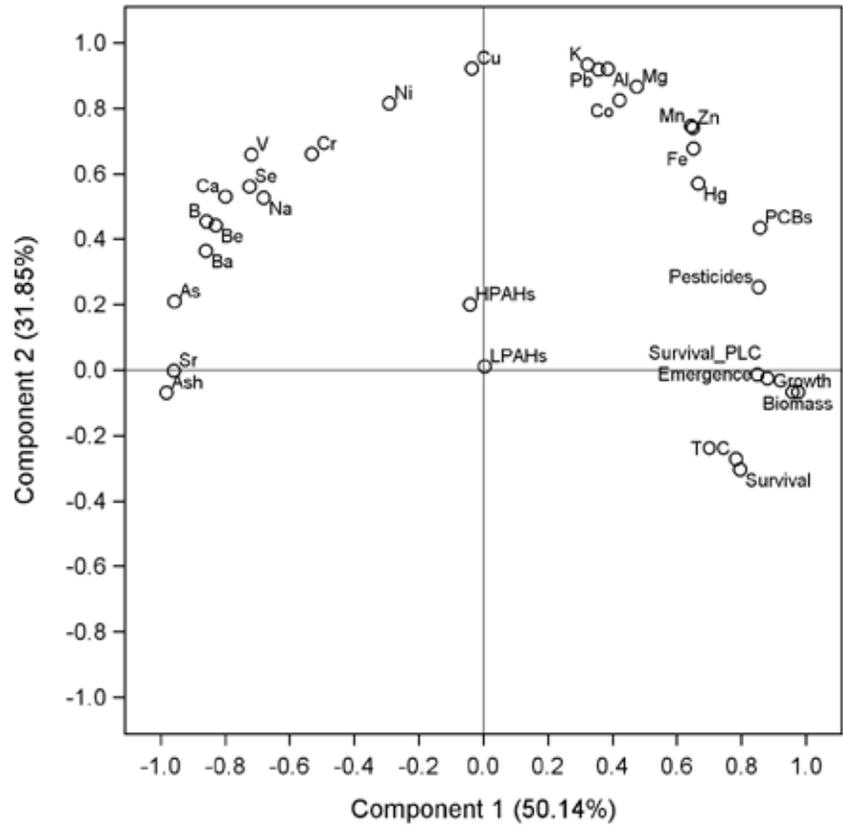


Notes: Principal component plots display *Chironomus dilutus* long-term test endpoints as IC₂₅ of percent sediment where the lower the IC₂₅ translates to less site sediment required to elicit an effect.

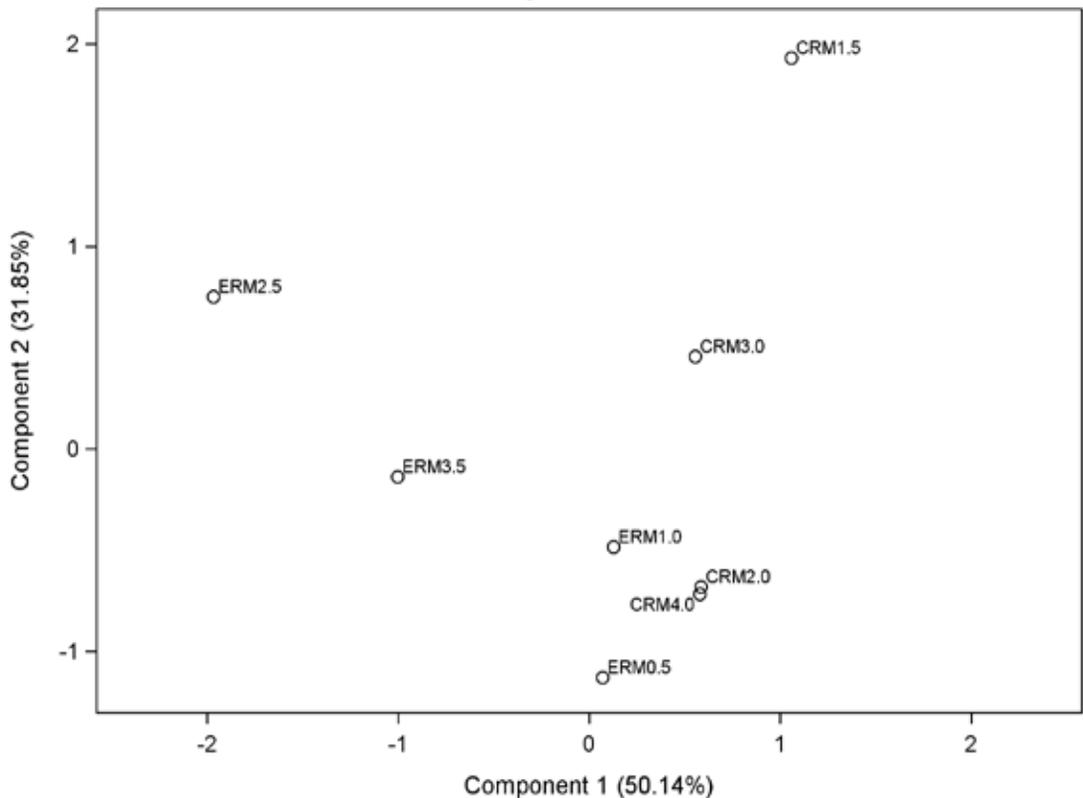
Axes are the component percent of explained variability.

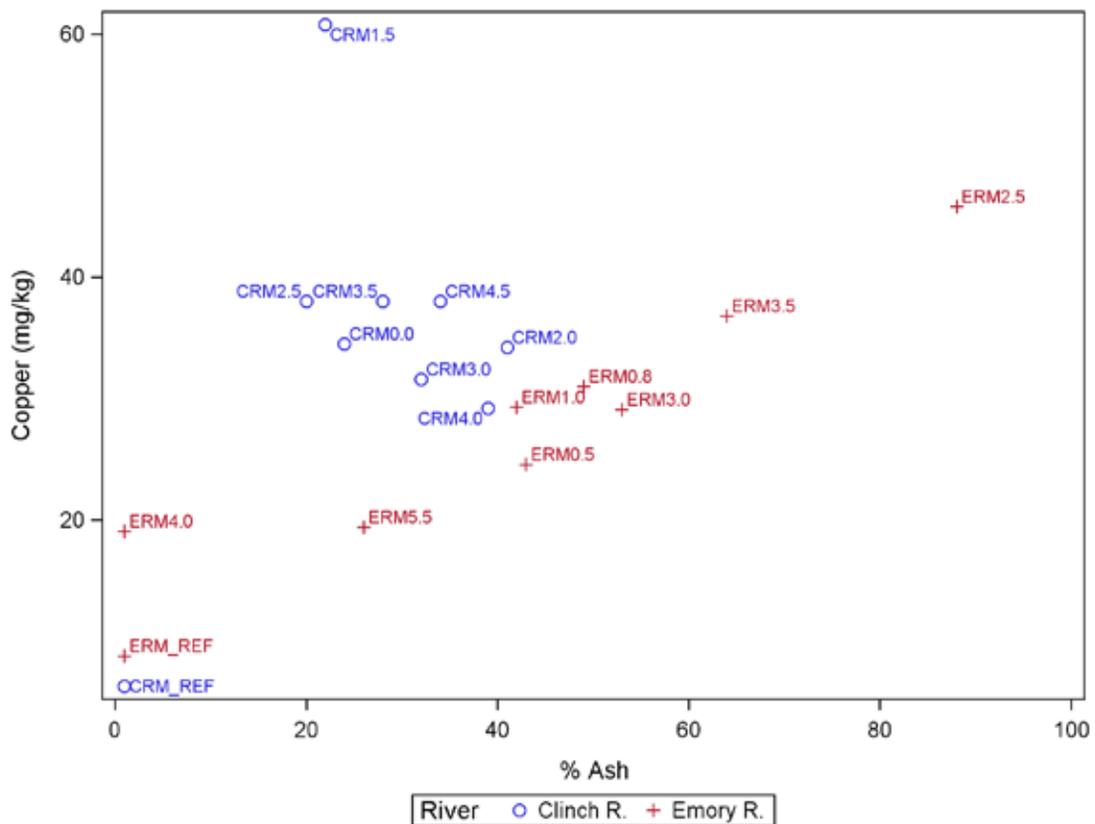
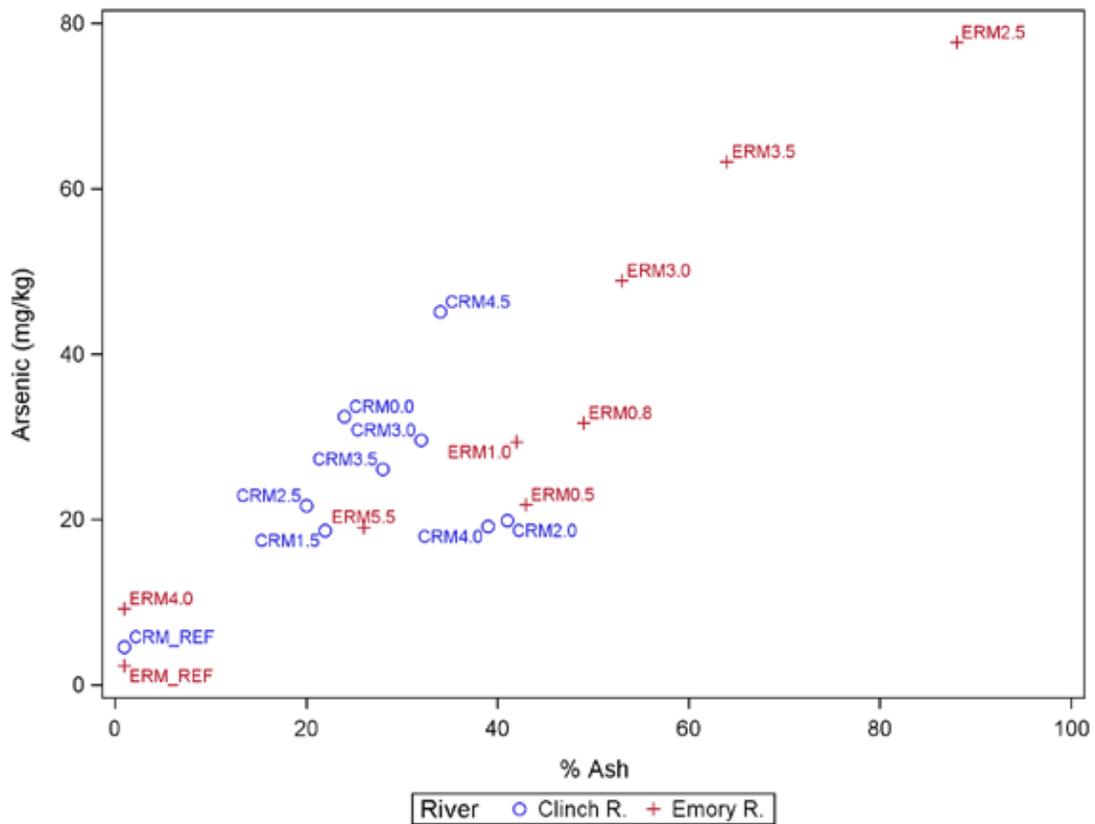
CRM = Clinch River Mile
 ERM = Emory River Mile
 REF = Reference
 IC₂₅ = Concentration that inhibits 25% of test organisms

Component Pattern



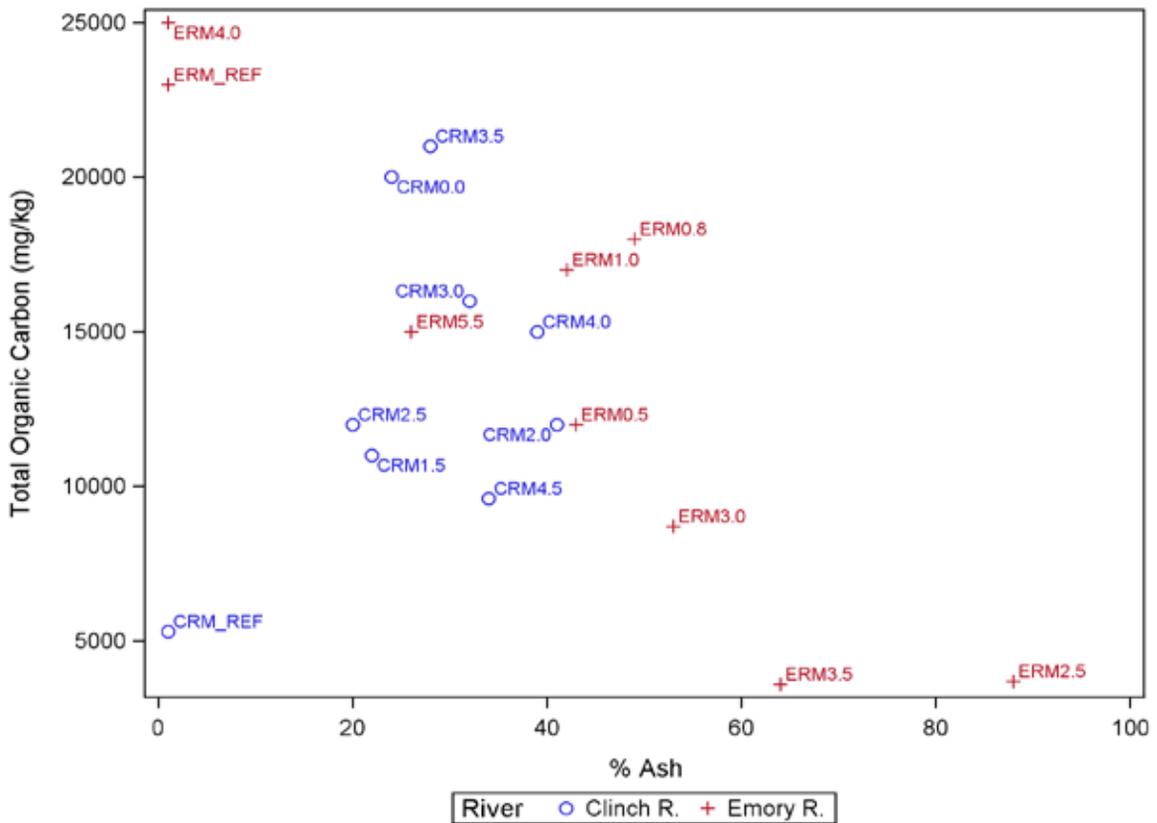
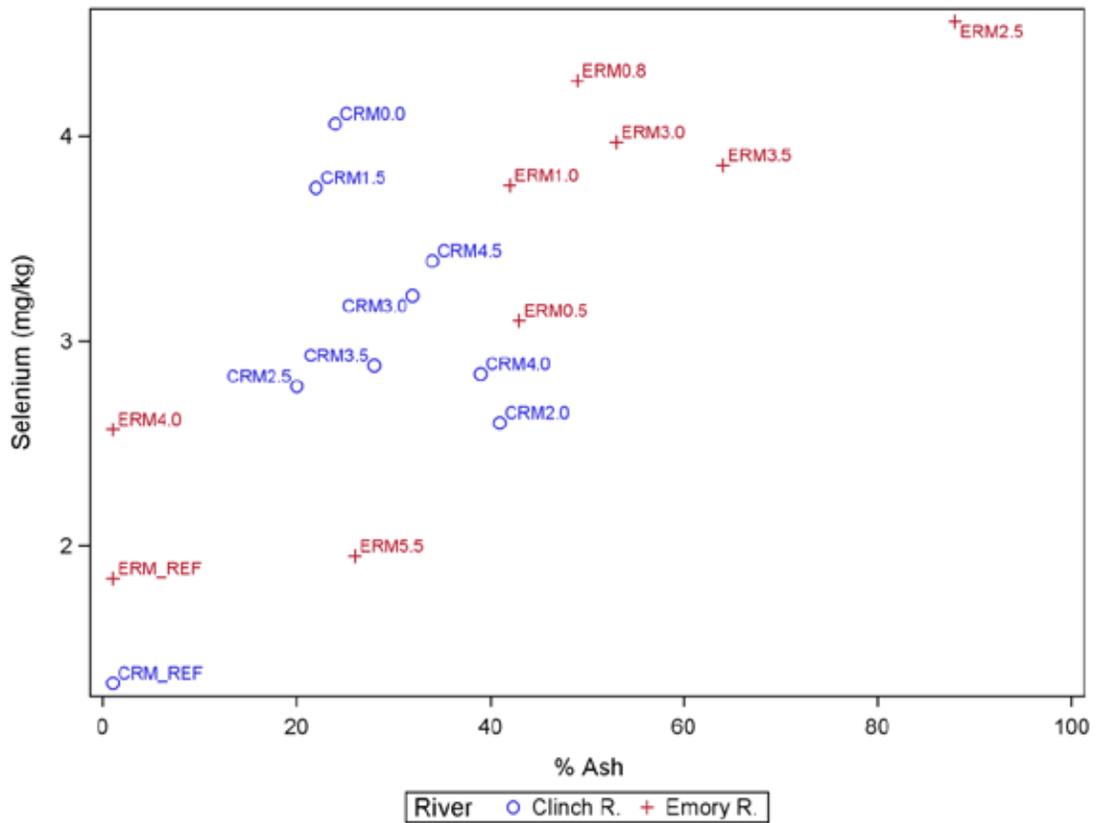
Component Scores





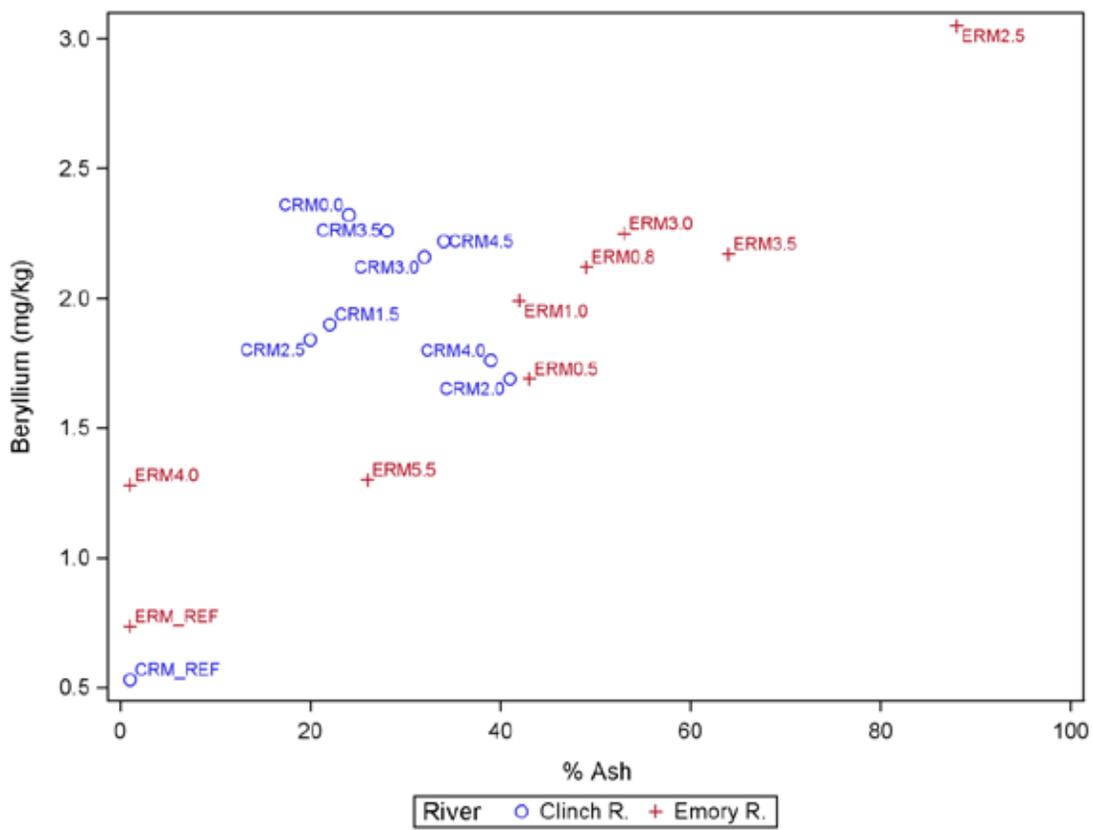
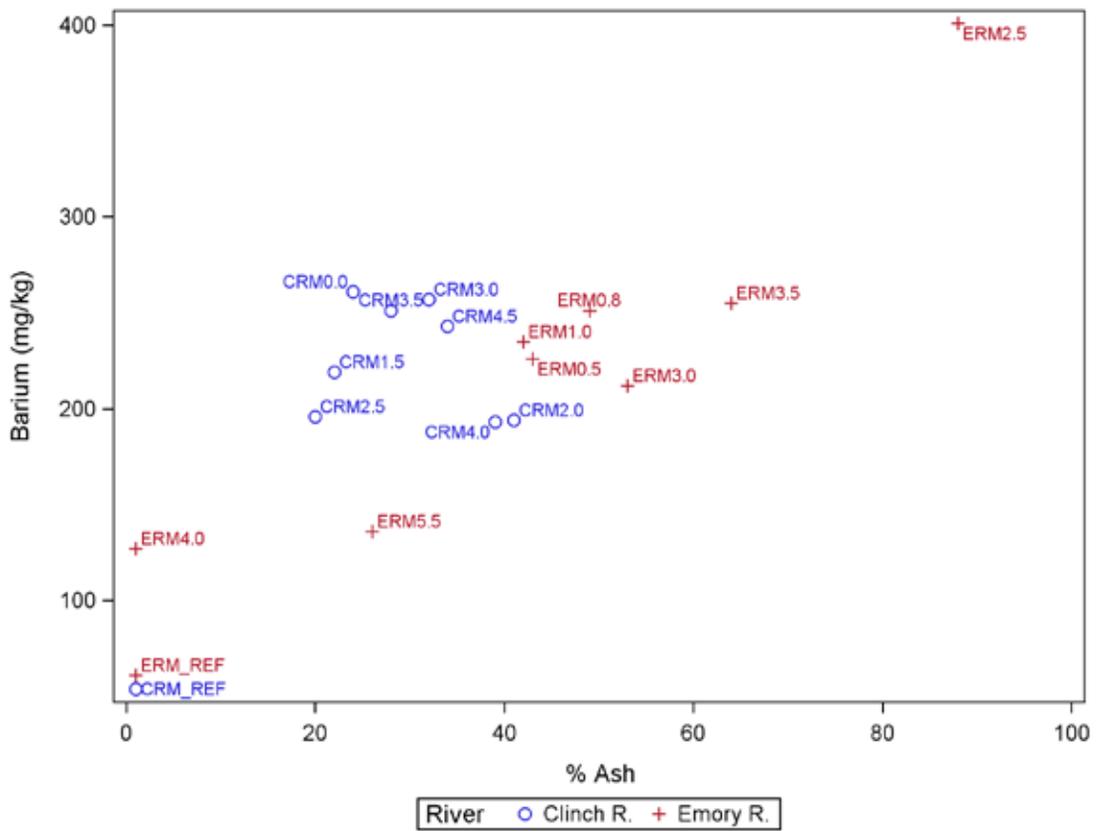
Notes:
 % = Percent; mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile





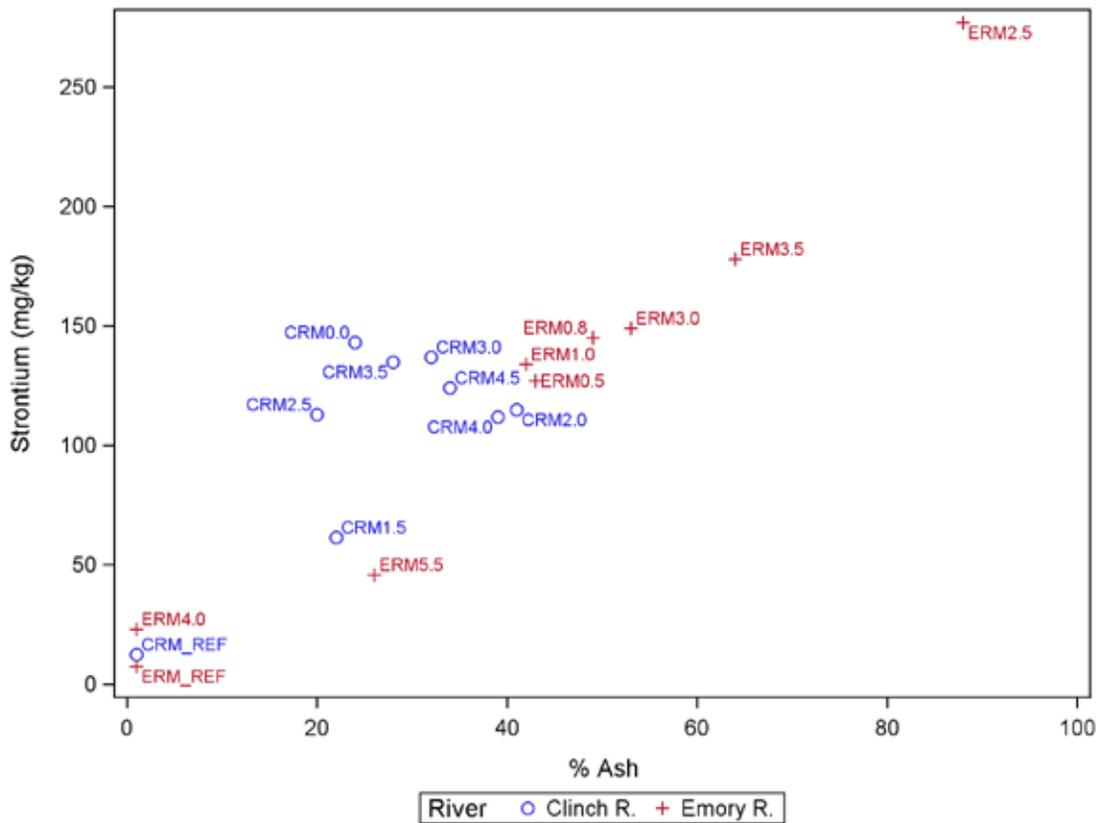
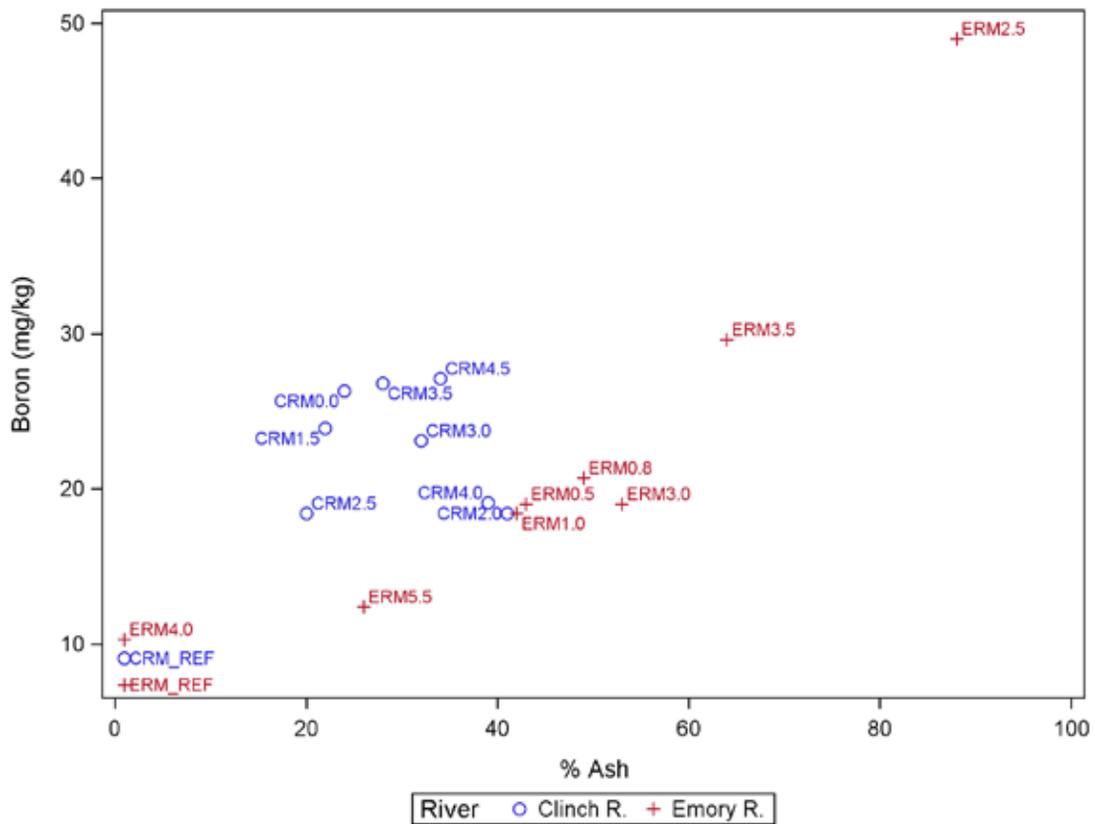
Notes:
 % = Percent; mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile





Notes:
 % = Percent; mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

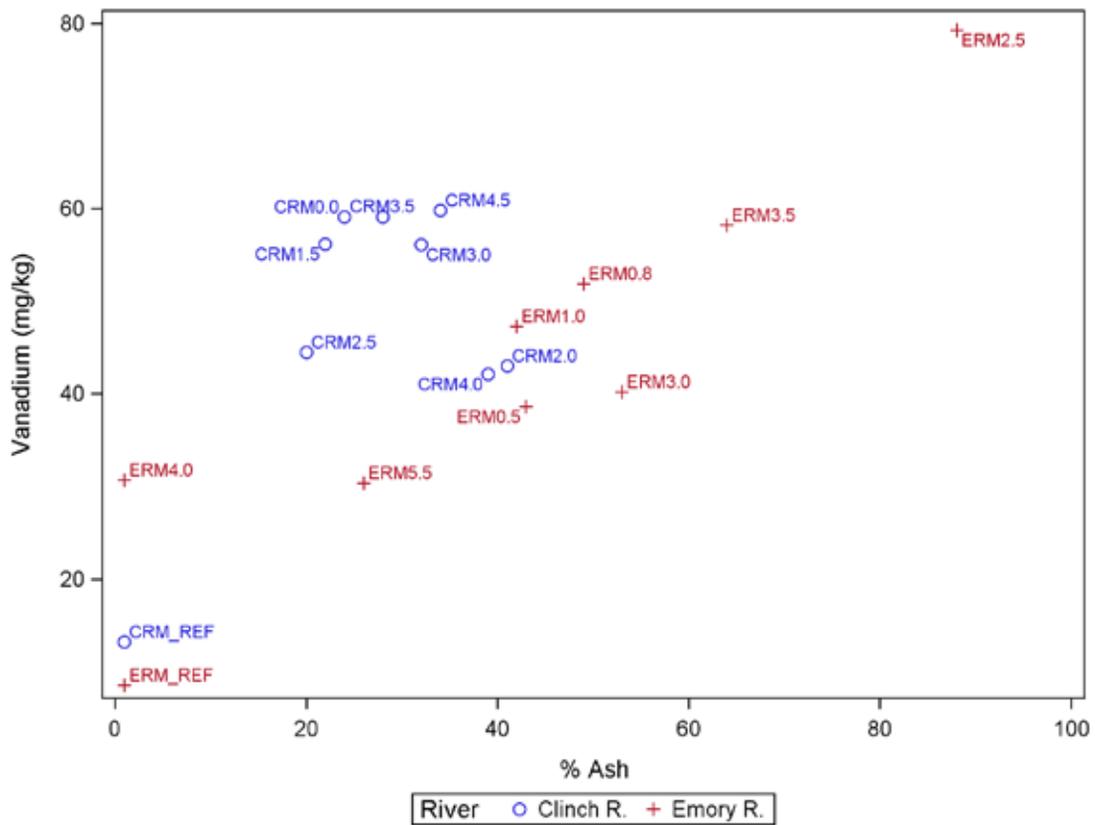
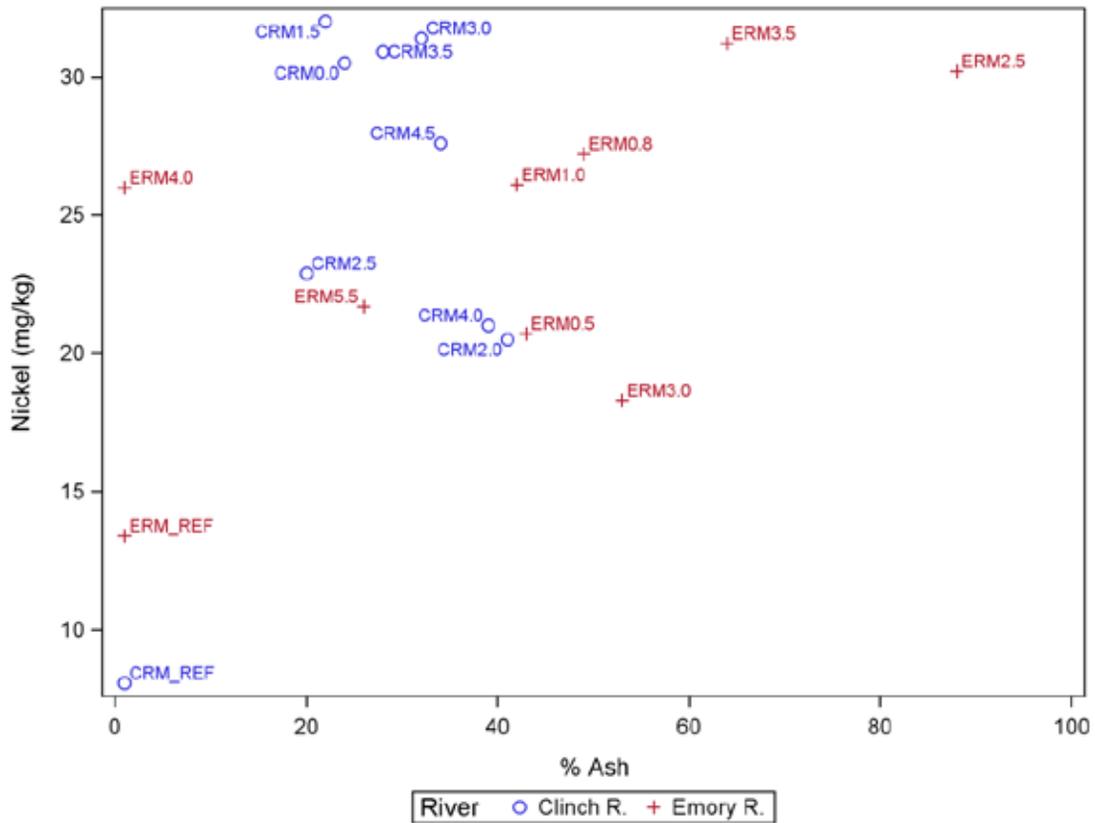




Notes:
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 CRM = Clinch River Mile; ERM = Emory River Mile

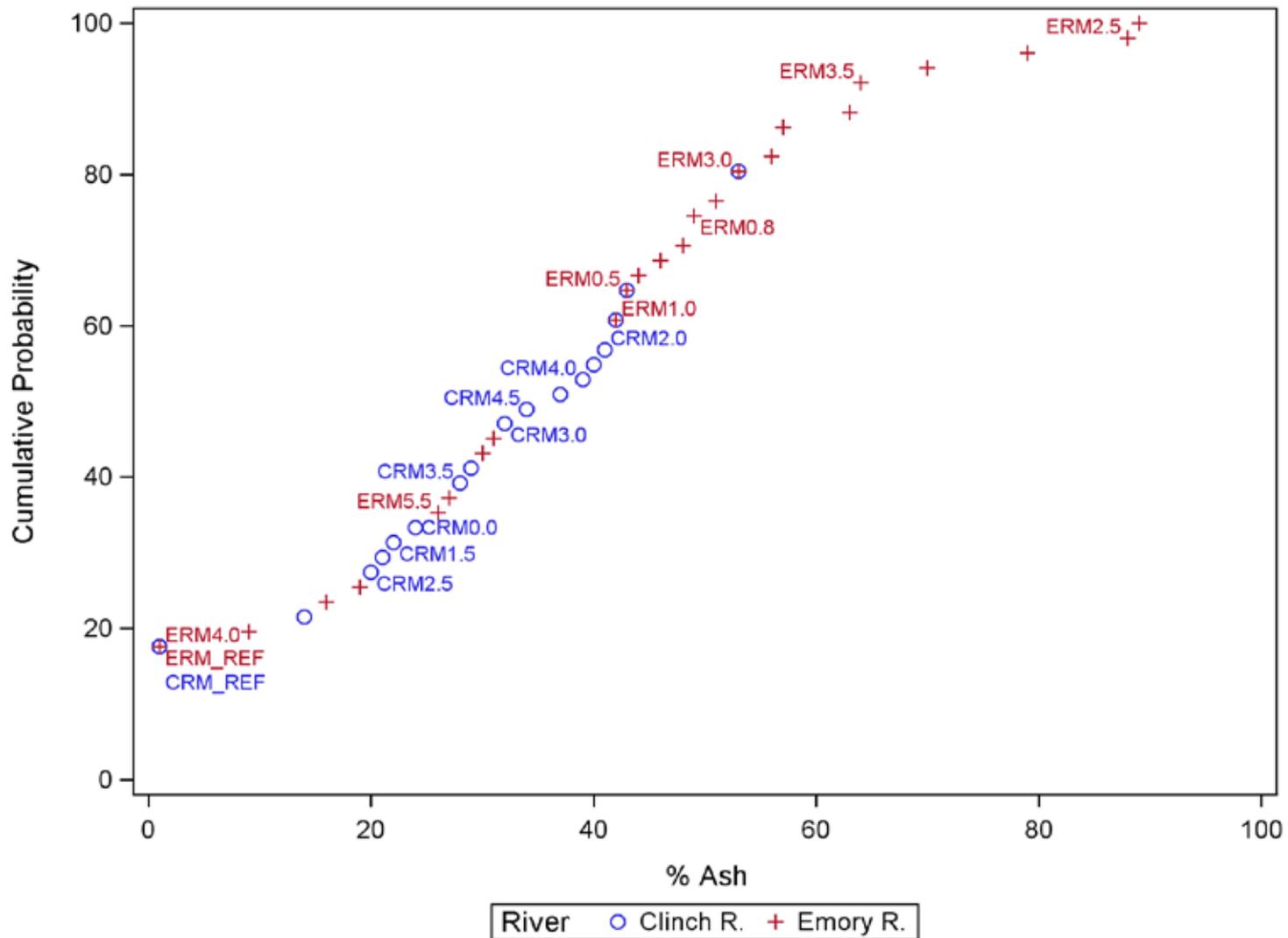
Boron and Strontium vs. Ash from Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE





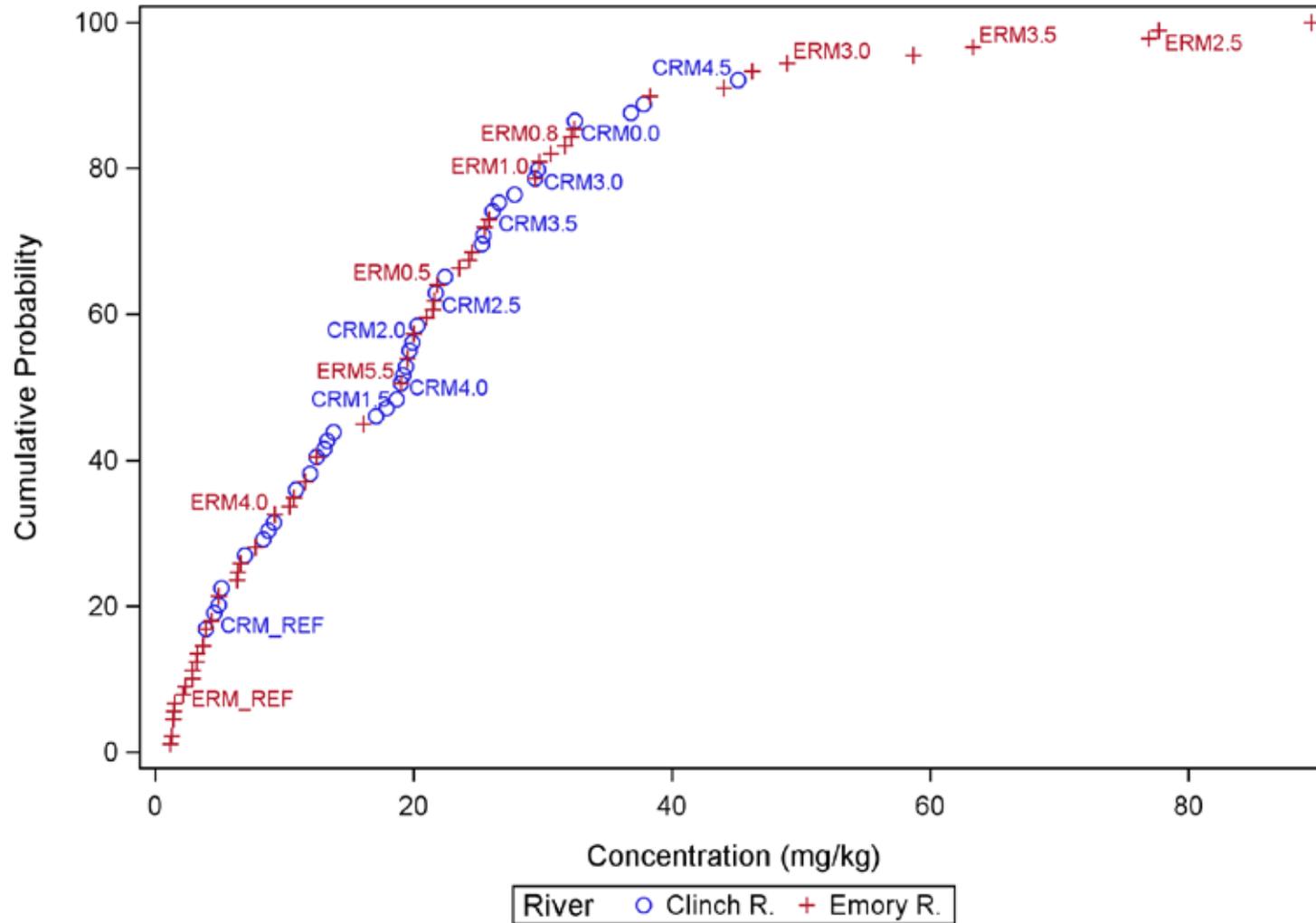
Notes:
 % = Percent; mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile





Notes: Bulk sediment samples are labeled with respective river miles. Vibracore submerged sediment samples are not labeled.
 % = Percent; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

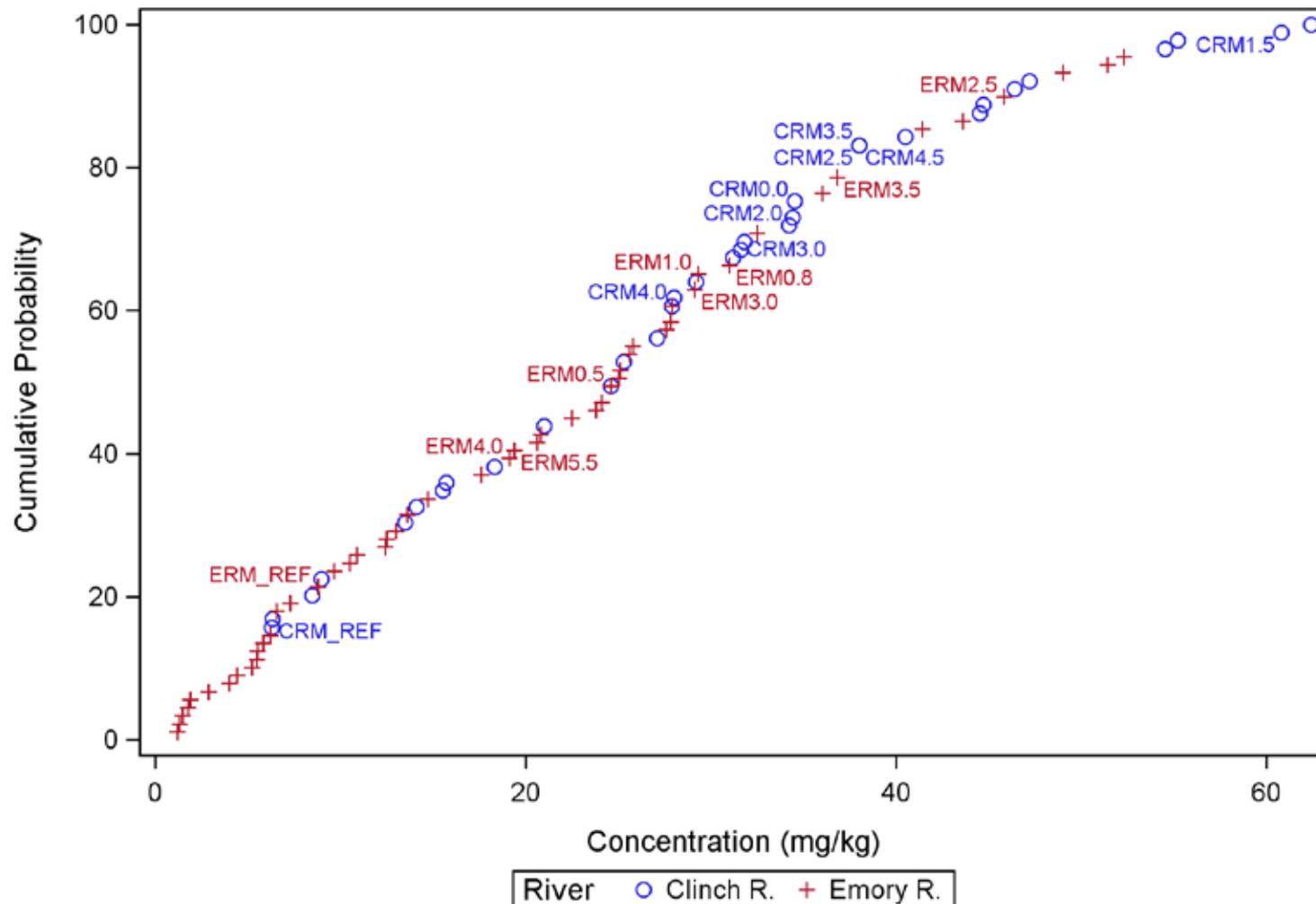
Cumulative Distribution of Percent Ash Concentrations in Submerged and Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



Notes: Bulk sediment samples are labeled with respective river miles. Vibracore submerged sediment samples are not labeled.
 mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

Cumulative Distribution of Arsenic Concentrations in Submerged and Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

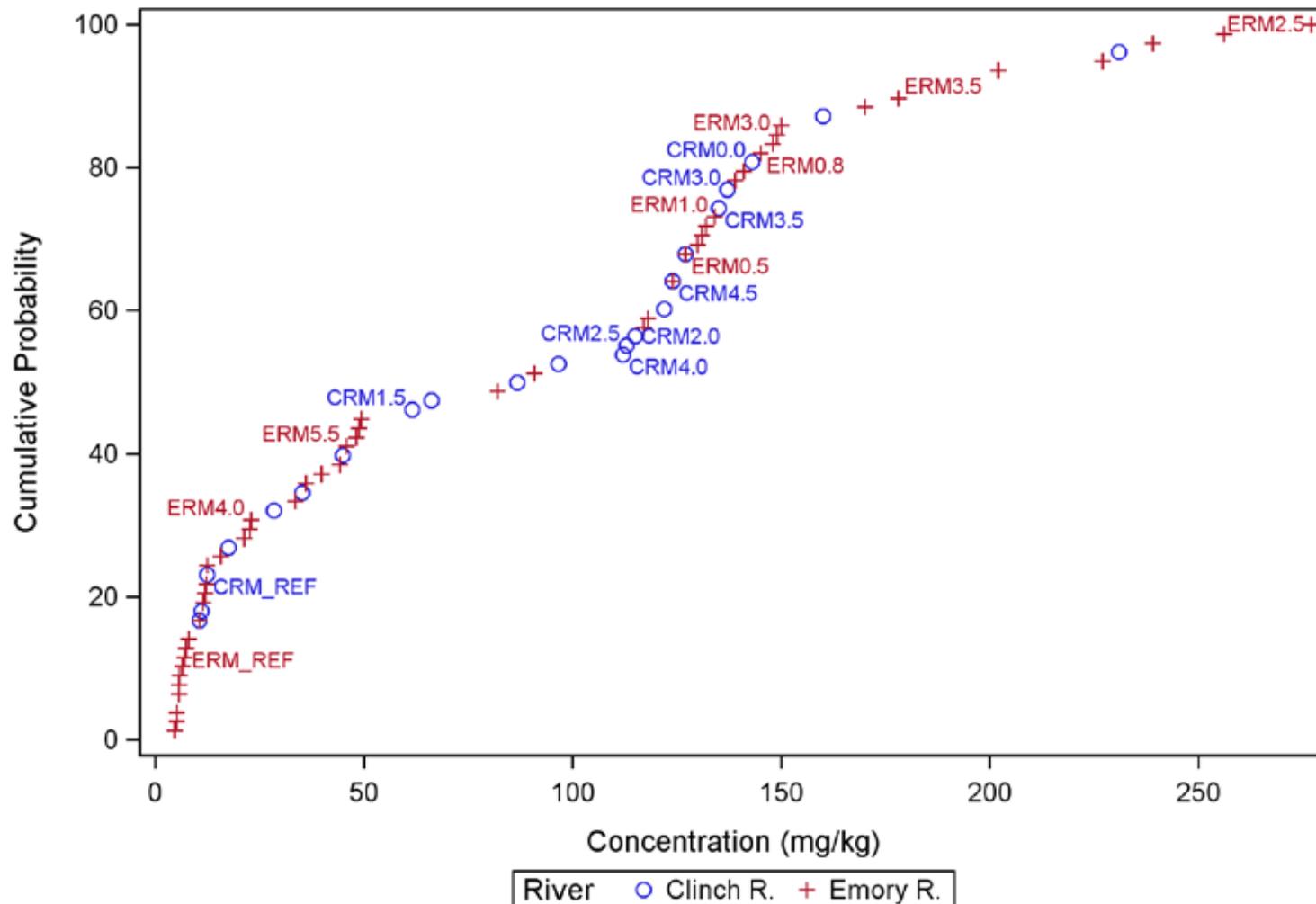




Notes: Bulk sediment samples are labeled with respective river miles. Vibracore submerged sediment samples are not labeled.
 mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

Cumulative Distribution of Copper Concentrations in Submerged and Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

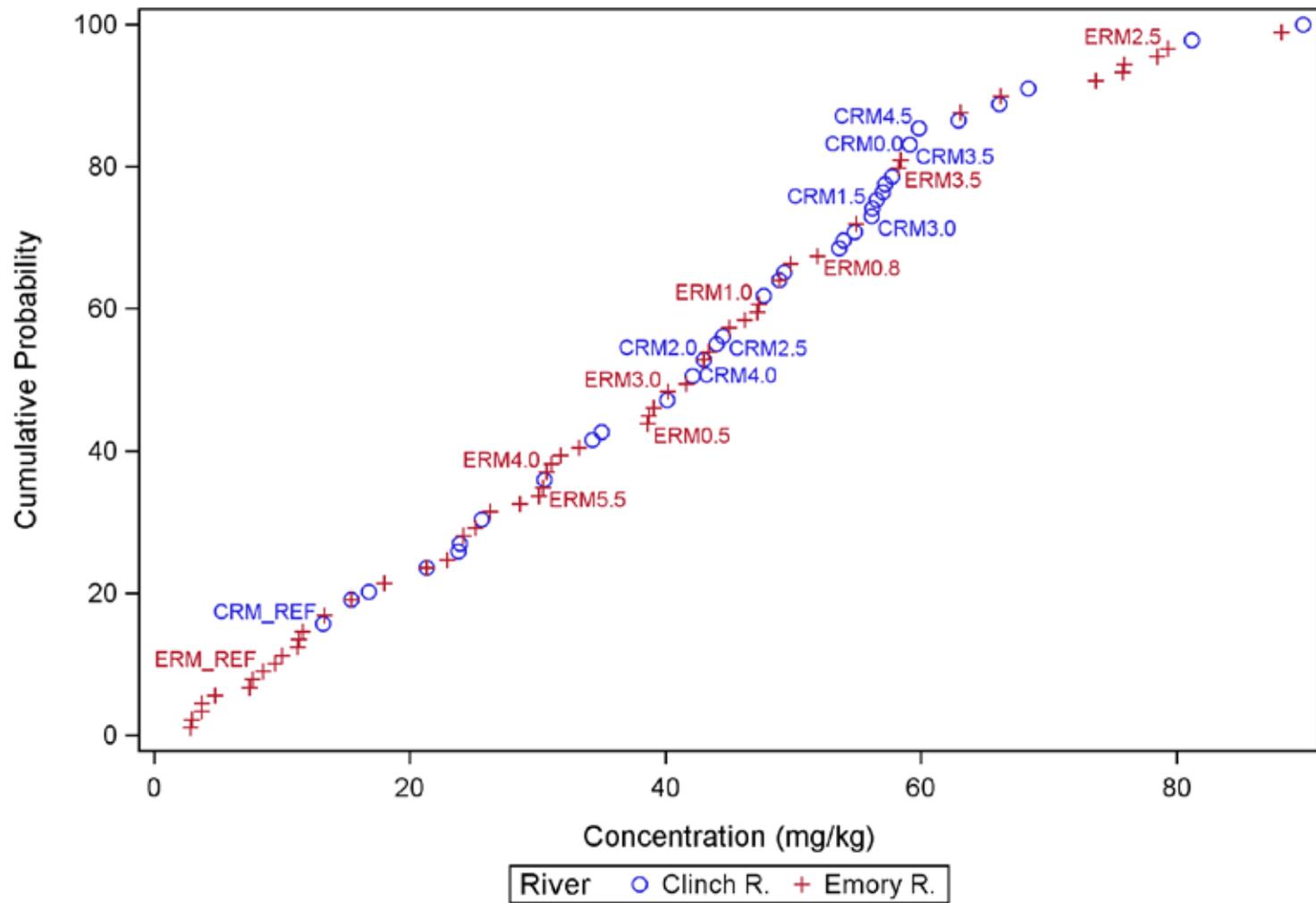




Notes: Bulk sediment samples are labeled with respective river miles. Vibracore submerged sediment samples are not labeled.
 mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

Cumulative Distribution of Strontium Concentrations in Submerged and Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

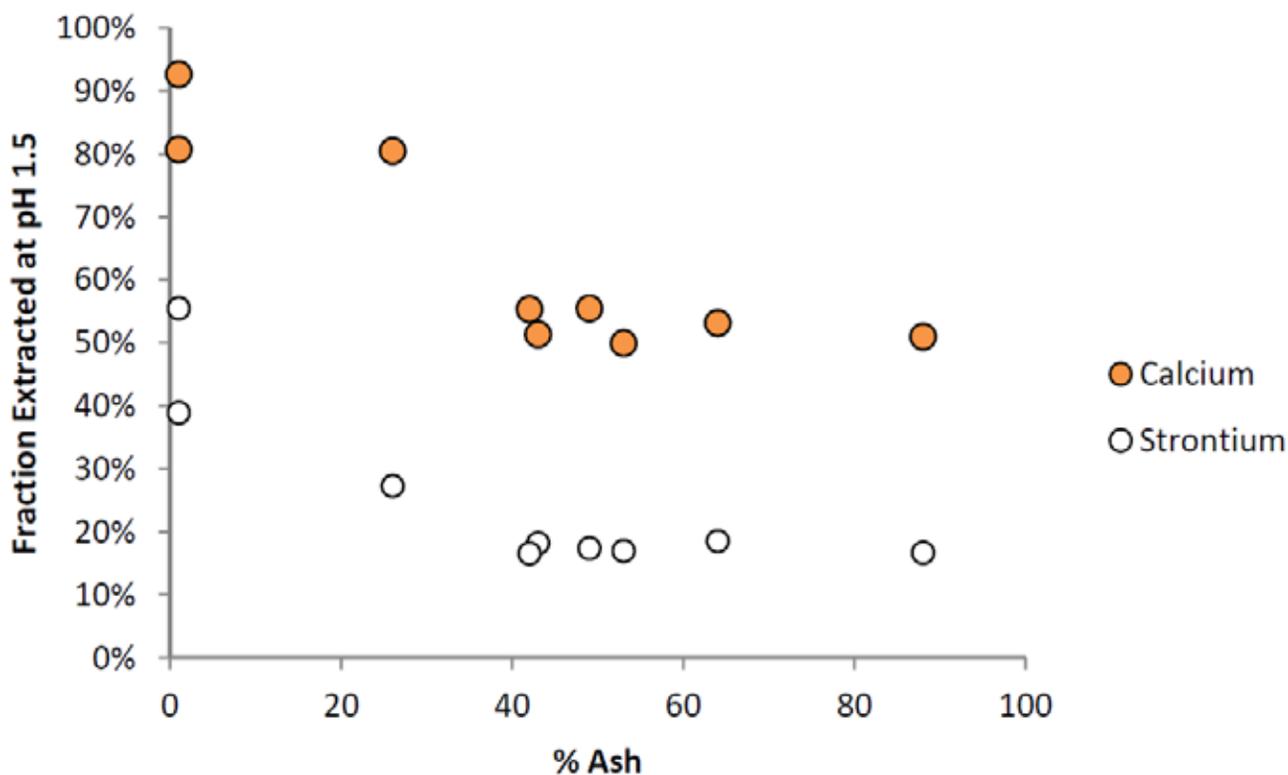
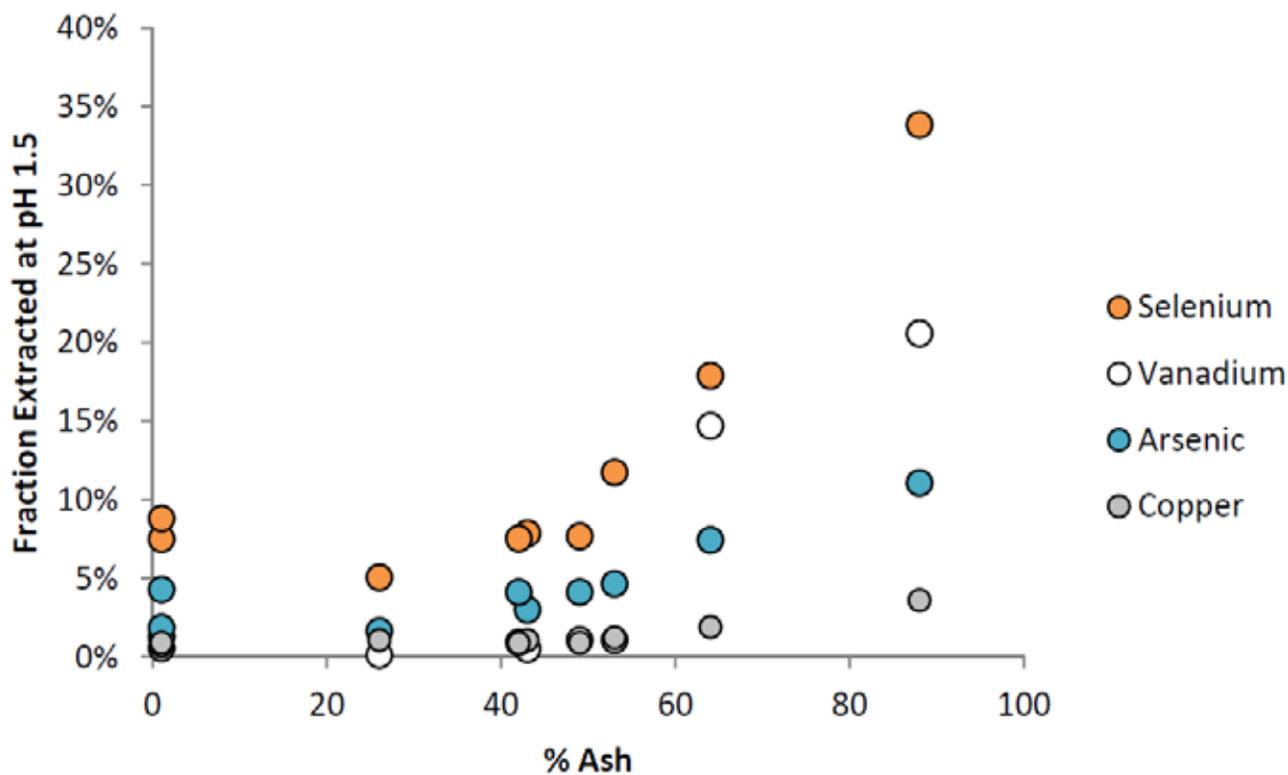




Notes: Bulk sediment samples are labeled with respective river miles. Vibracore submerged sediment samples are not labeled.
 mg/kg = Milligrams per kilogram; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

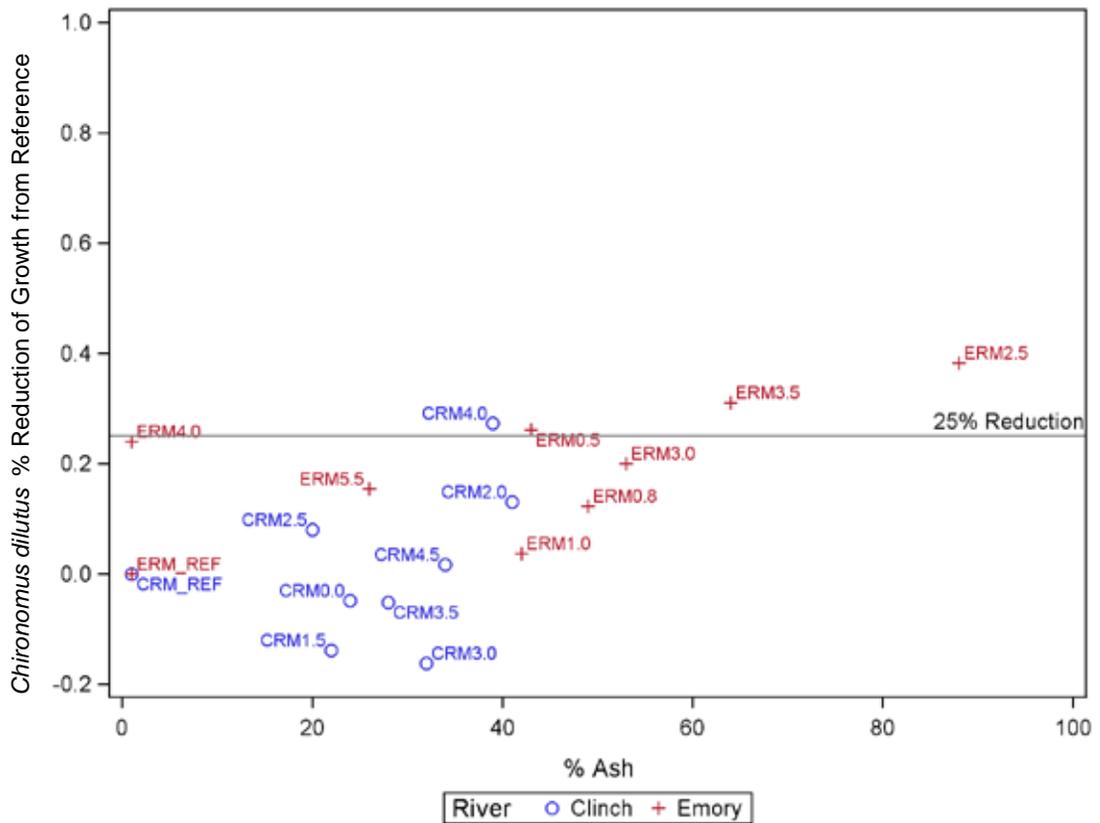
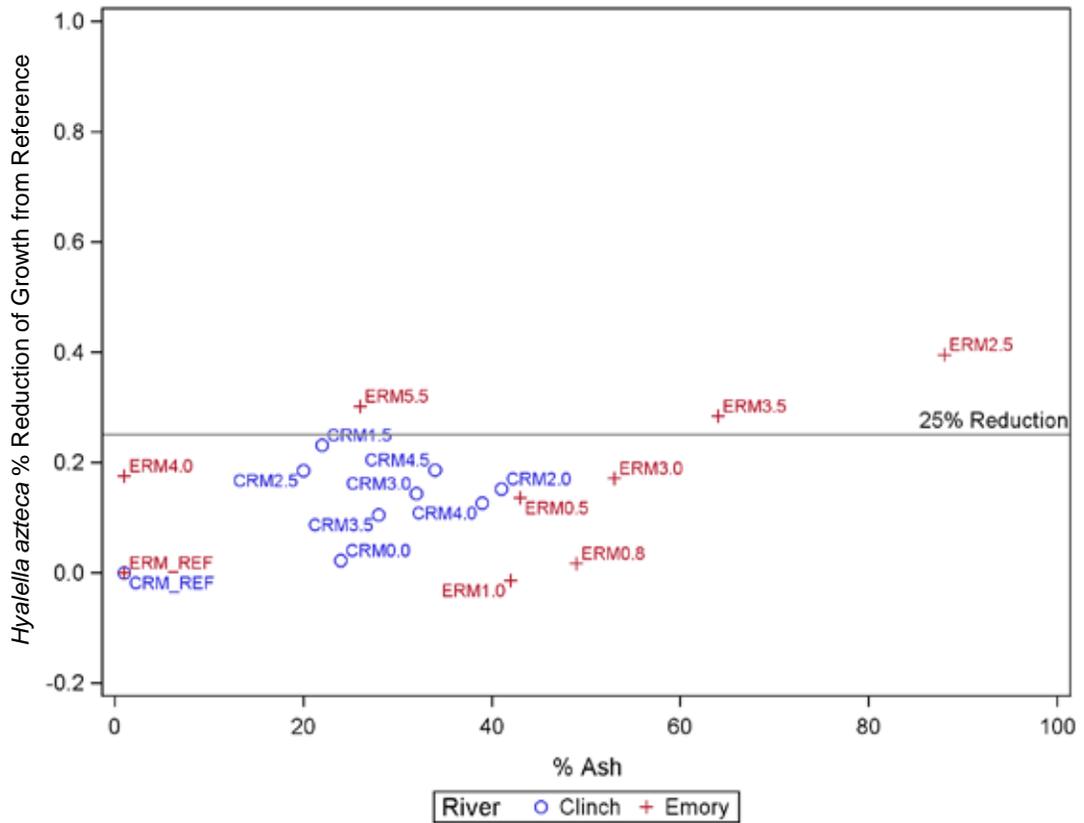
Cumulative Distribution of Vanadium Concentrations in Submerged and Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE





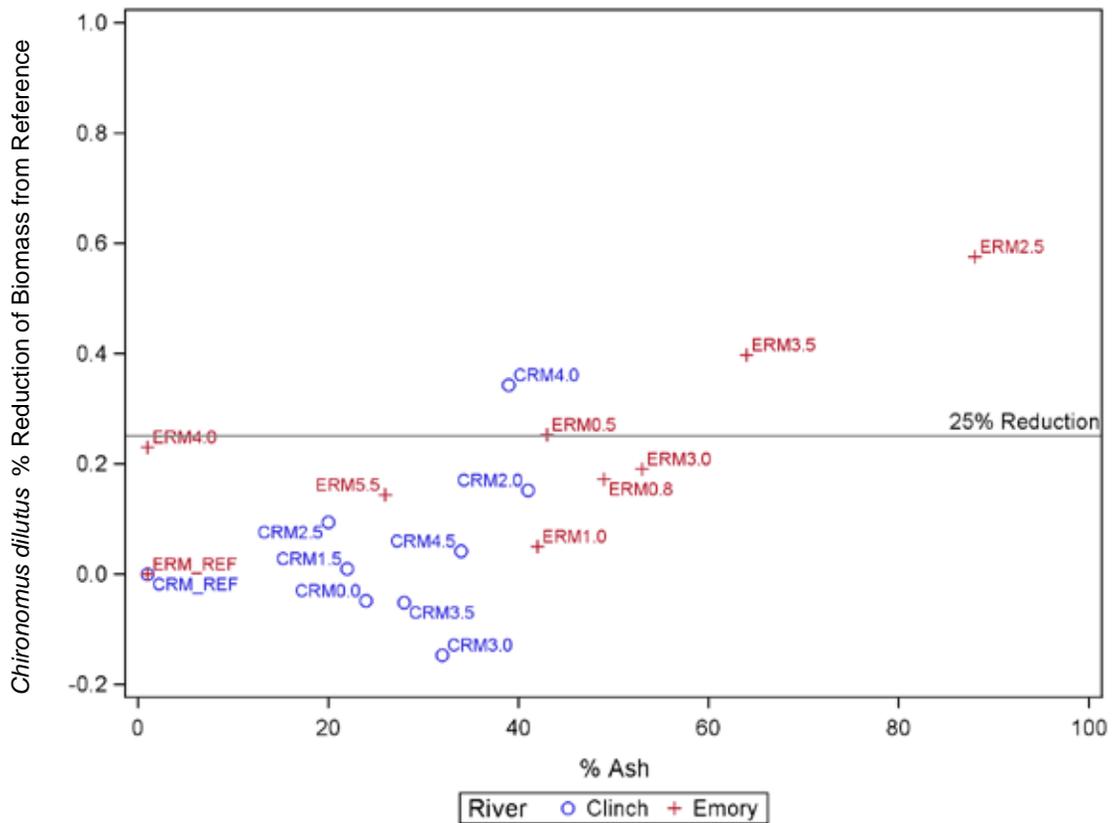
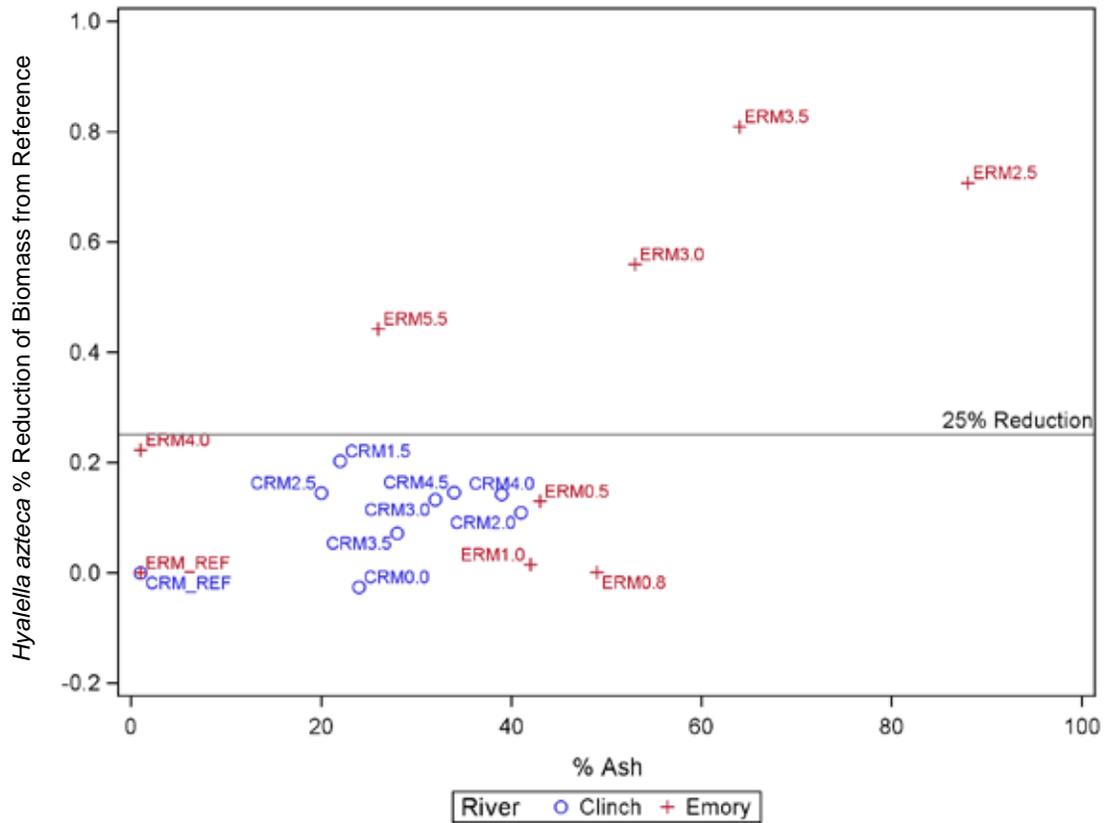
Percent of Total COPECs Extracted at pH 1.5 From Bulk Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

FIGURE
 4-55

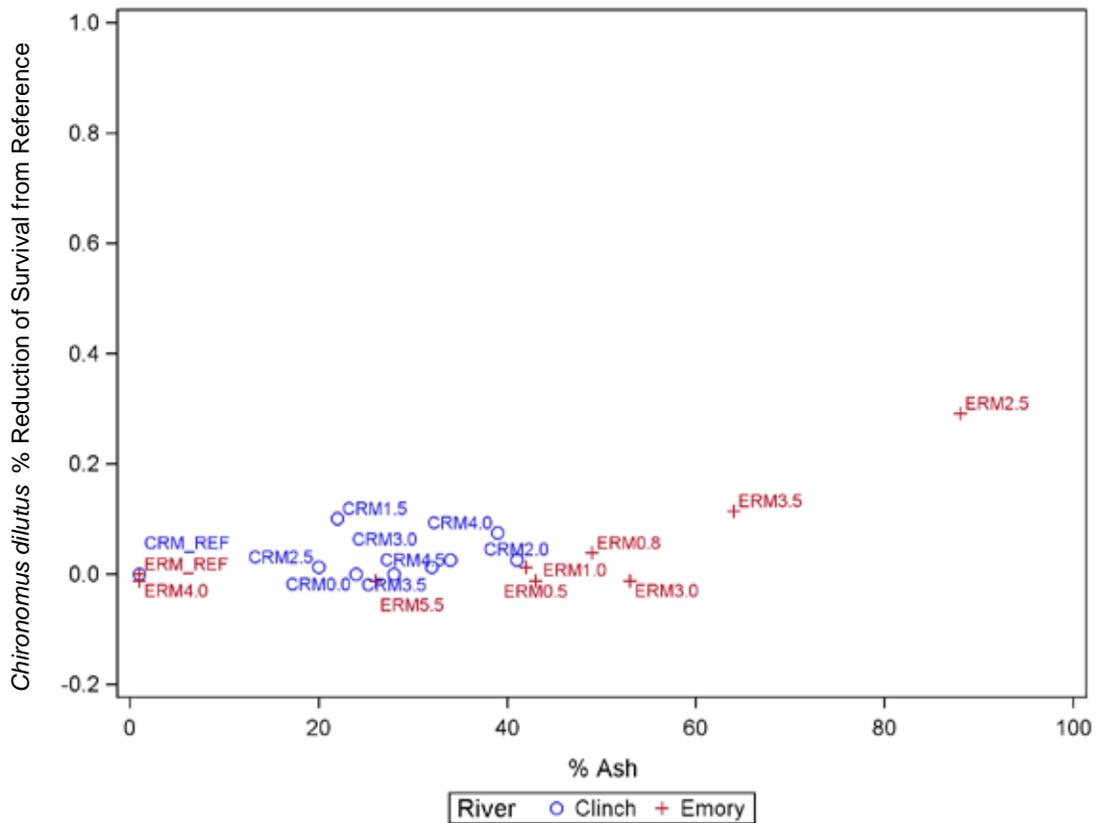
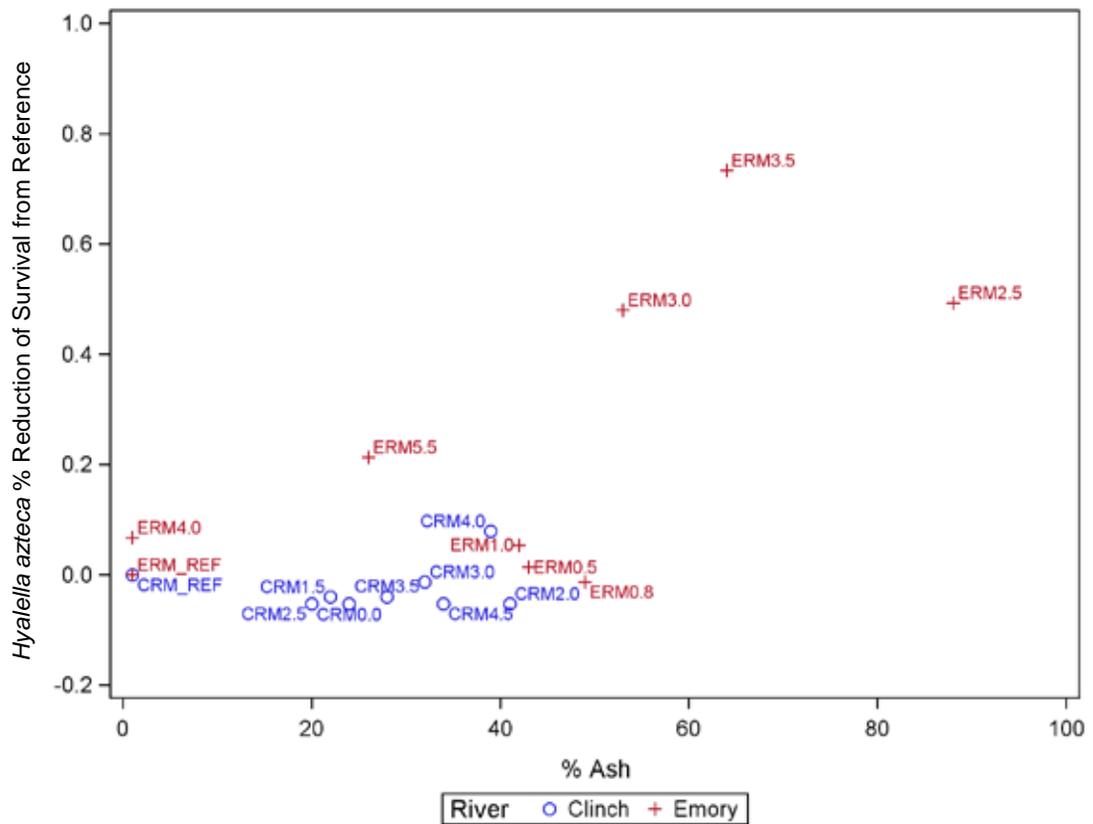


Notes:
 % = Percent; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile



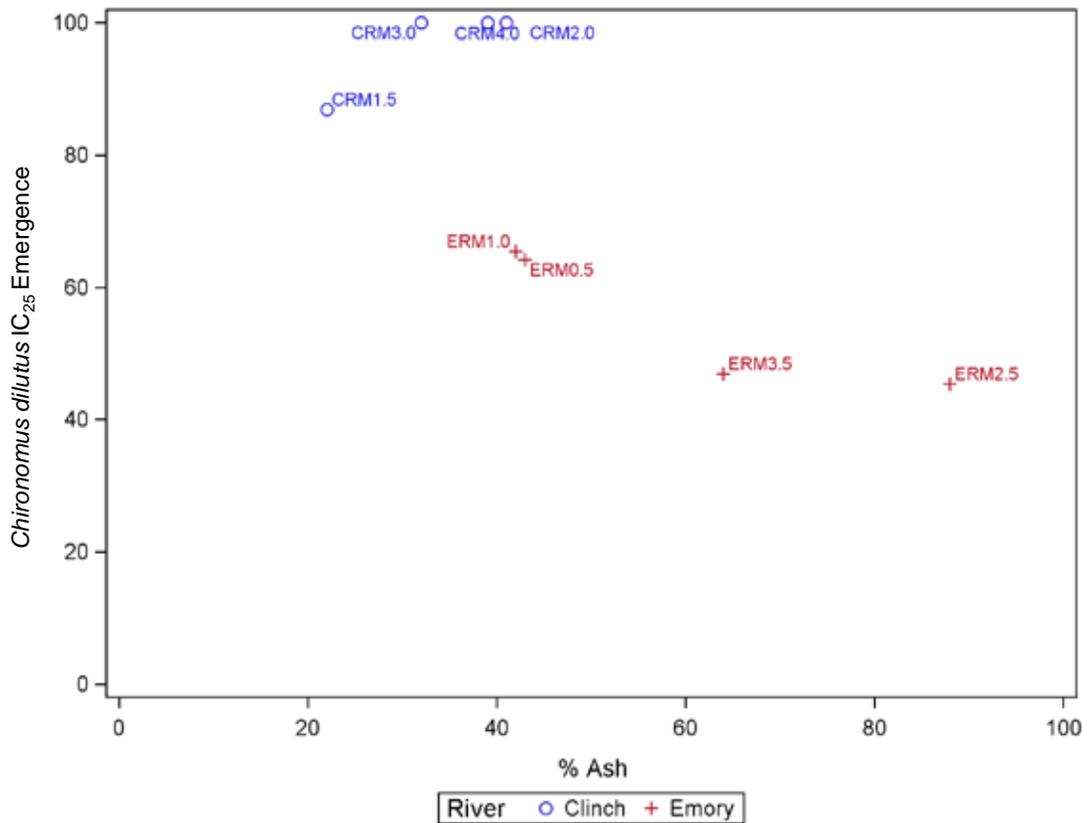
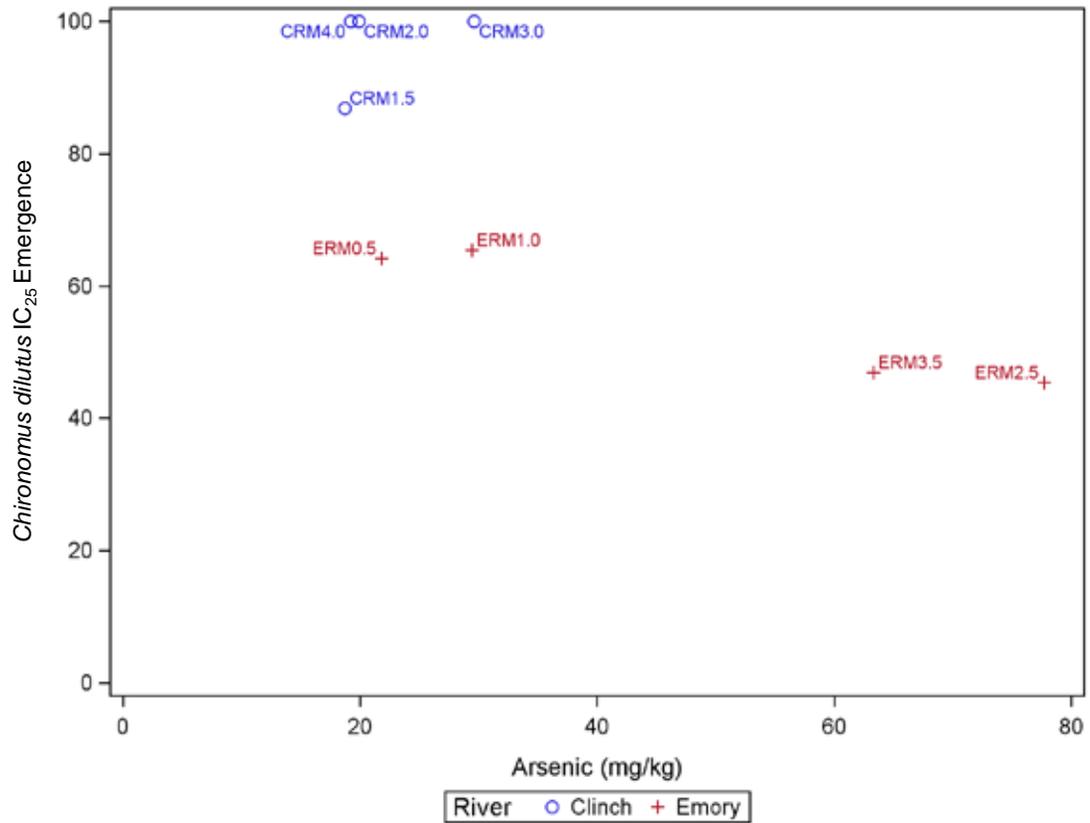


Notes:
 % = Percent; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile



Notes:
 % = Percent; REF = Reference;
 CRM = Clinch River Mile; ERM = Emory River Mile

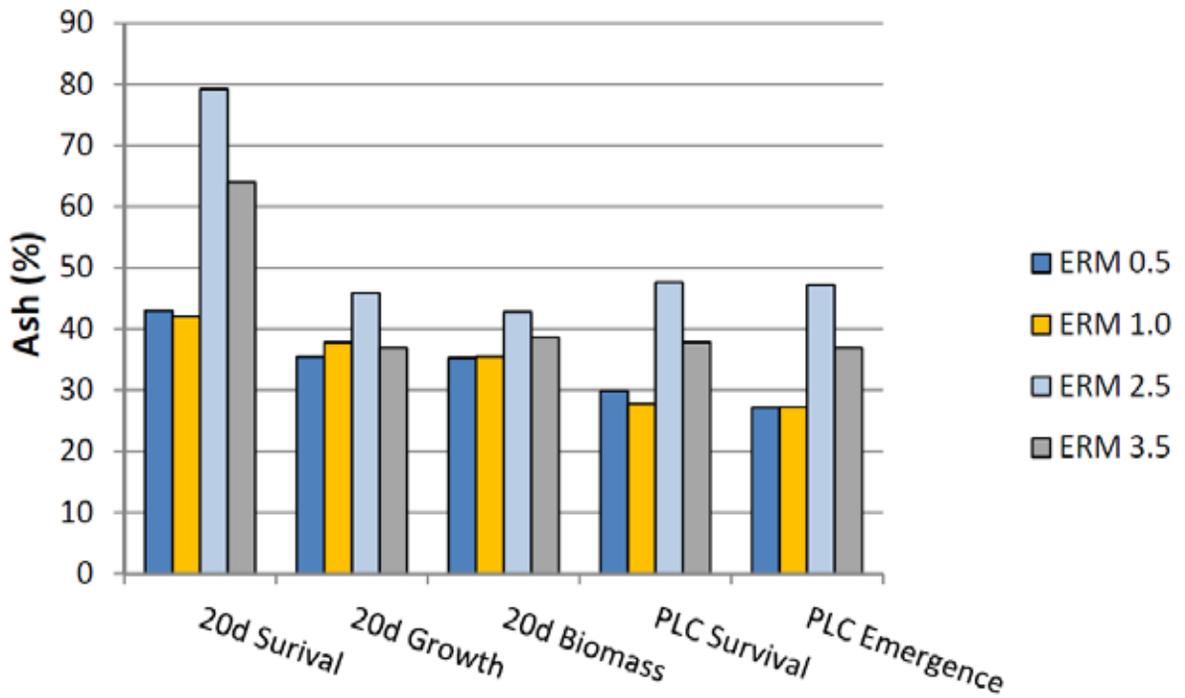




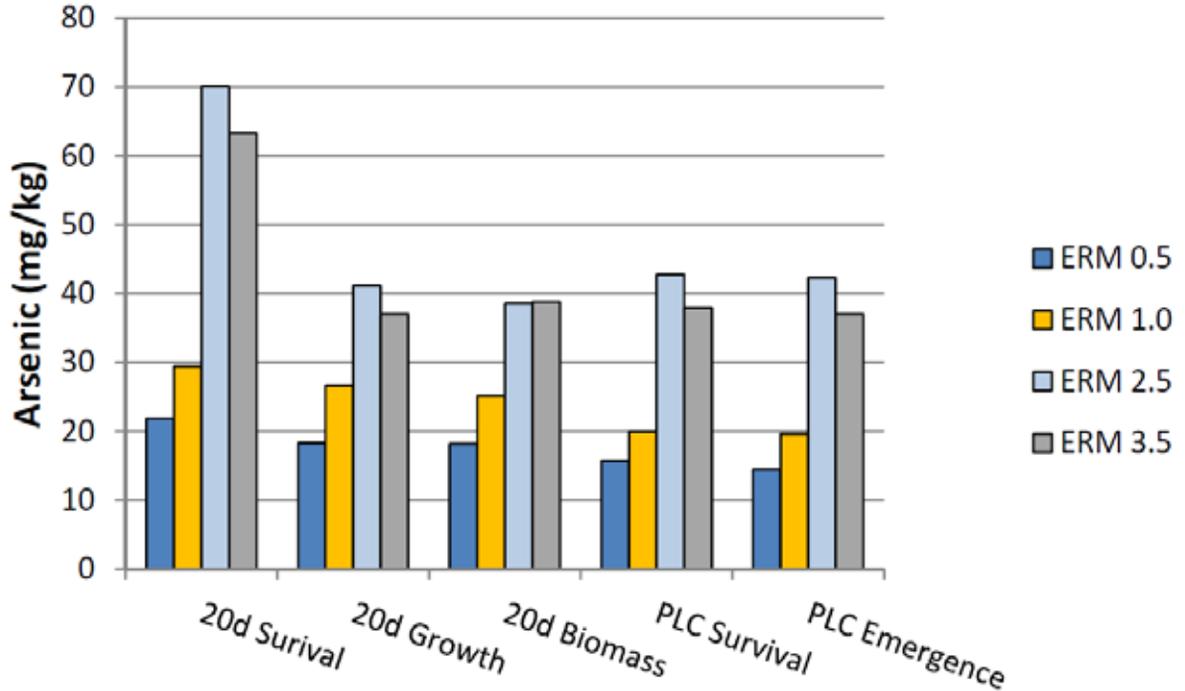
Notes:
 % = Percent; mg/kg = Milligrams per kilogram; IC₂₅ = Concentration that inhibits 25 percent of test organisms;
 CRM = Clinch River Mile; ERM = Emory River Mile



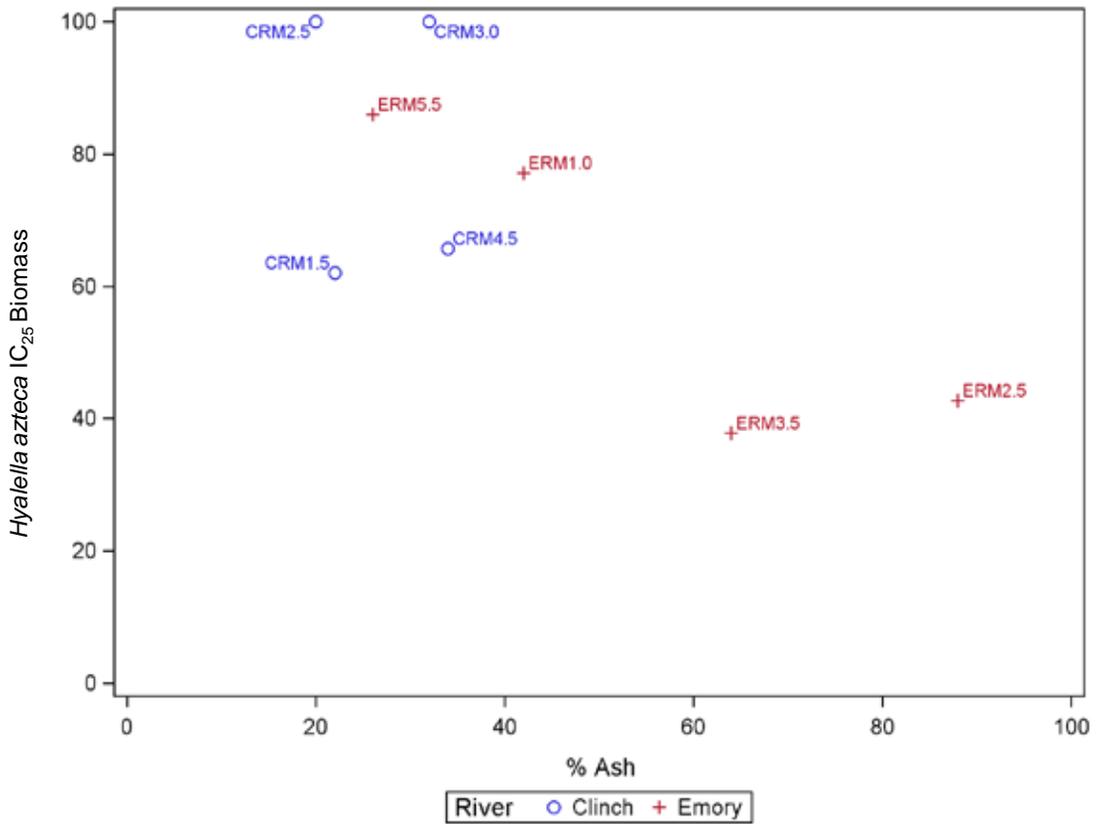
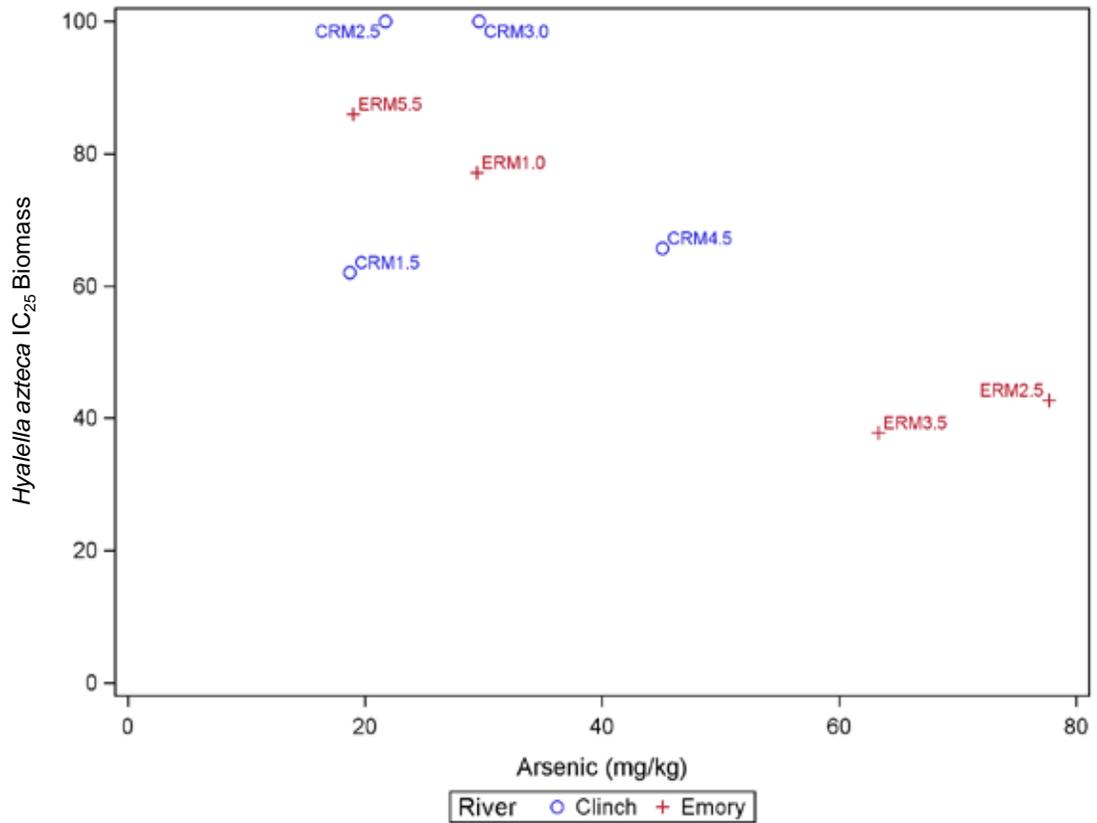
Chironomus dilutus Emory River IC₂₅ : Ash



Chironomus dilutus Emory River IC₂₅ : Arsenic



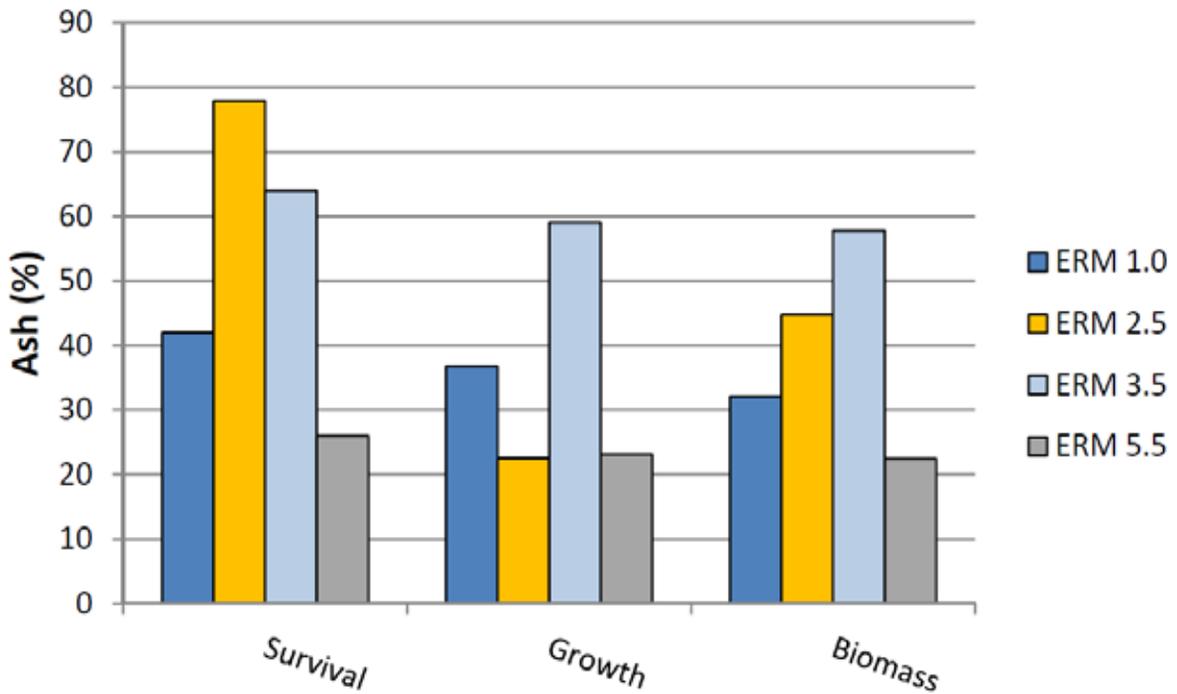
Notes:
 % = Percent; d = day; mg/kg = Milligrams per kilogram; PLC = Partial life cycle ; IC₂₅ = Concentration that inhibits 25 percent of test organisms;
 ERM = Emory River Mile



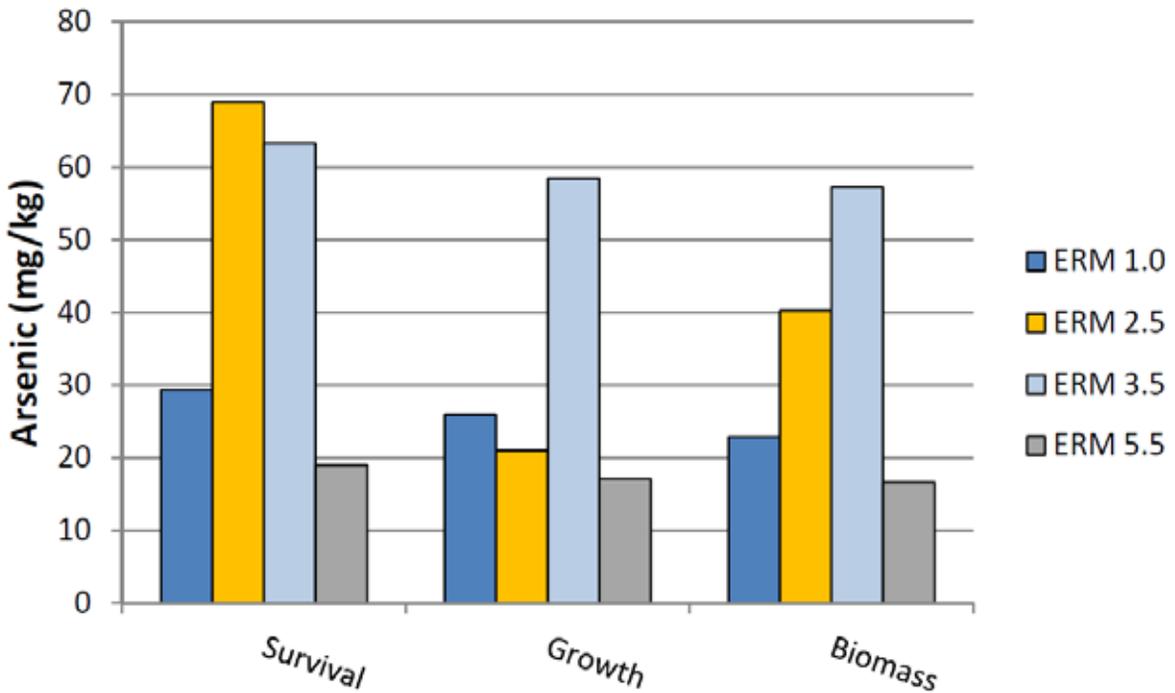
Notes:
 % = Percent; mg/kg = Milligrams per kilogram; IC₂₅ = Concentration that inhibits 25 percent of test organisms;
 CRM = Clinch River Mile; ERM = Emory River Mile



Hyalella azteca Emory River IC₂₅ : Ash



Hyalella azteca Emory River IC₂₅ : Arsenic



Notes:

% = Percent; mg/kg = Milligrams per kilogram; IC₂₅ = Concentration that inhibits 25 percent of test organisms;
ERM = Emory River Mile



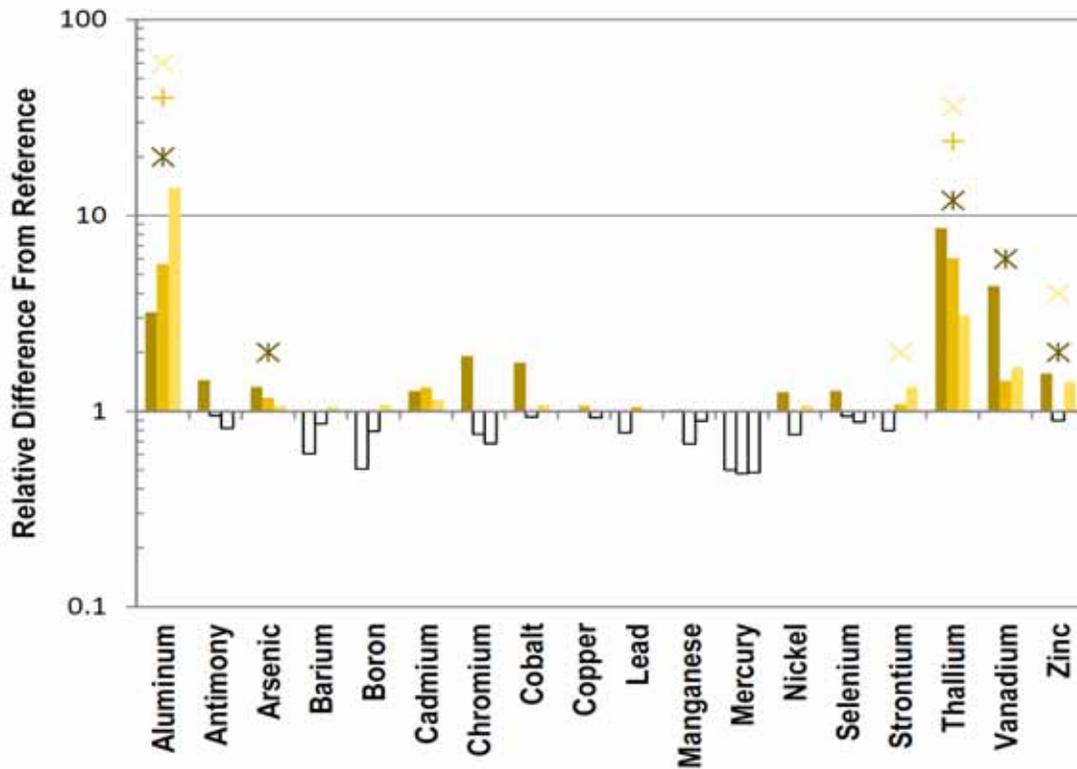
Pleurocera canaliculatum
silty horn snail



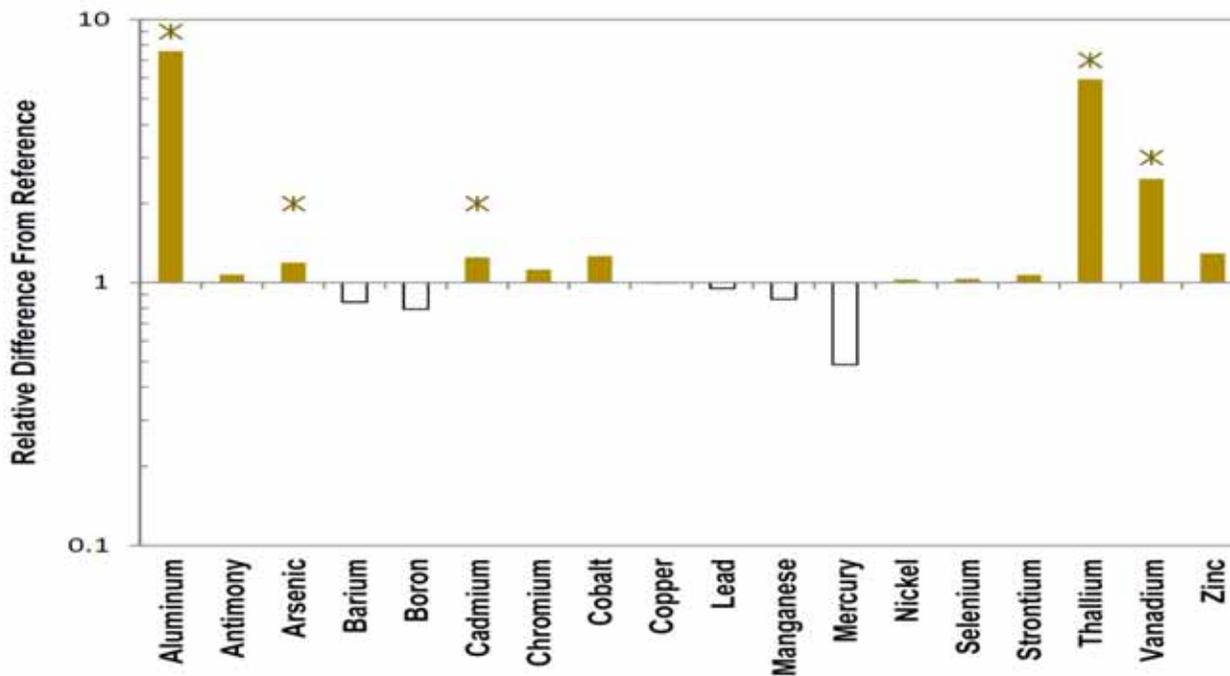
Hexagenia bilineata
burrowing mayfly - nymph



Hexagenia bilineata
burrowing mayfly - adult

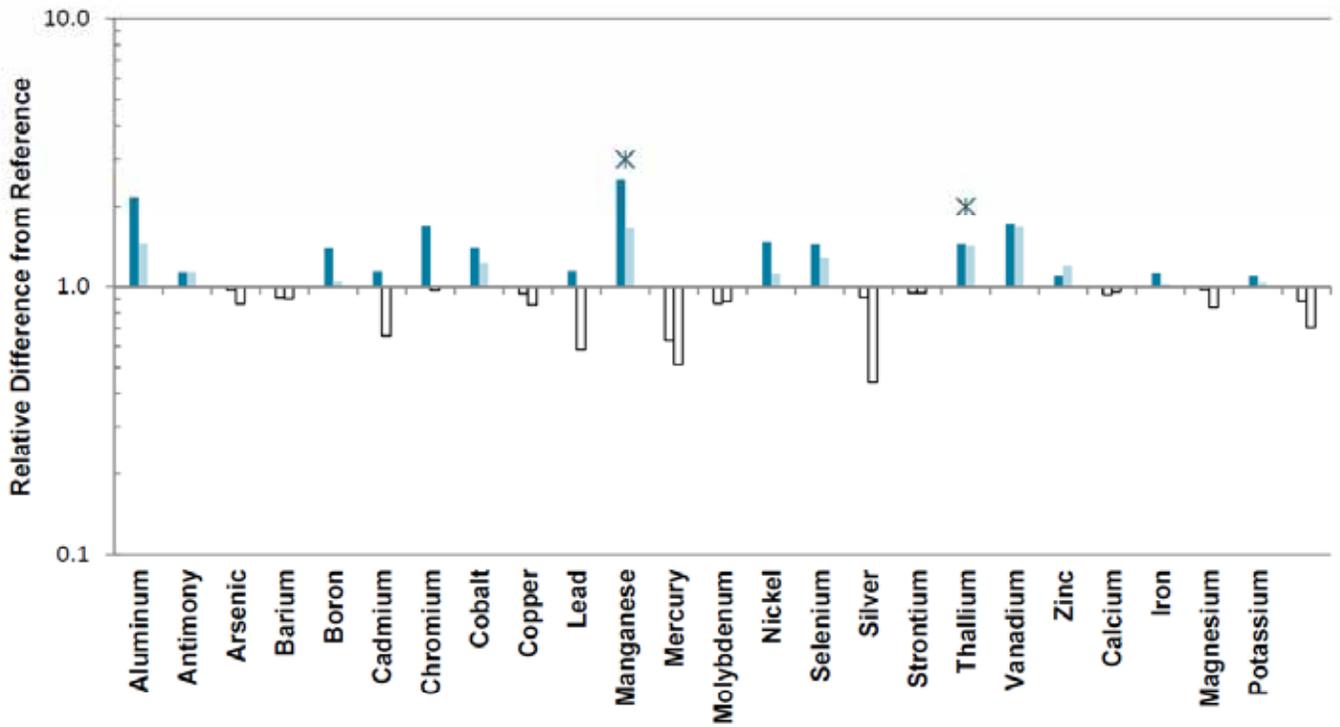


Emory River Depurated Snails

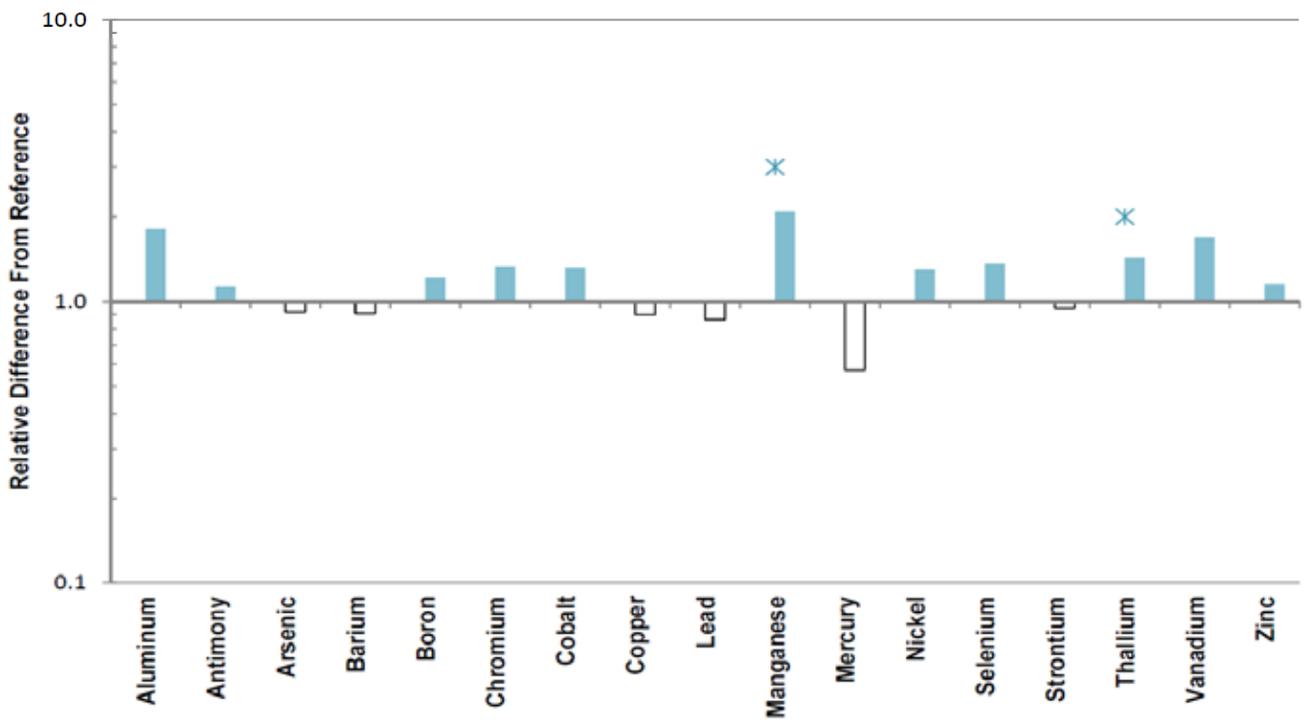


Emory River Depurated Snails



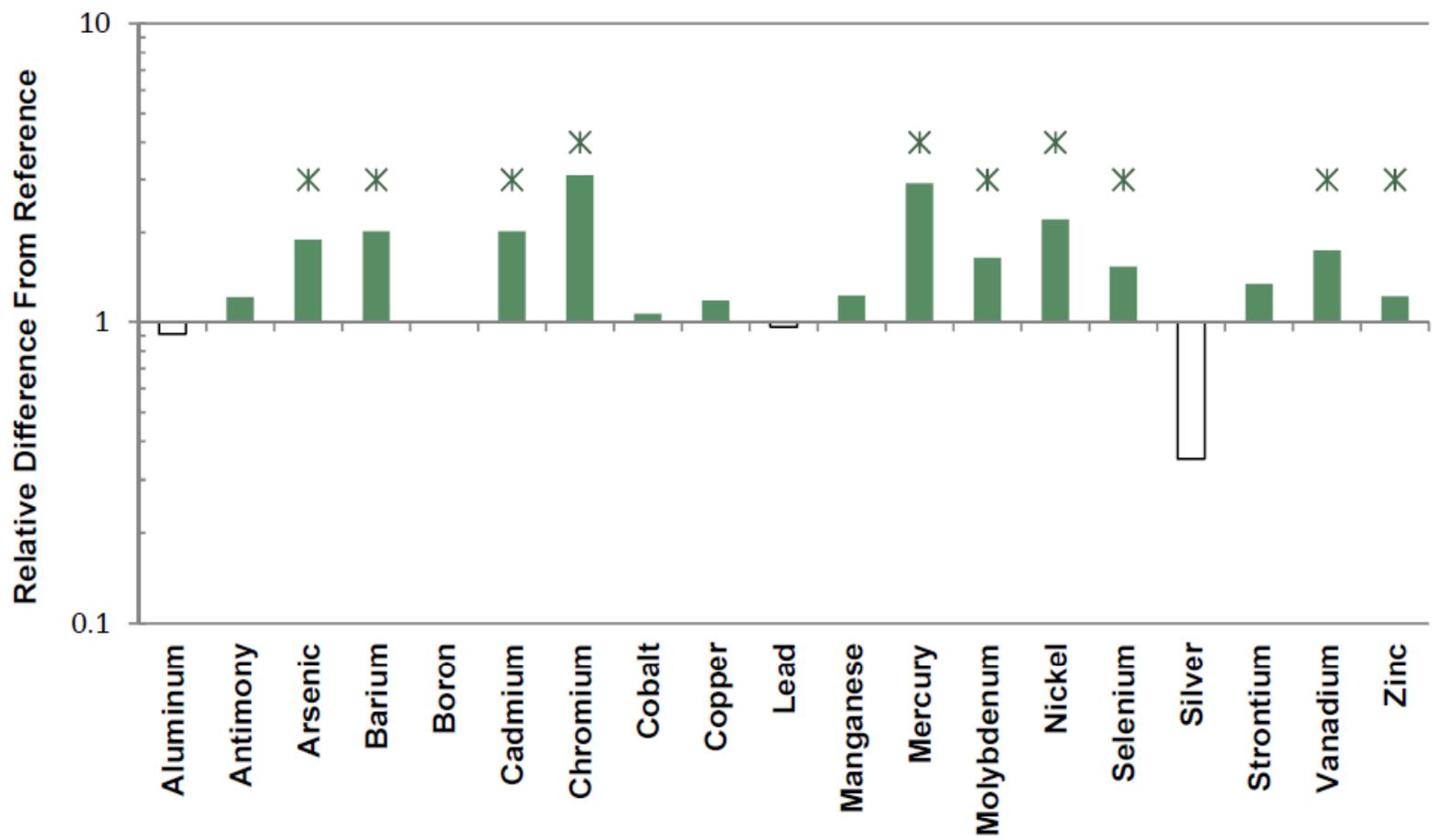


Clinch River Depurated Snails



Clinch River Depurated Snails



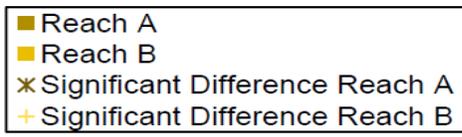
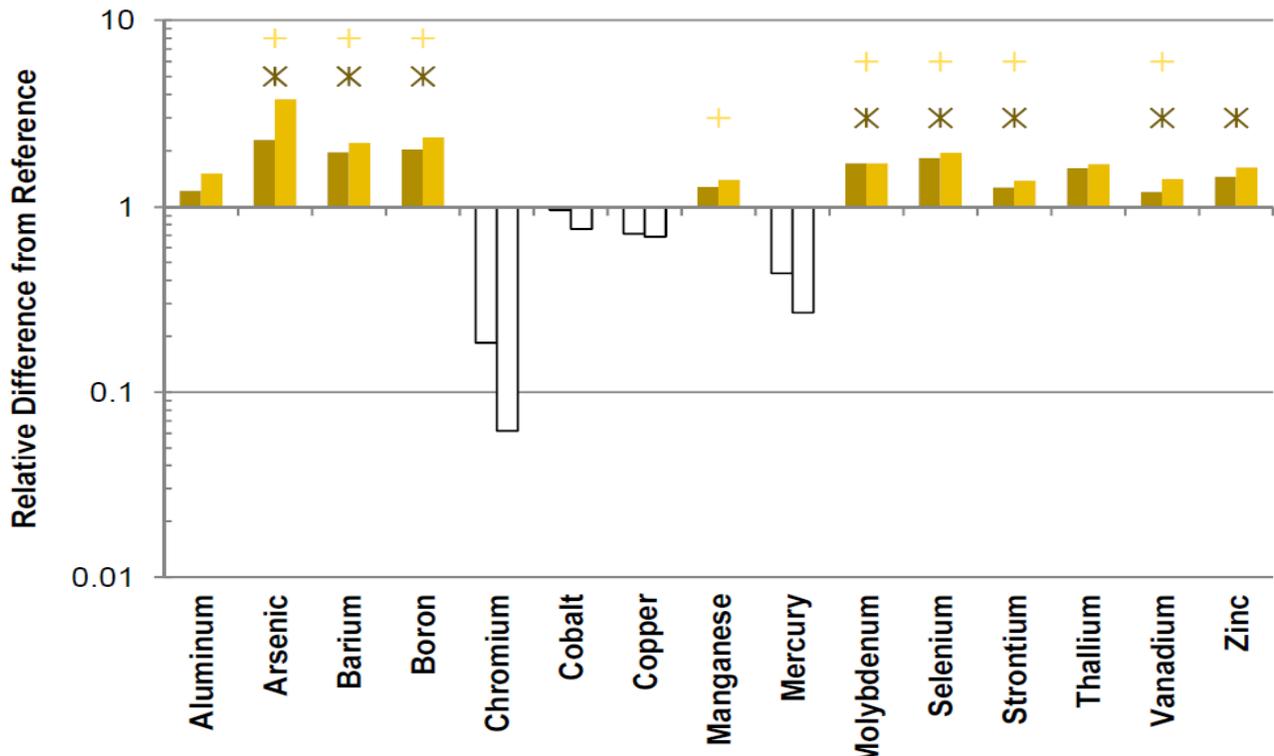


Tennessee River Depurated Snails

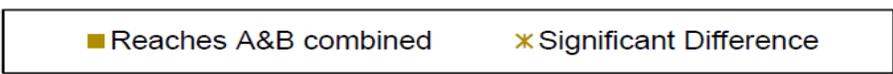
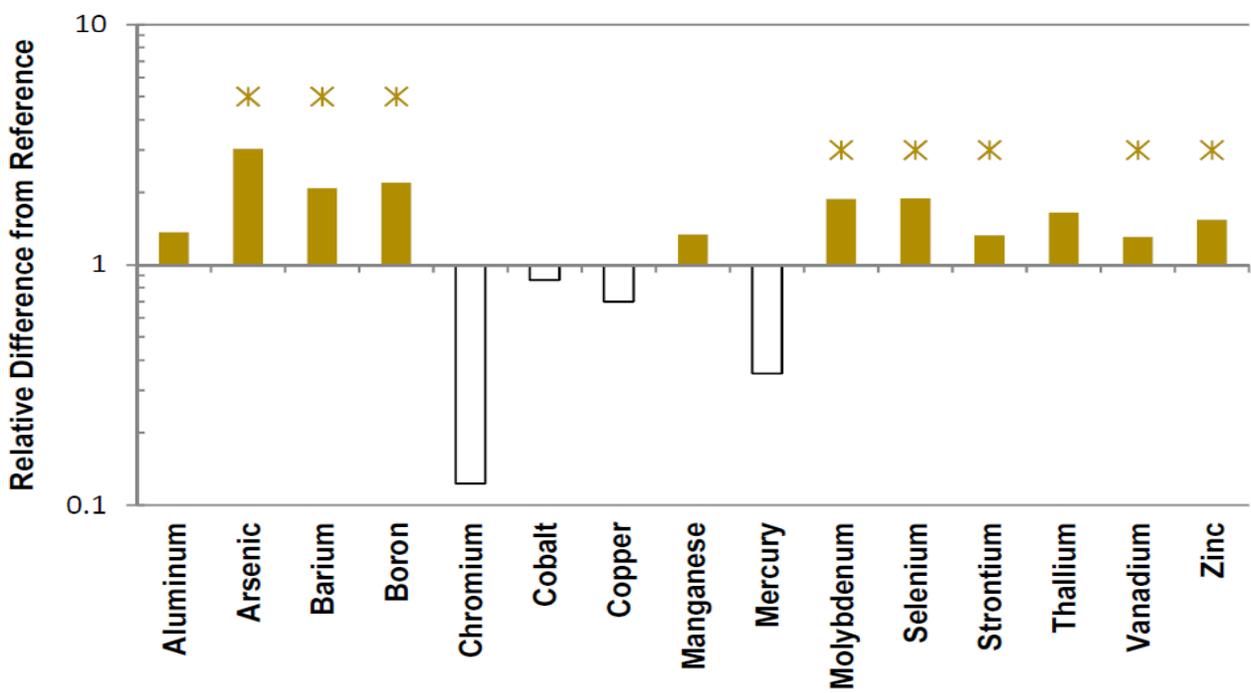
■ Reach B * Significant Difference

Notes: Arsenic, barium, cadmium, chromium, mercury, molybdenum, nickel, selenium, vanadium, and zinc were significant when excluding the Clinch River Reference.

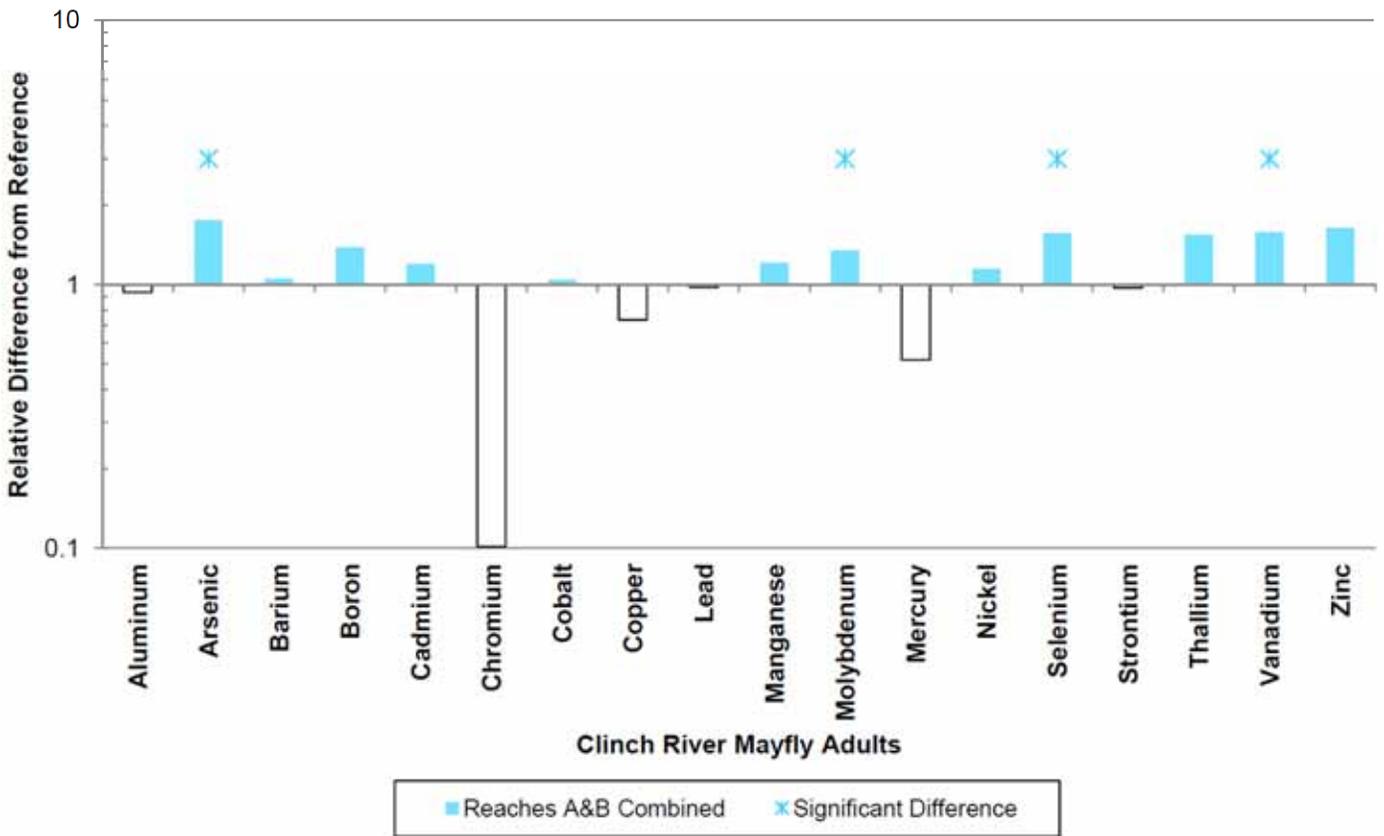
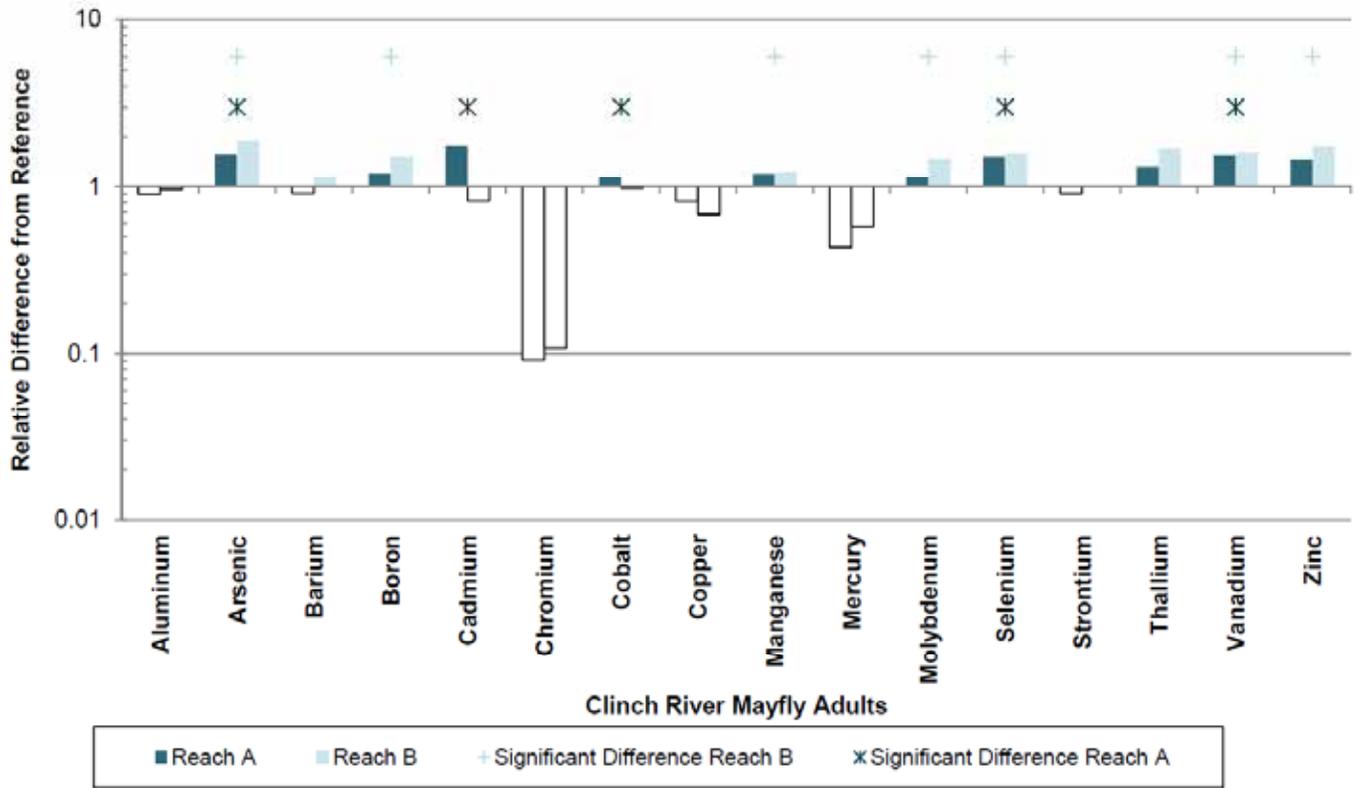


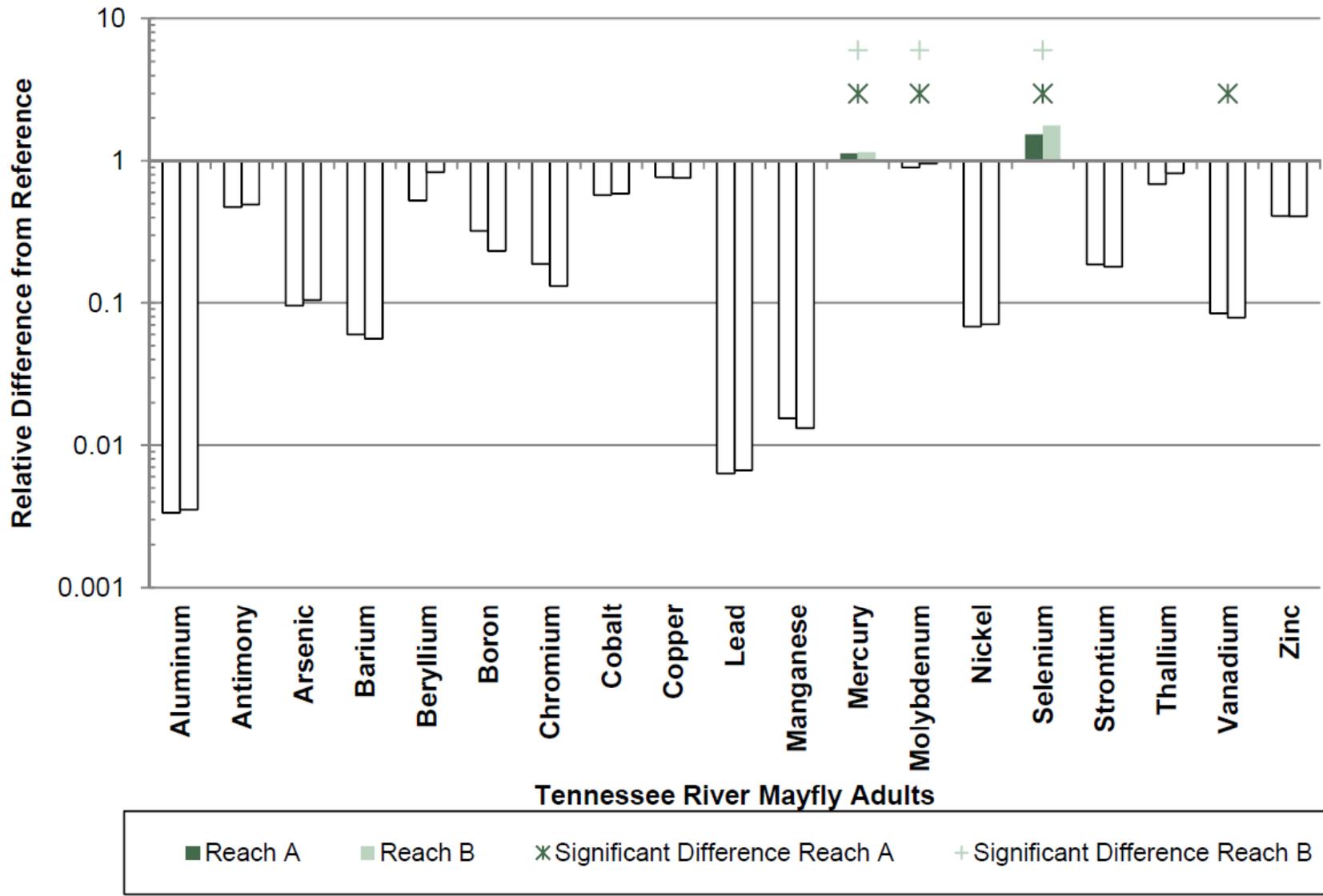


Emory River Mayfly Adults



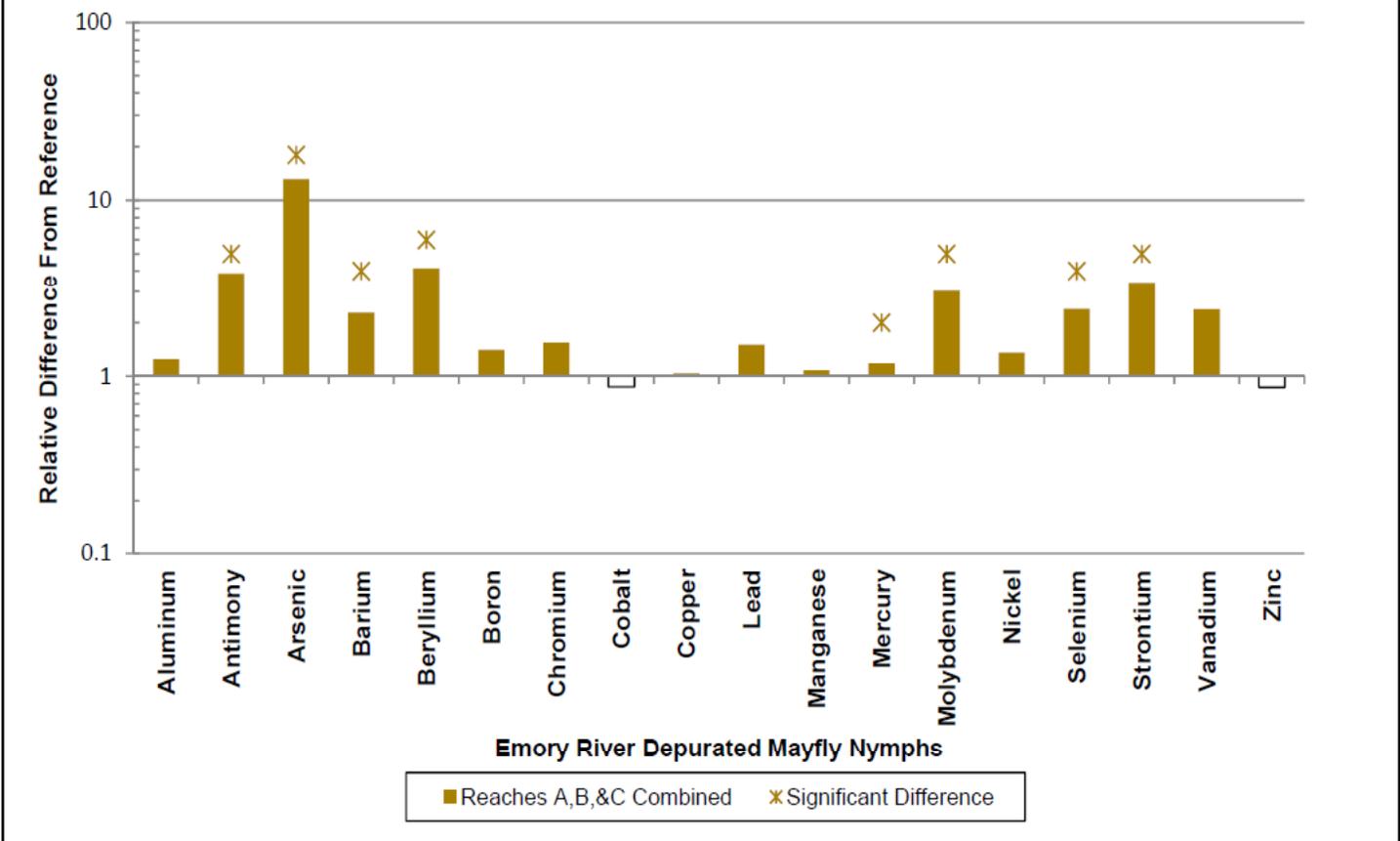
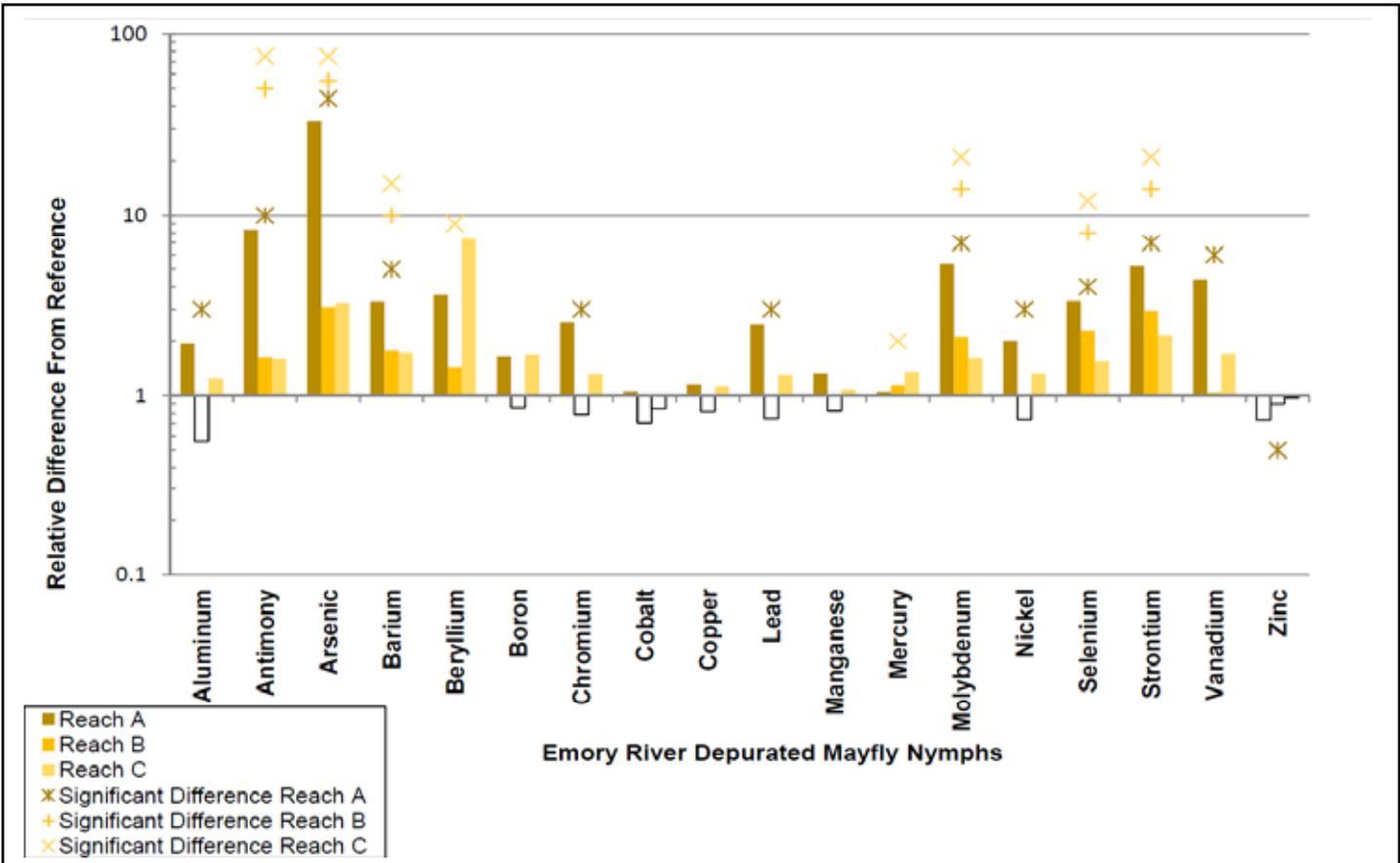
Emory River Mayfly Adults

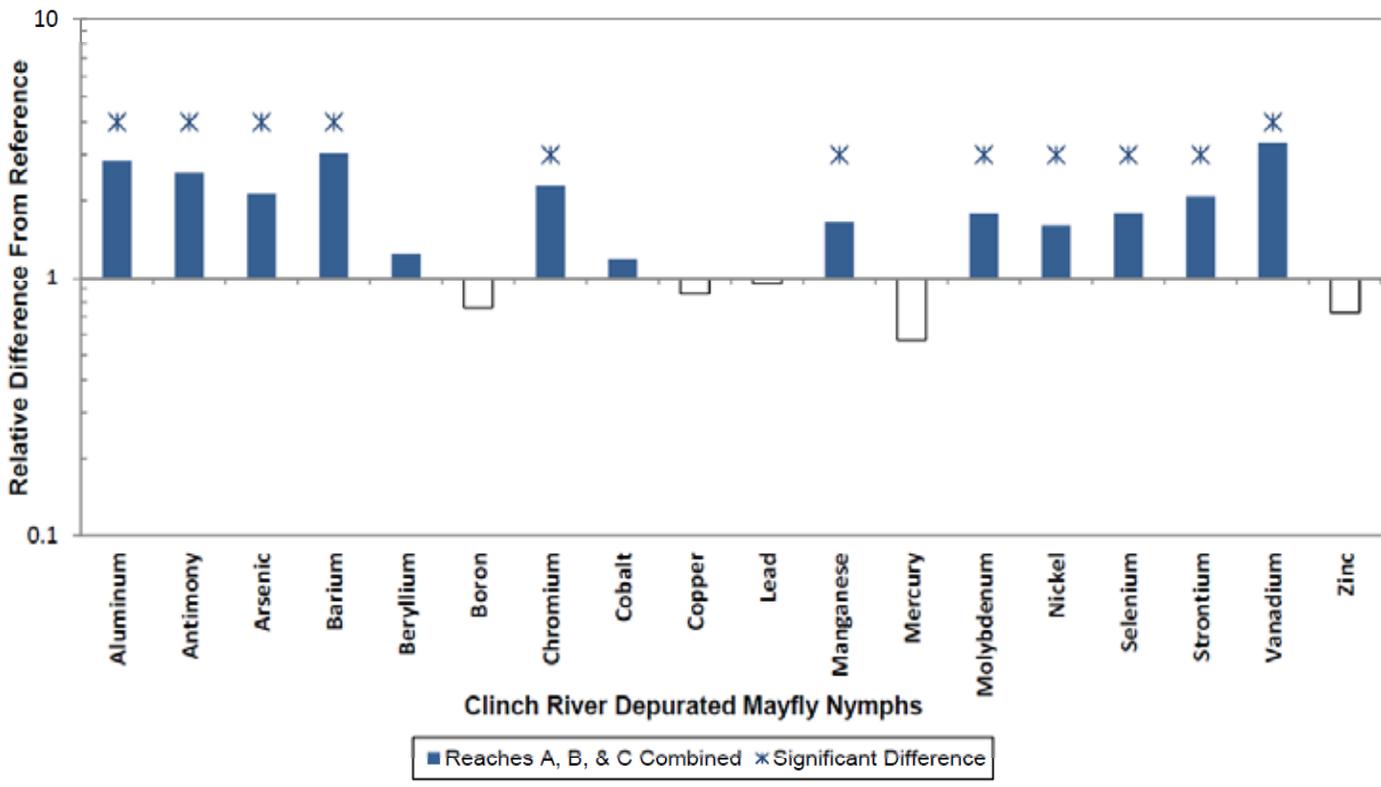
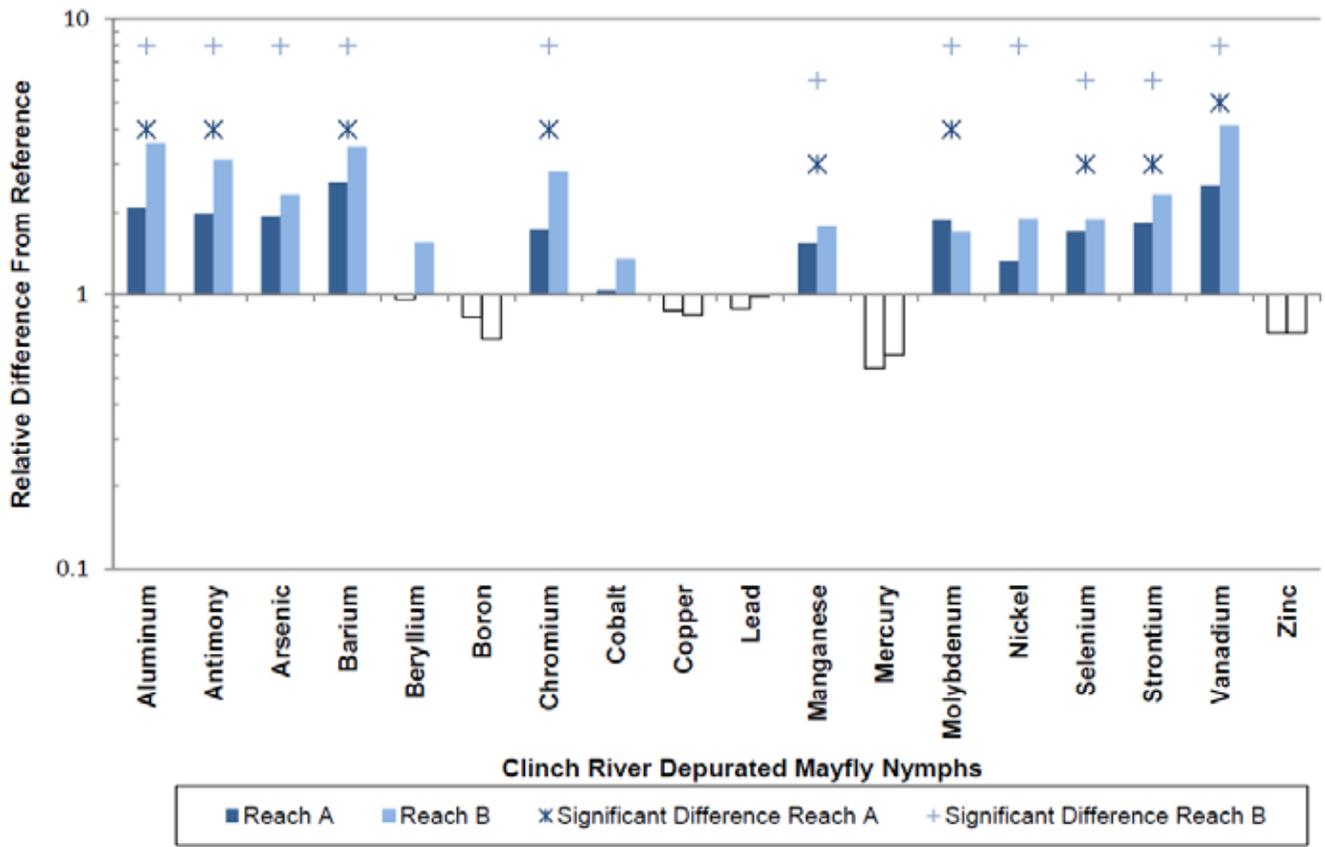


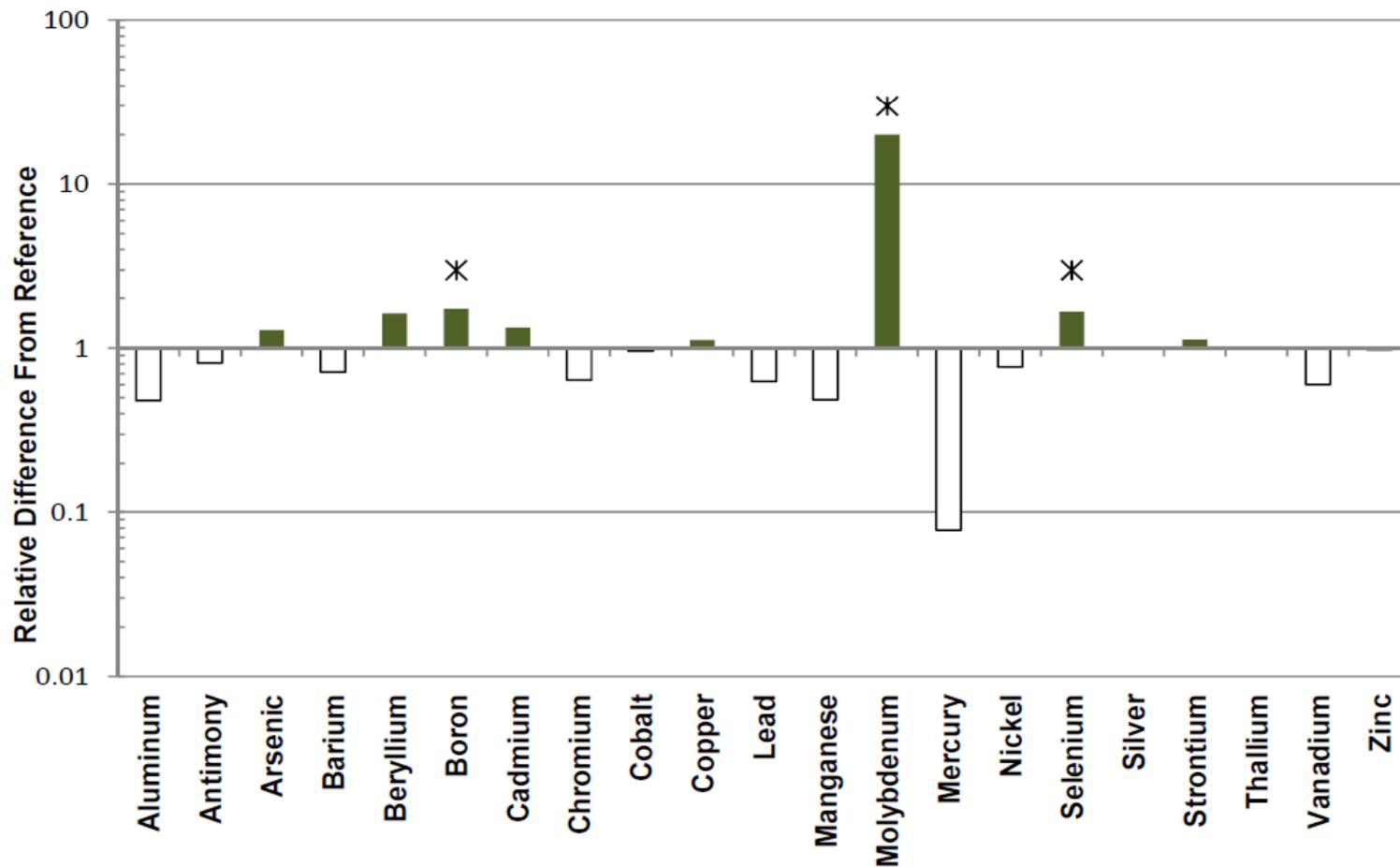


Notes: Mercury was significant when excluding the Clinch River Reference.



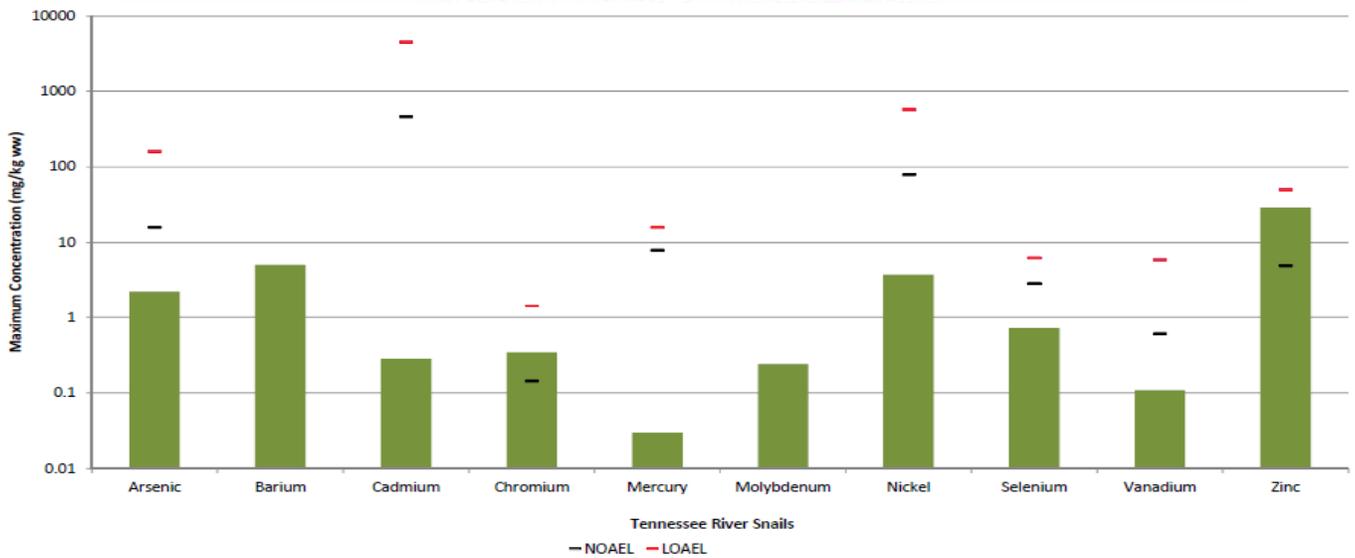
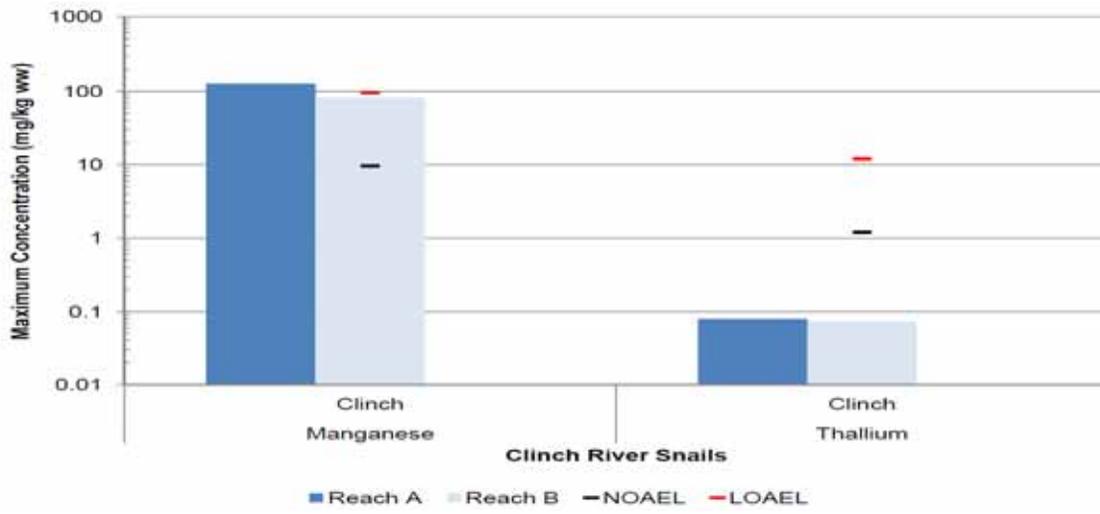
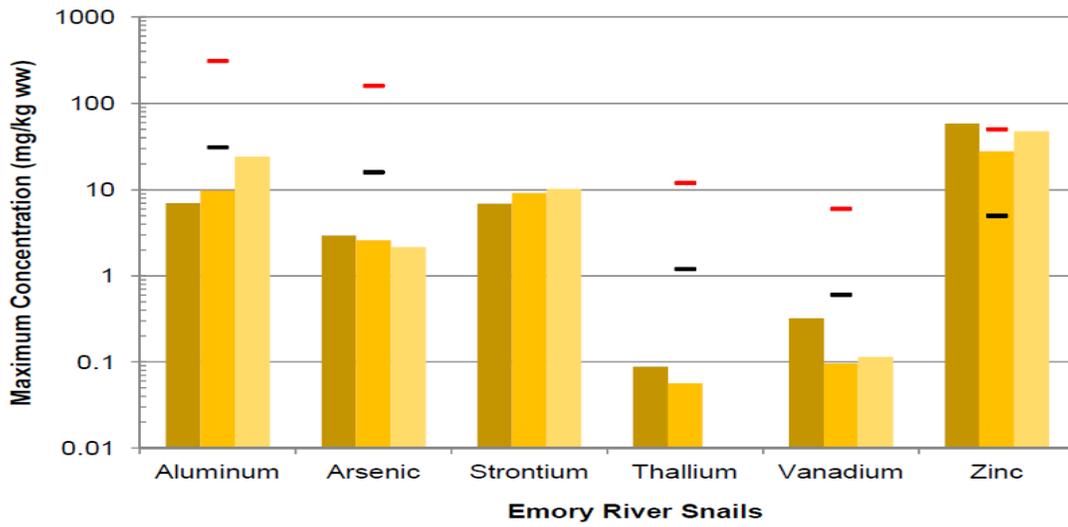






Tennessee River Depurated Mayfly Nymphs

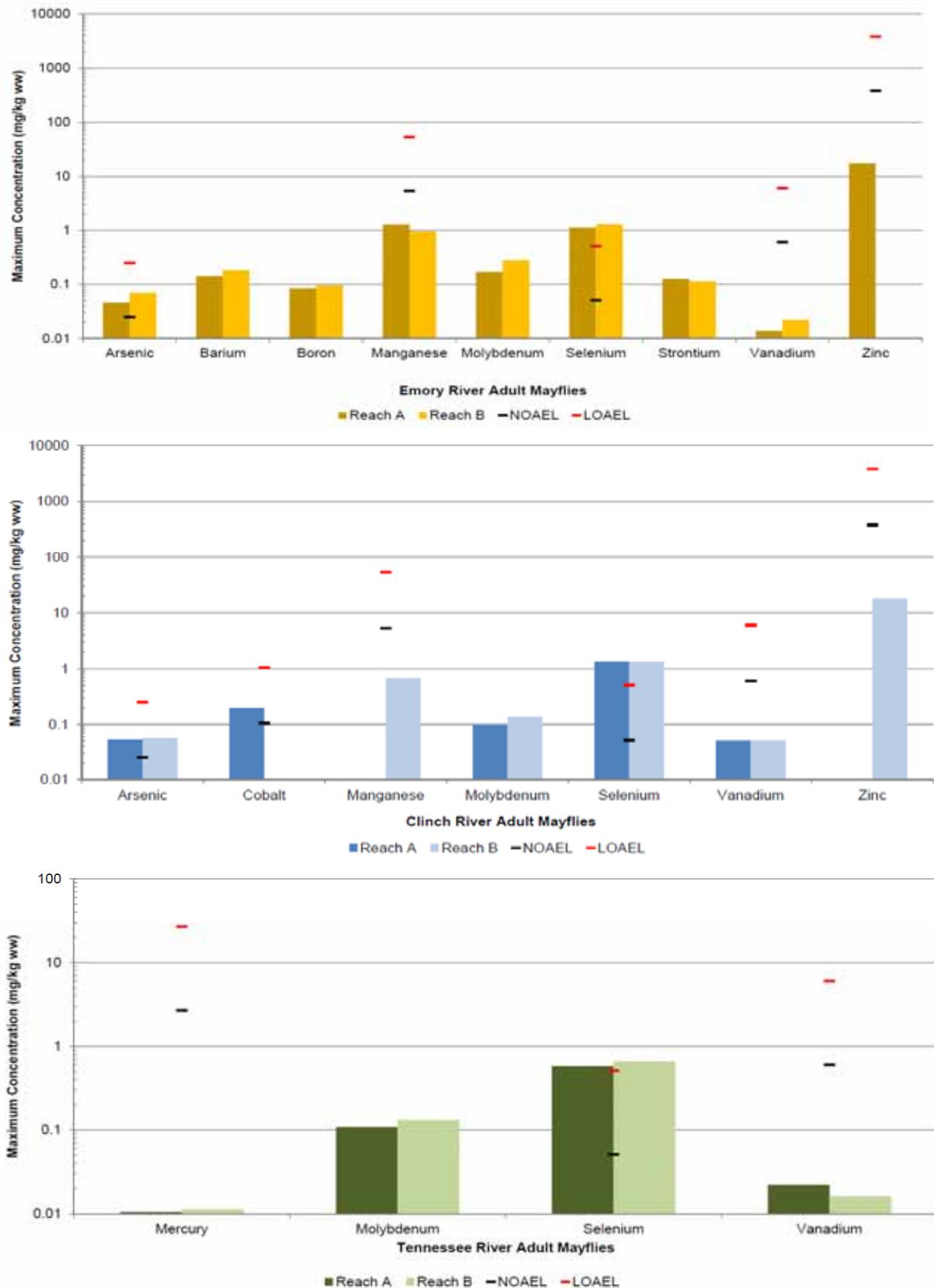




Notes: A percent moisture content of 80% was assumed for all tissue types.
 mg/kg = Milligrams per kilogram; ww = Wet weight

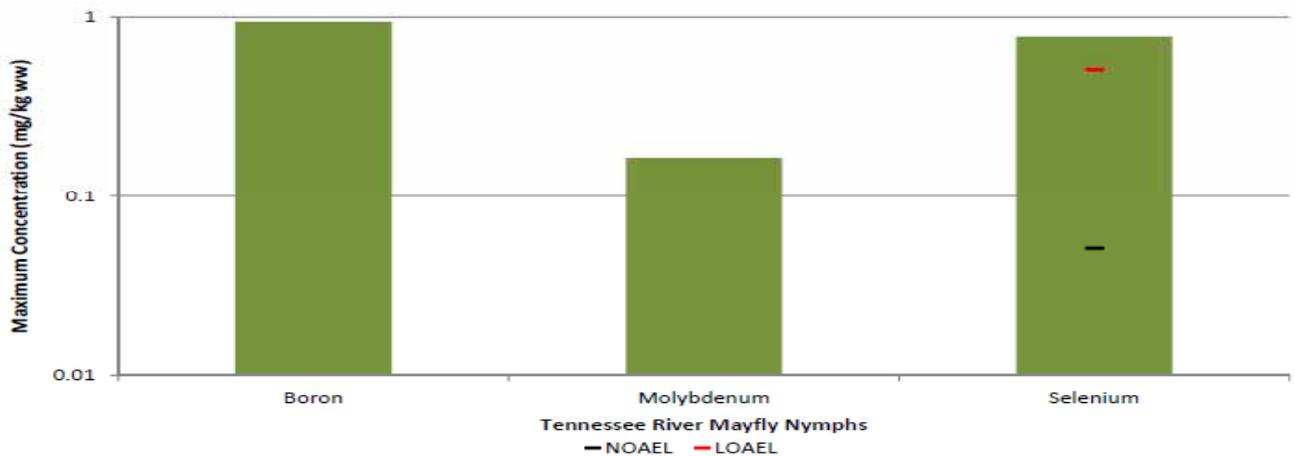
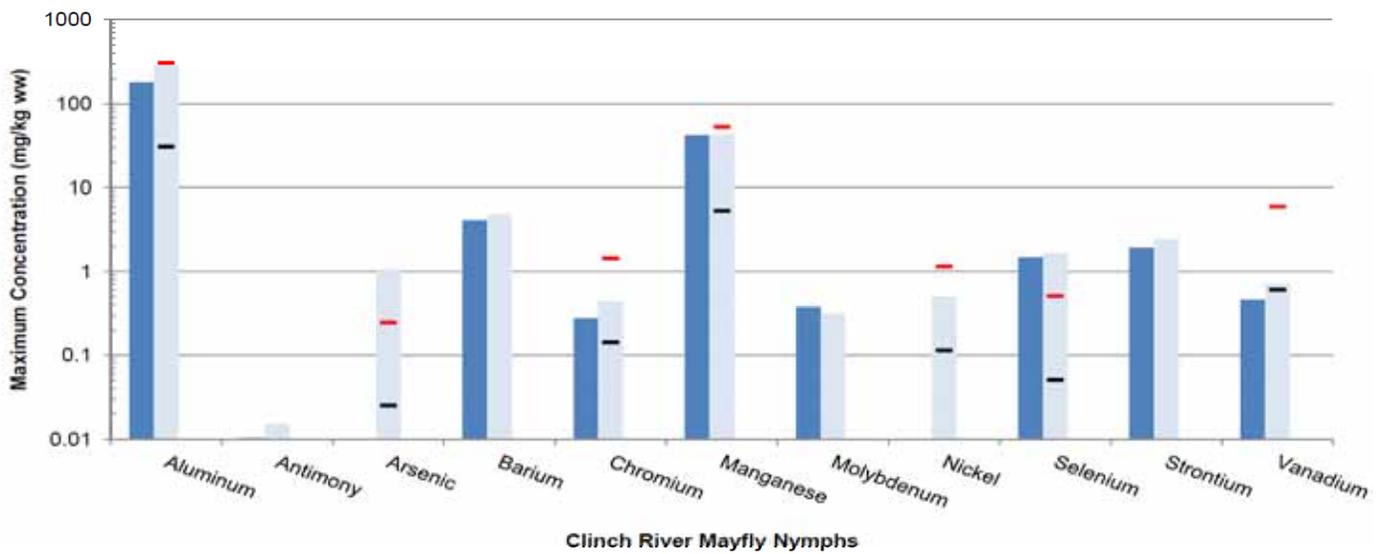
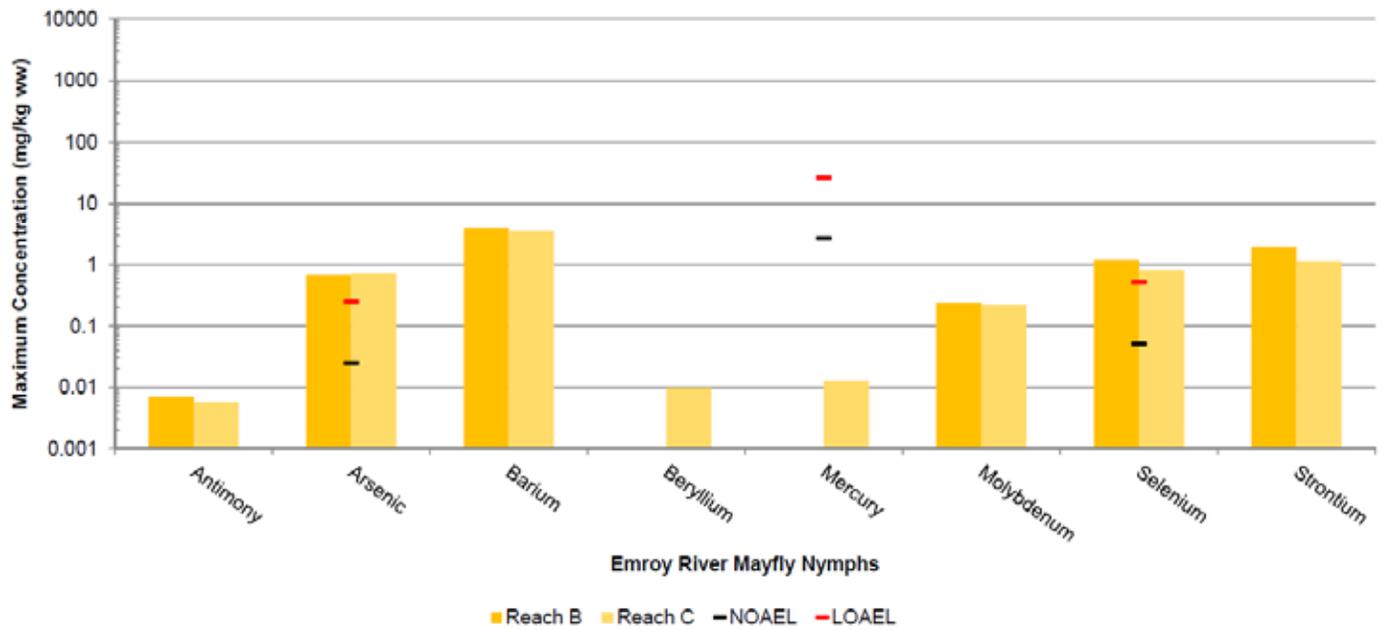


Critical Body Residue Comparisons for Snails
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



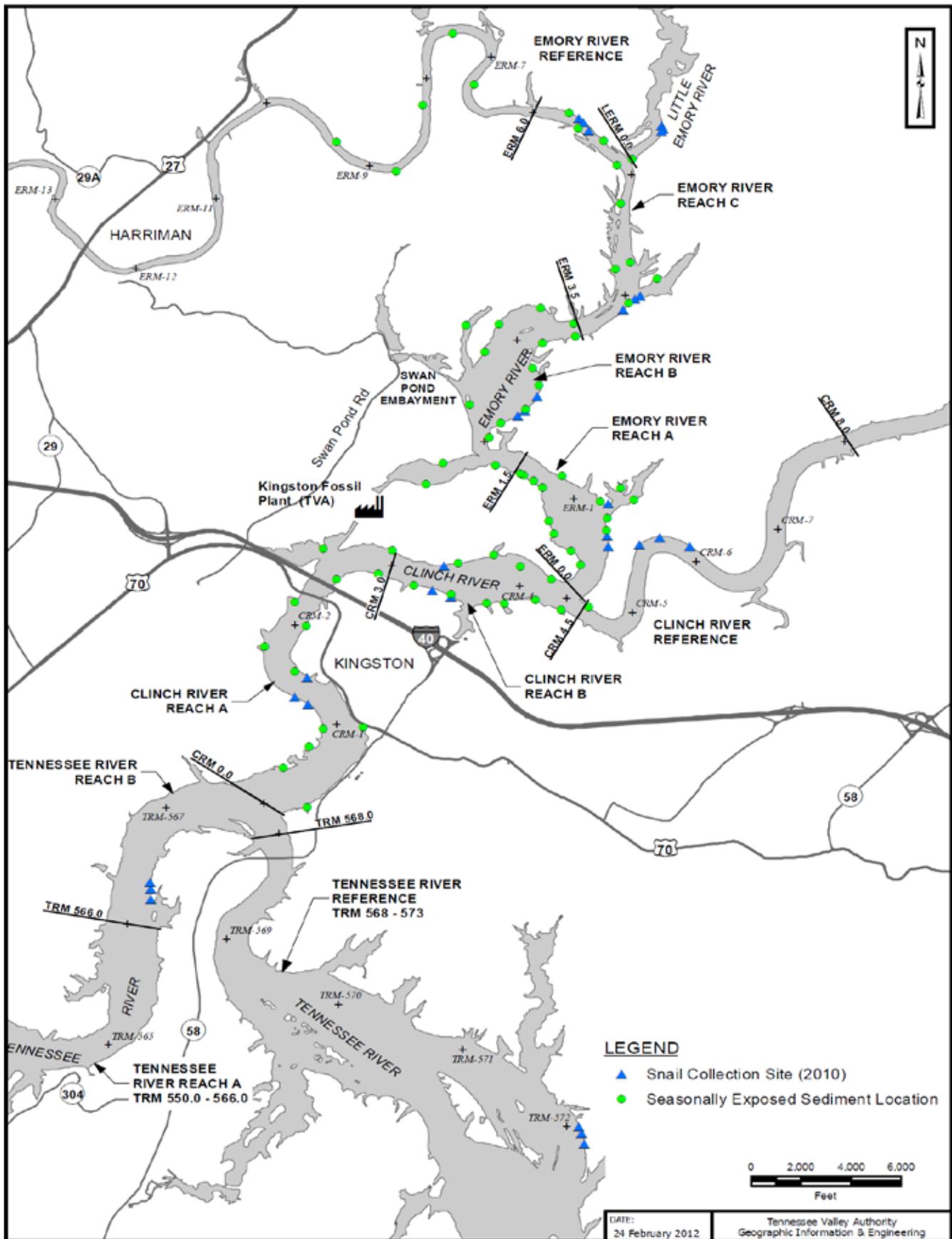
Notes: A percent moisture content of 80% was assumed for all tissue types.
 mg/kg= Milligrams per kilogram; ww= Wet weight





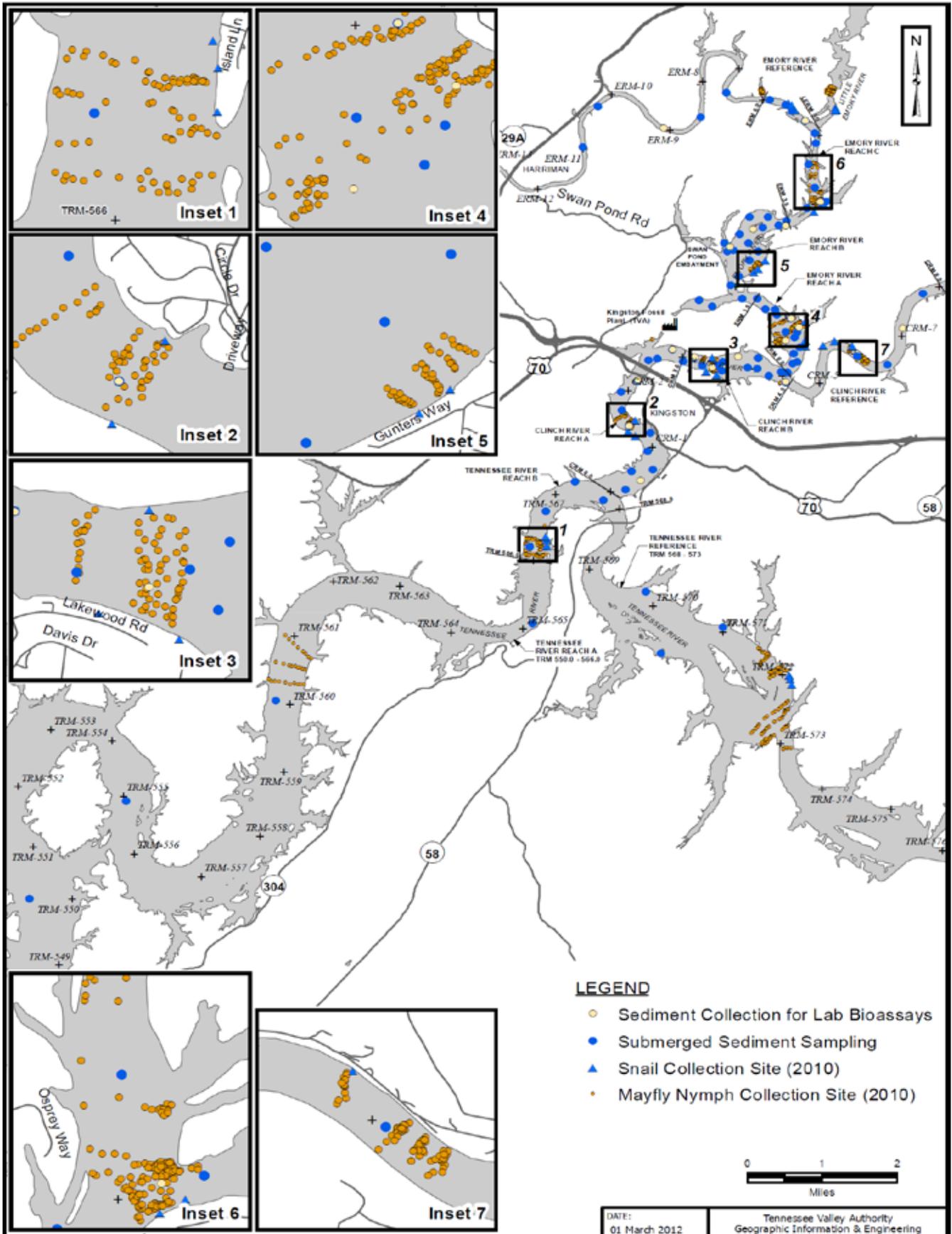
Notes: A percent moisture content of 80% was assumed for all tissue types.
 mg/kg= Milligrams per kilogram; ww= Wet weight



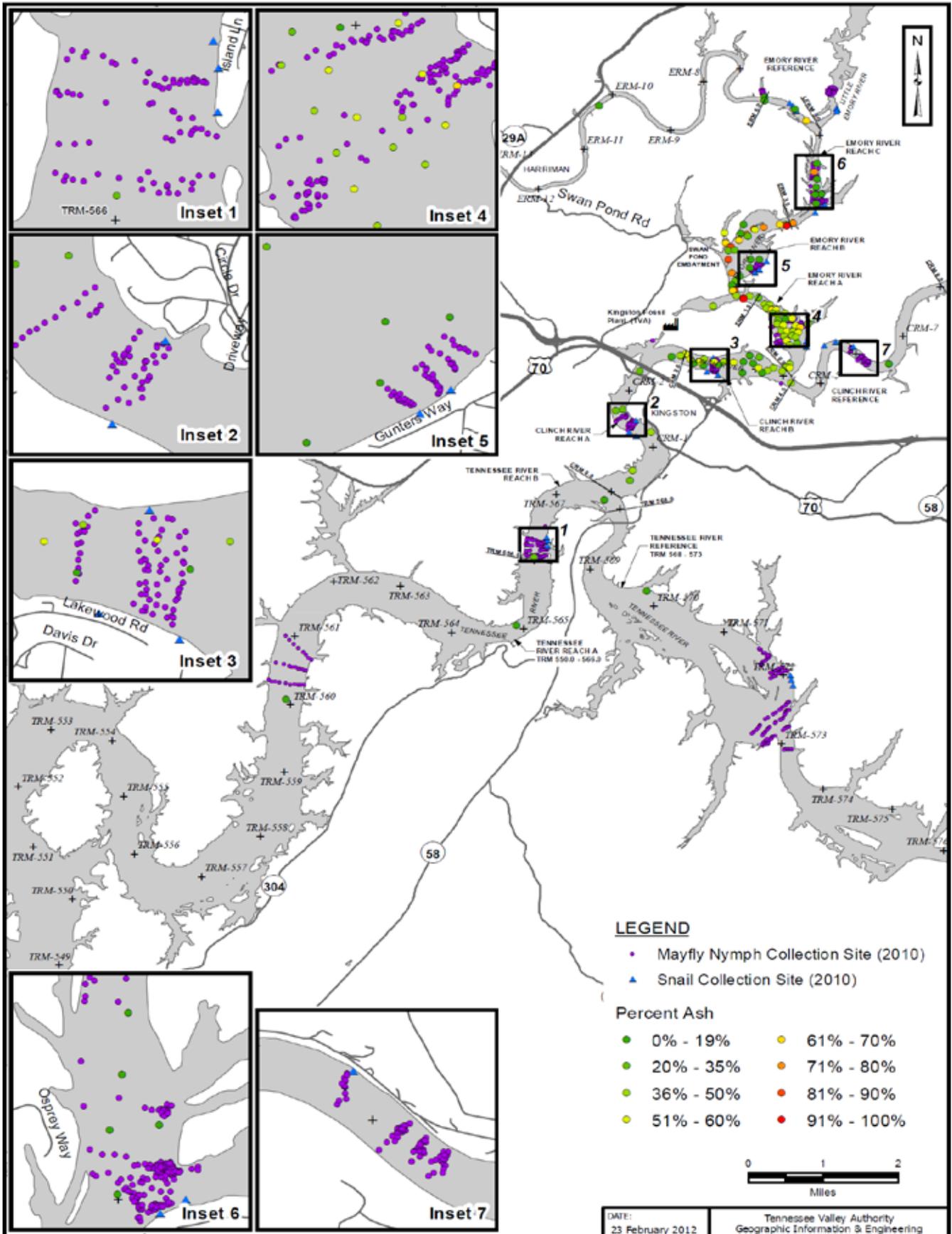


Benthic Invertebrate and Seasonally-Exposed Sediment Sampling Locations
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE



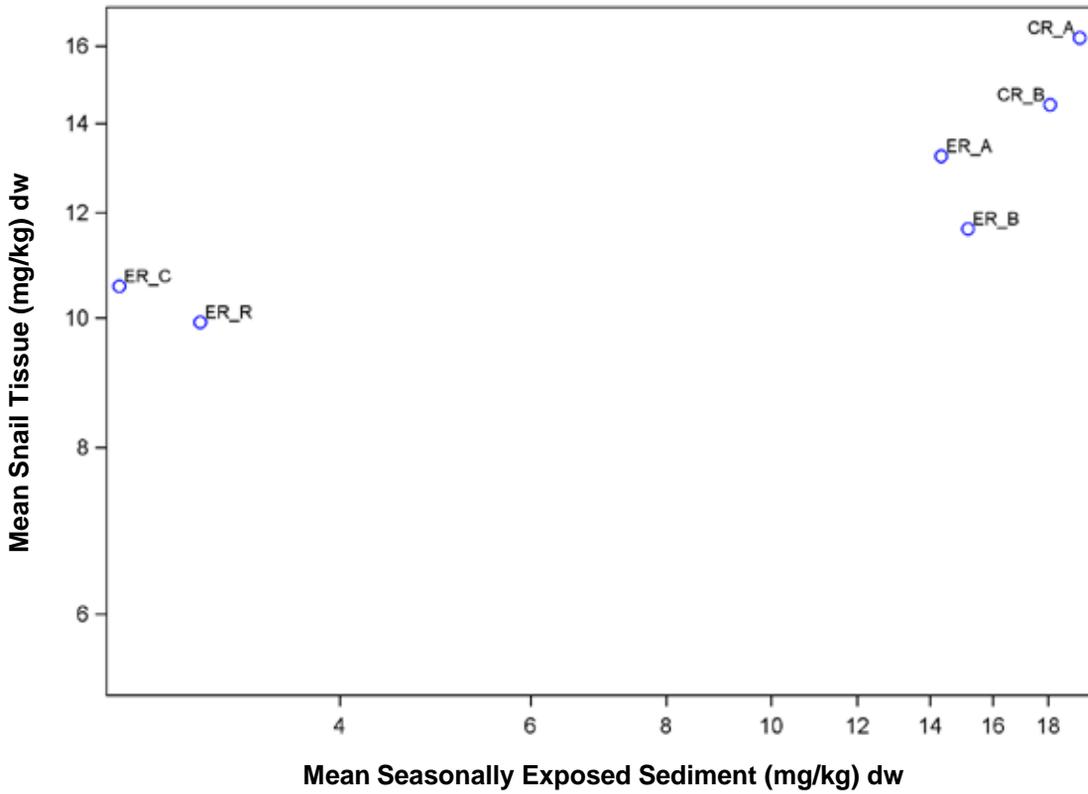


Benthic Invertebrate and Sediment Sampling Locations
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

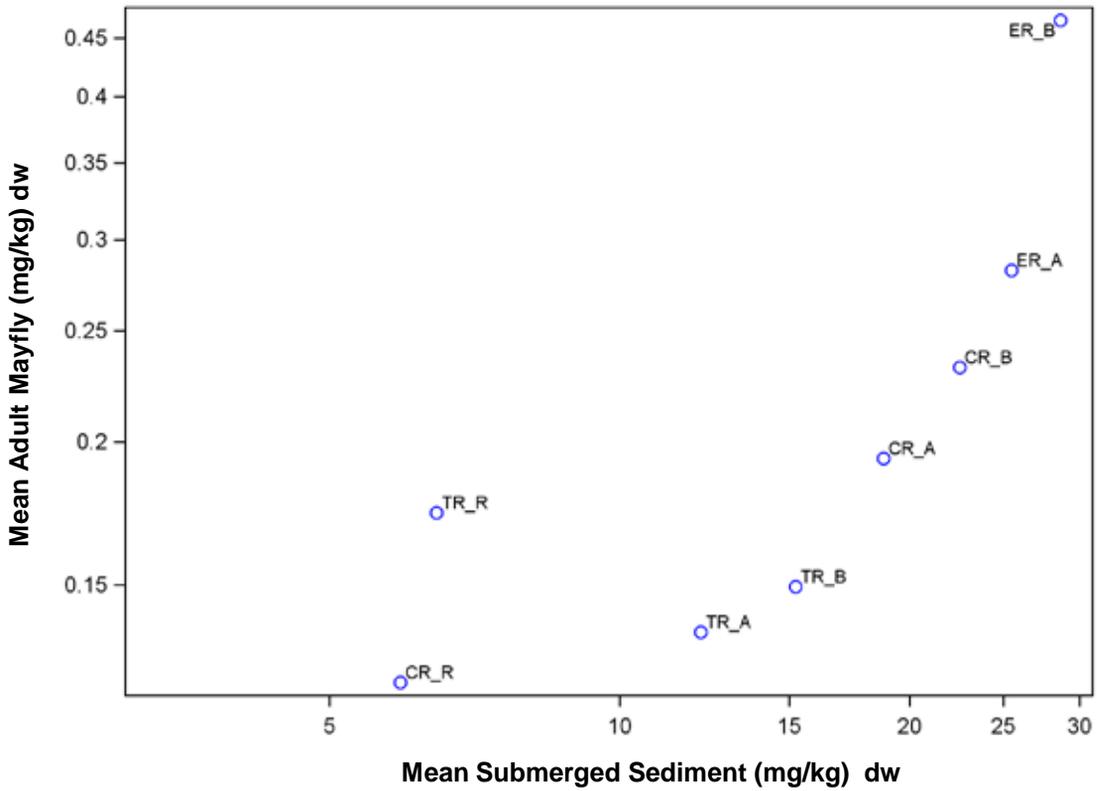


Benthic Invertebrate and Percent Ash Sampling Locations
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

Arsenic



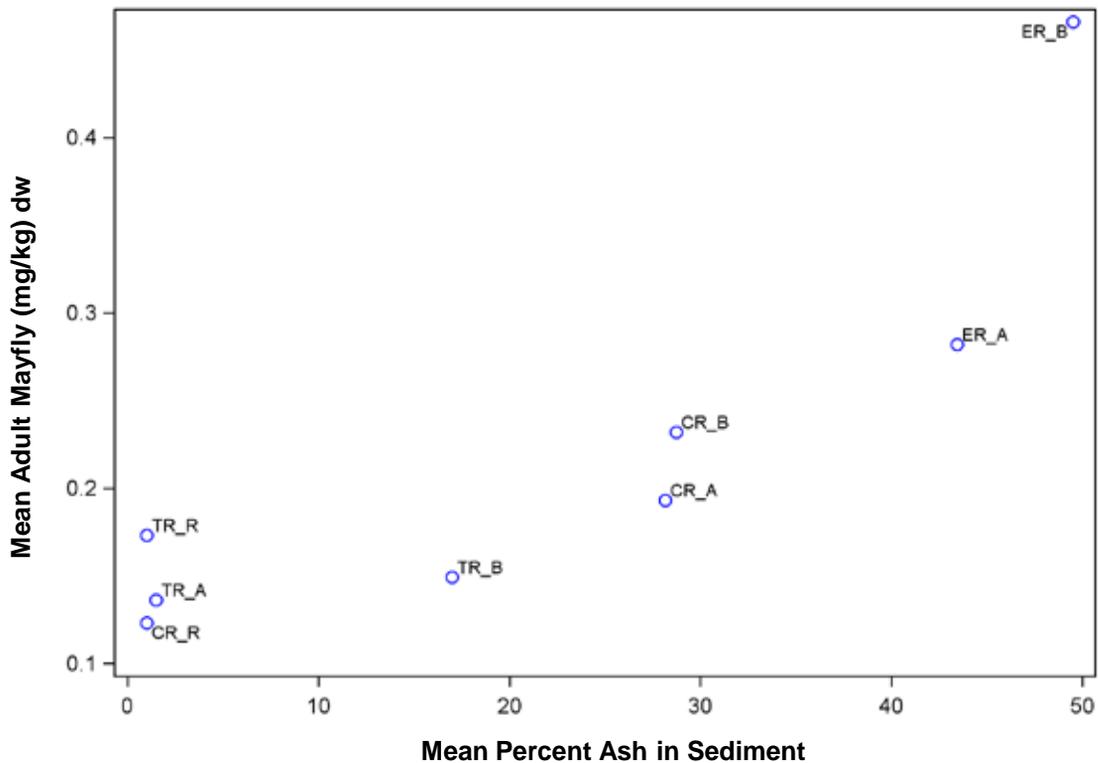
Arsenic



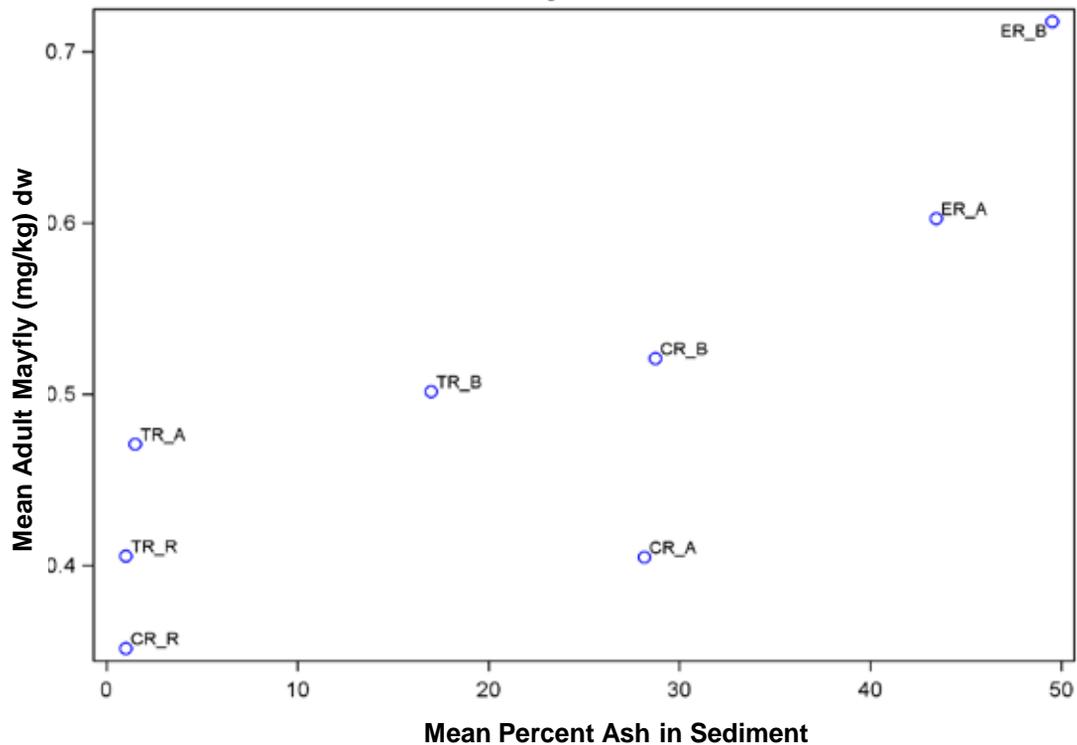
Notes:
mg/kg = Milligrams per kilogram; dw = Dry weight;
ER = Emory River Reach; CR = Clinch River Reach; TR = Tennessee River Reach; R = Reference;



Arsenic



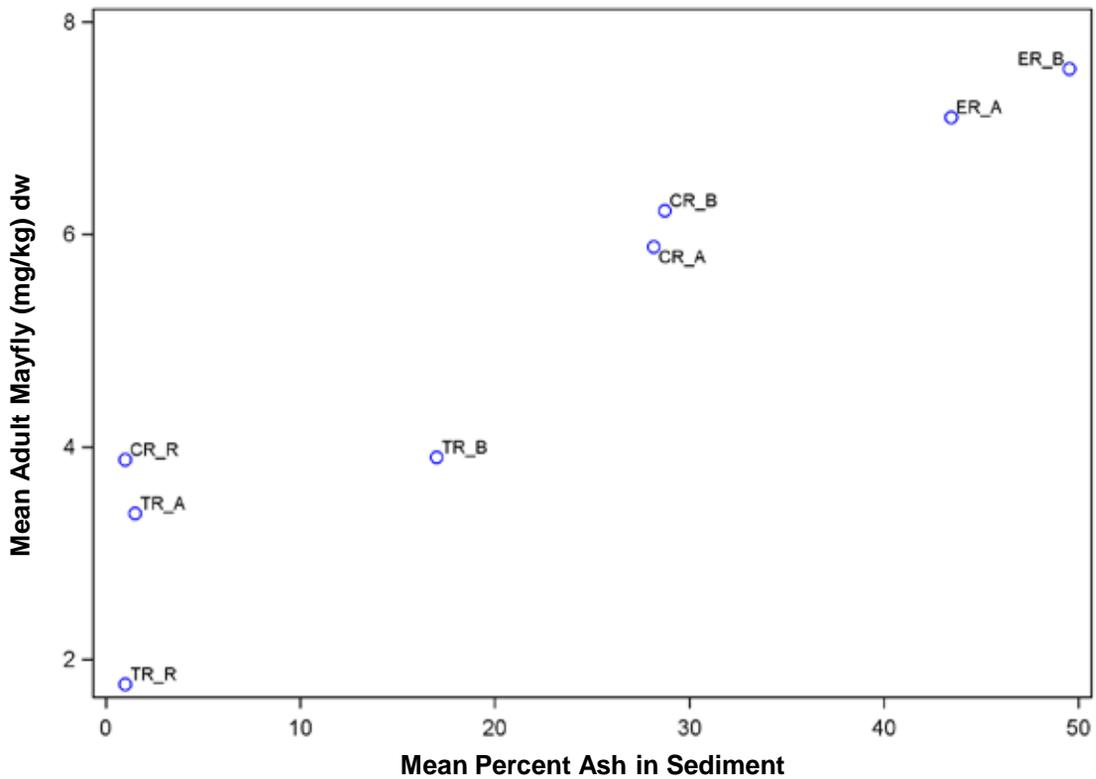
Molybdenum



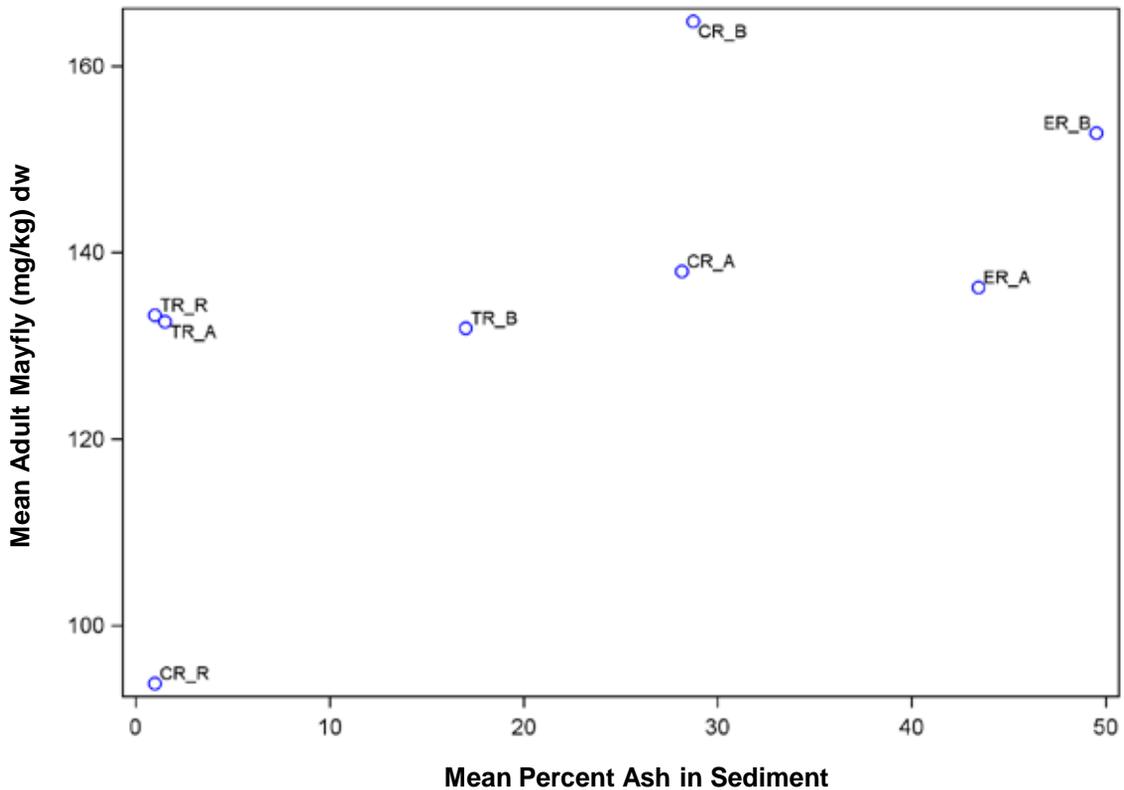
Notes:
mg/kg = Milligrams per kilogram; dw = Dry weight;
ER = Emory River Reach; CR = Clinch River Reach; TR = Tennessee River Reach; R = Reference;



Selenium



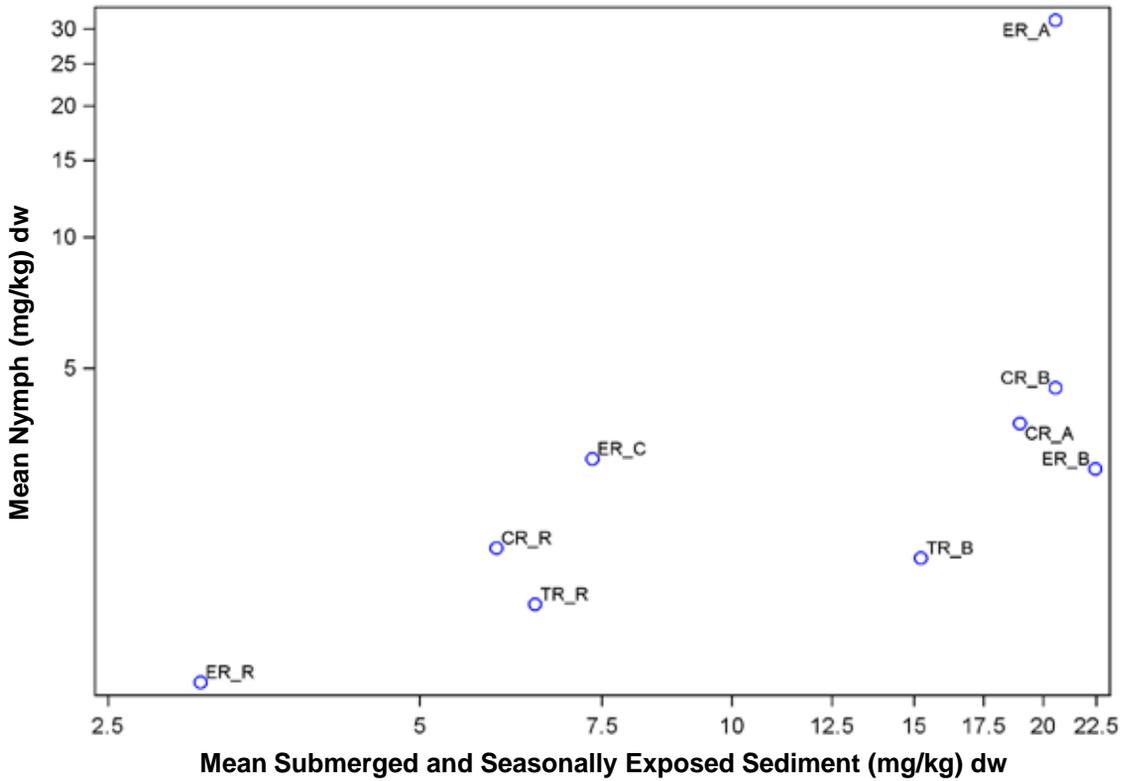
Zinc



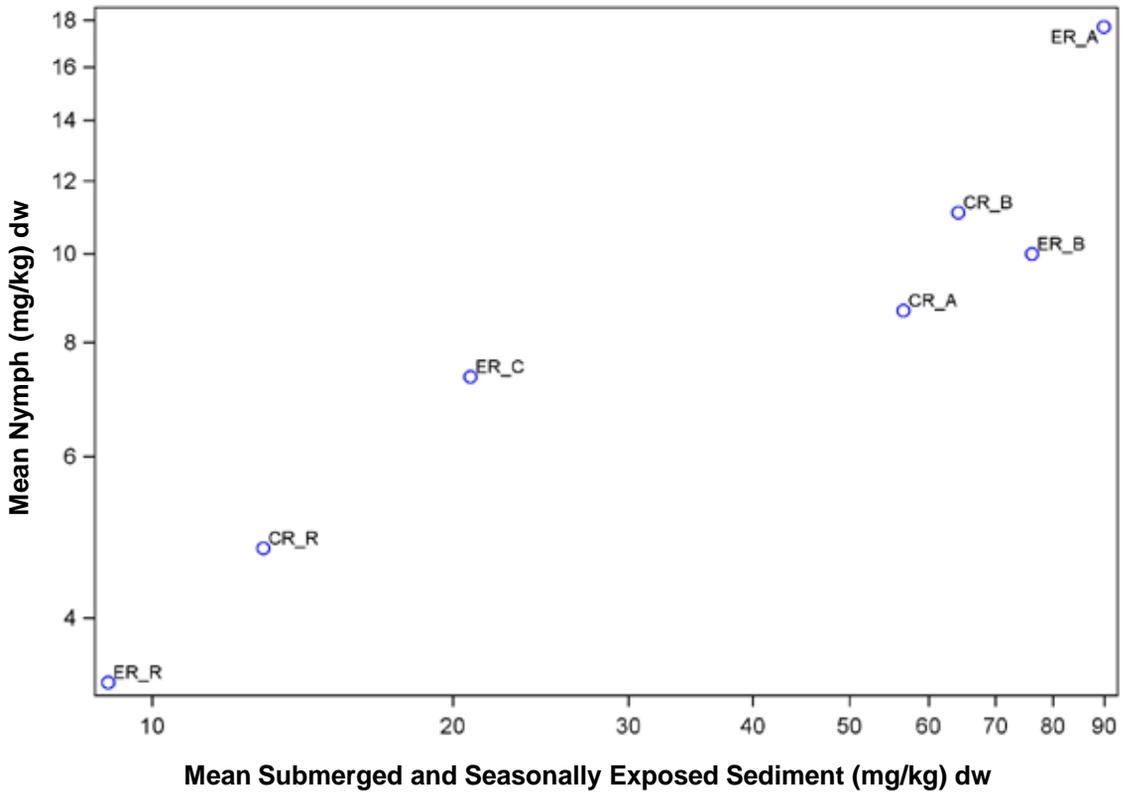
Notes:
mg/kg = Milligrams per kilogram; dw = Dry weight;
ER = Emory River Reach; CR = Clinch River Reach; TR = Tennessee River Reach; R = Reference;



Arsenic



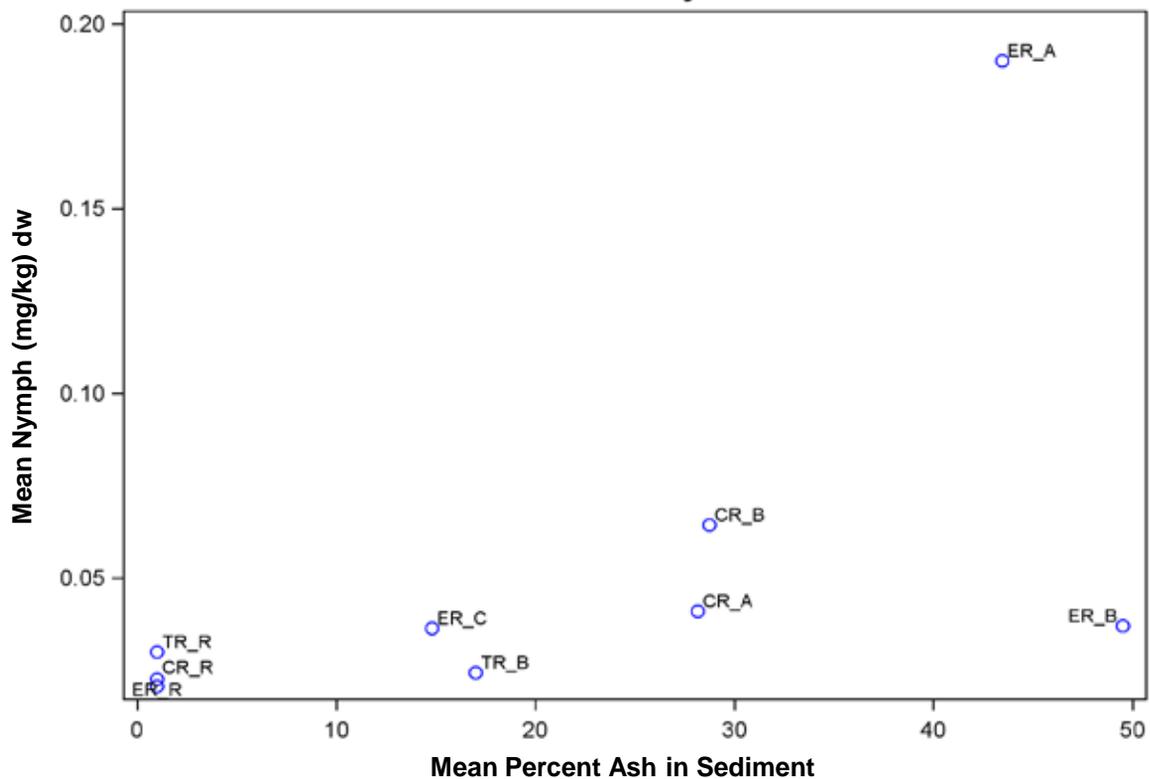
Strontium



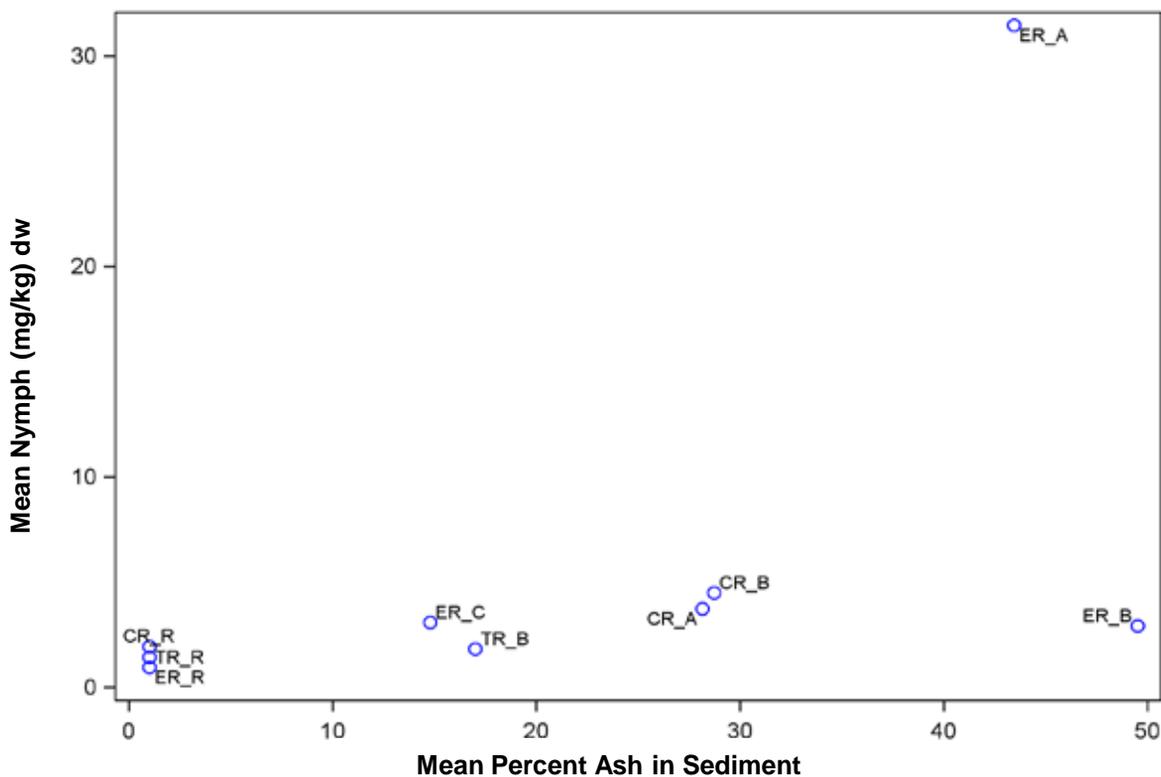
Notes:
mg/kg = Milligrams per kilogram; dw= Dry weight;
ER= Emory River Reach; CR= Clinch River Reach; TR= Tennessee River Reach; R= Reference;



Antimony



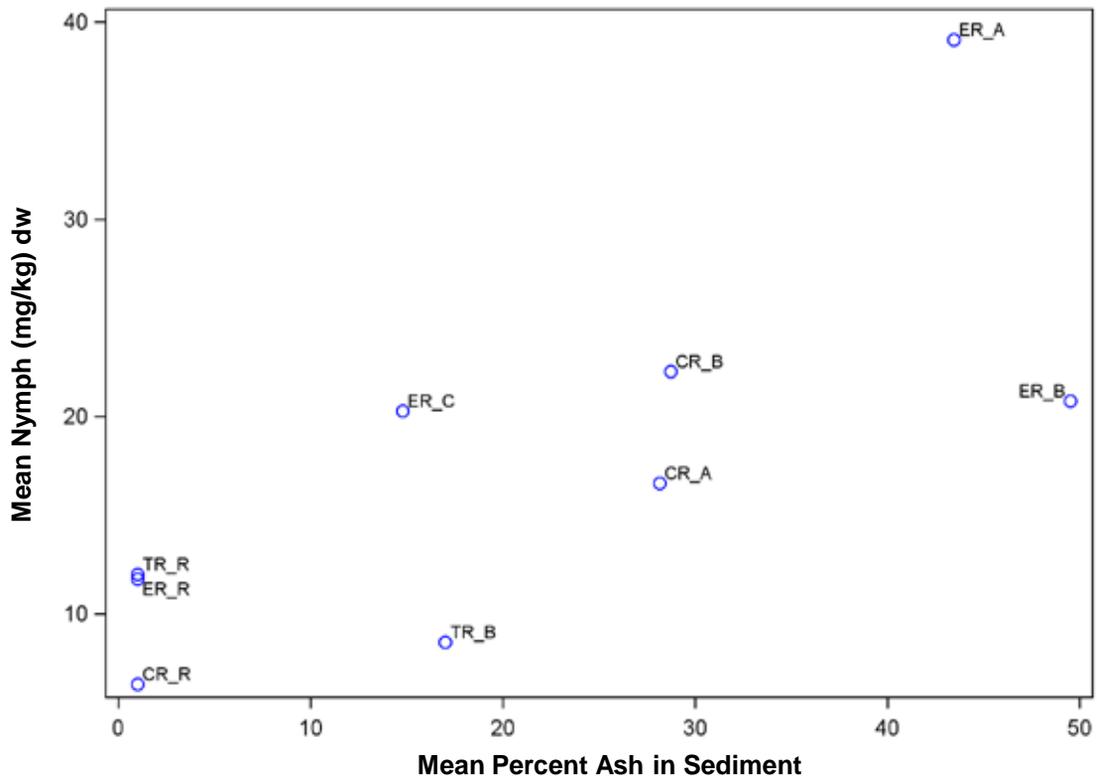
Arsenic



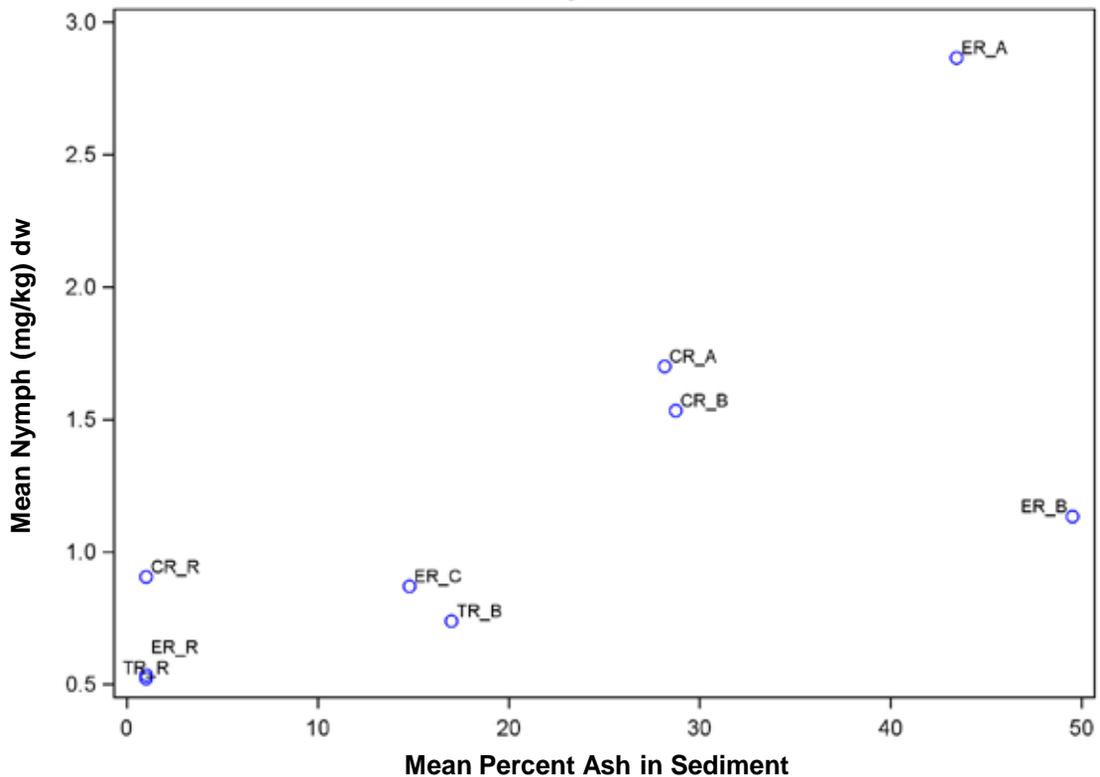
Notes:
mg/kg = Milligrams per kilogram; dw= Dry weight;
ER= Emory River Reach; CR= Clinch River Reach; TR= Tennessee River Reach; R= Reference;



Barium

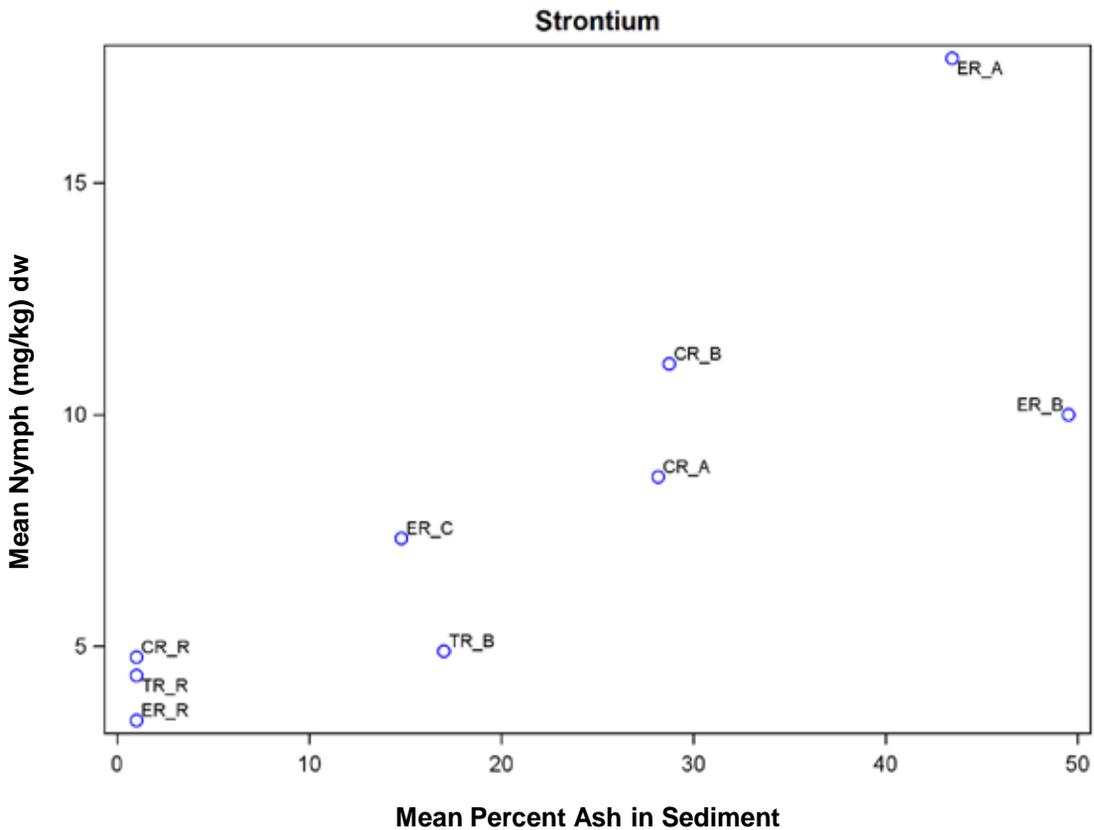
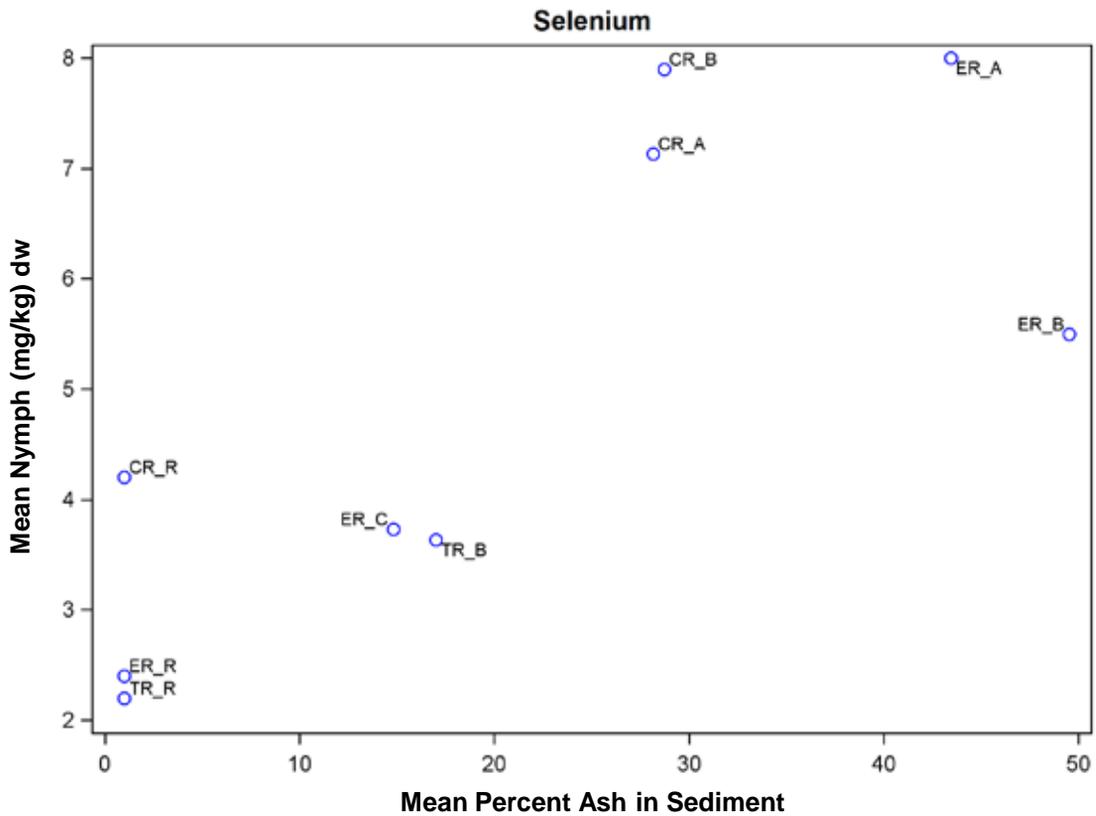


Molybdenum



Notes:
mg/kg = Milligrams per kilogram; dw= Dry weight;
ER= Emory River Reach; CR= Clinch River Reach; TR= Tennessee River Reach; R= Reference;





Notes:
 mg/kg = Milligrams per kilogram; dw= Dry weight;
 ER= Emory River Reach; CR= Clinch River Reach; TR= Tennessee River Reach; R= Reference;

Mean Selenium and Strontium in Nymphs vs. Ash in Sediment
 Baseline Ecological Risk Assessment
 TENNESSEE VALLEY AUTHORITY
 KINGSTON, TENNESSEE

