Fluvial Erosion Impacts on Infrastructure Along Indiana Rivers and Streams

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Center for Earth and Environmental Science
Indiana University ~ Purdue University, Indianapolis

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We bring things into perspective.
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In June 2008, flooding damaged or destroyed more than 650 sections of road, 60 bridges, and 100 culverts in Indiana.

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In Cooperation with the Federal Emergency Management Agency and the Indiana Department of Natural Resources, Division of Water

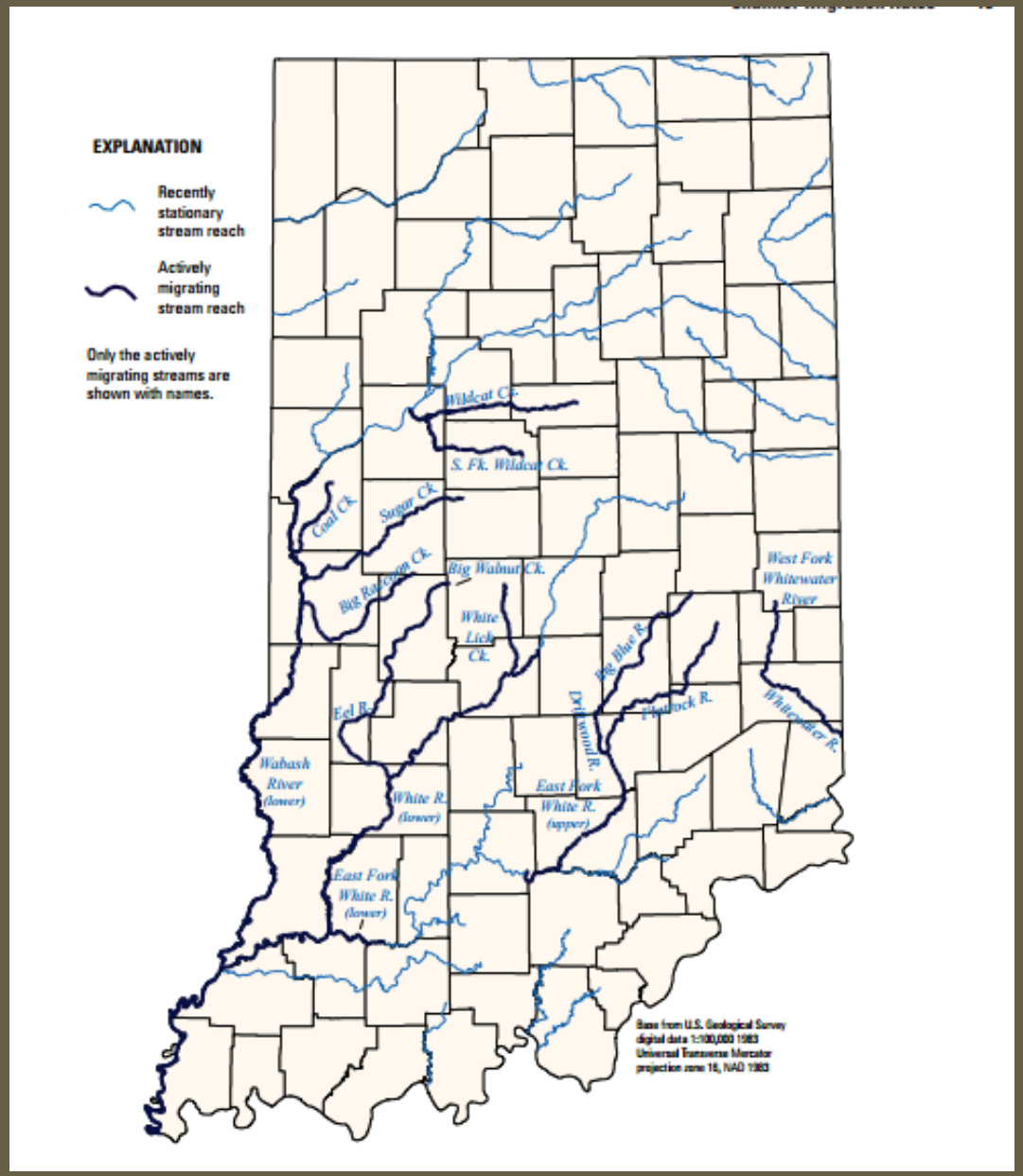
Flood of June 7–9, 2008, in Central and Southern Indiana

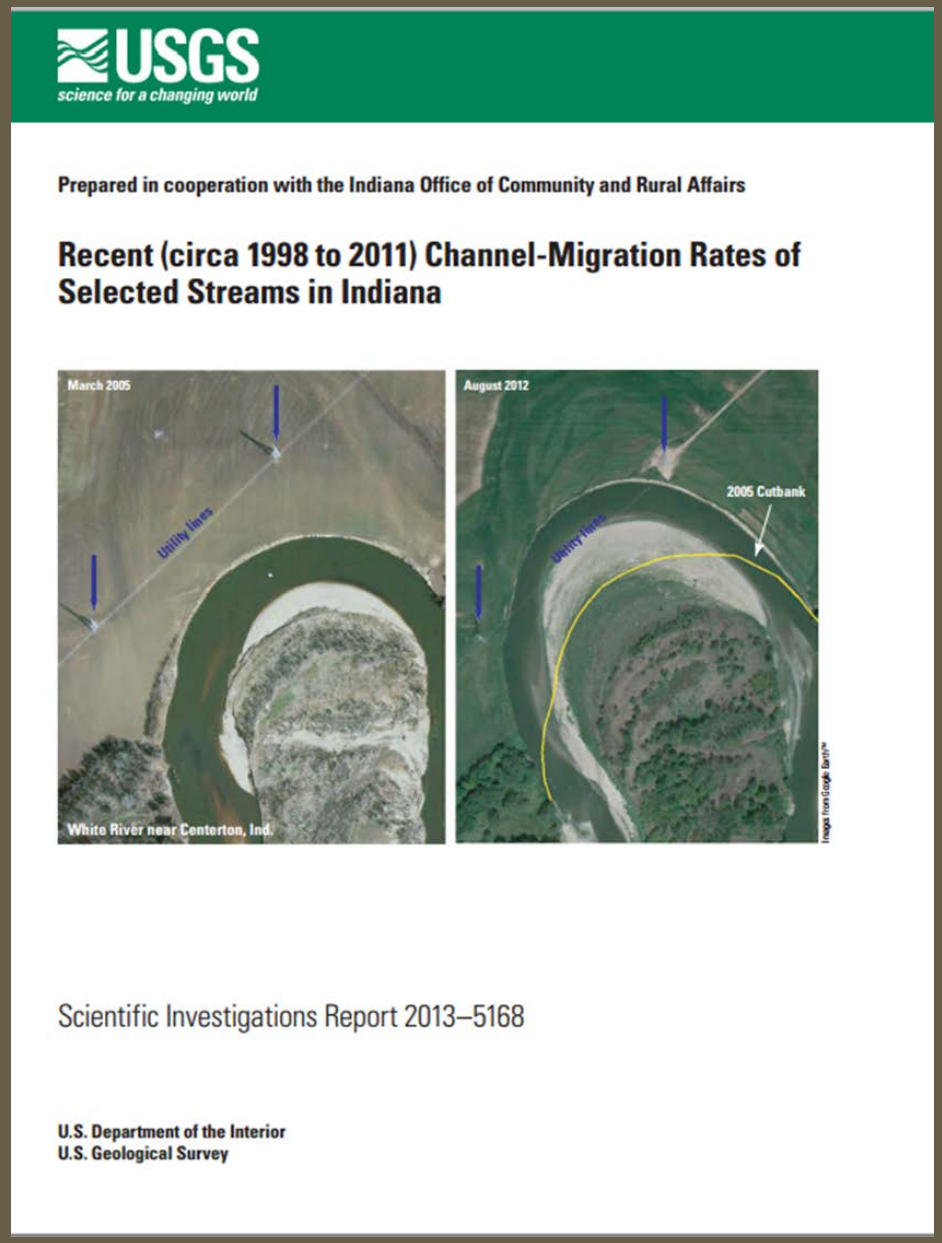
Open-File Report 2008–1322

U.S. Department of the Interior
U.S. Geological Survey

White River, Morgan County, IN

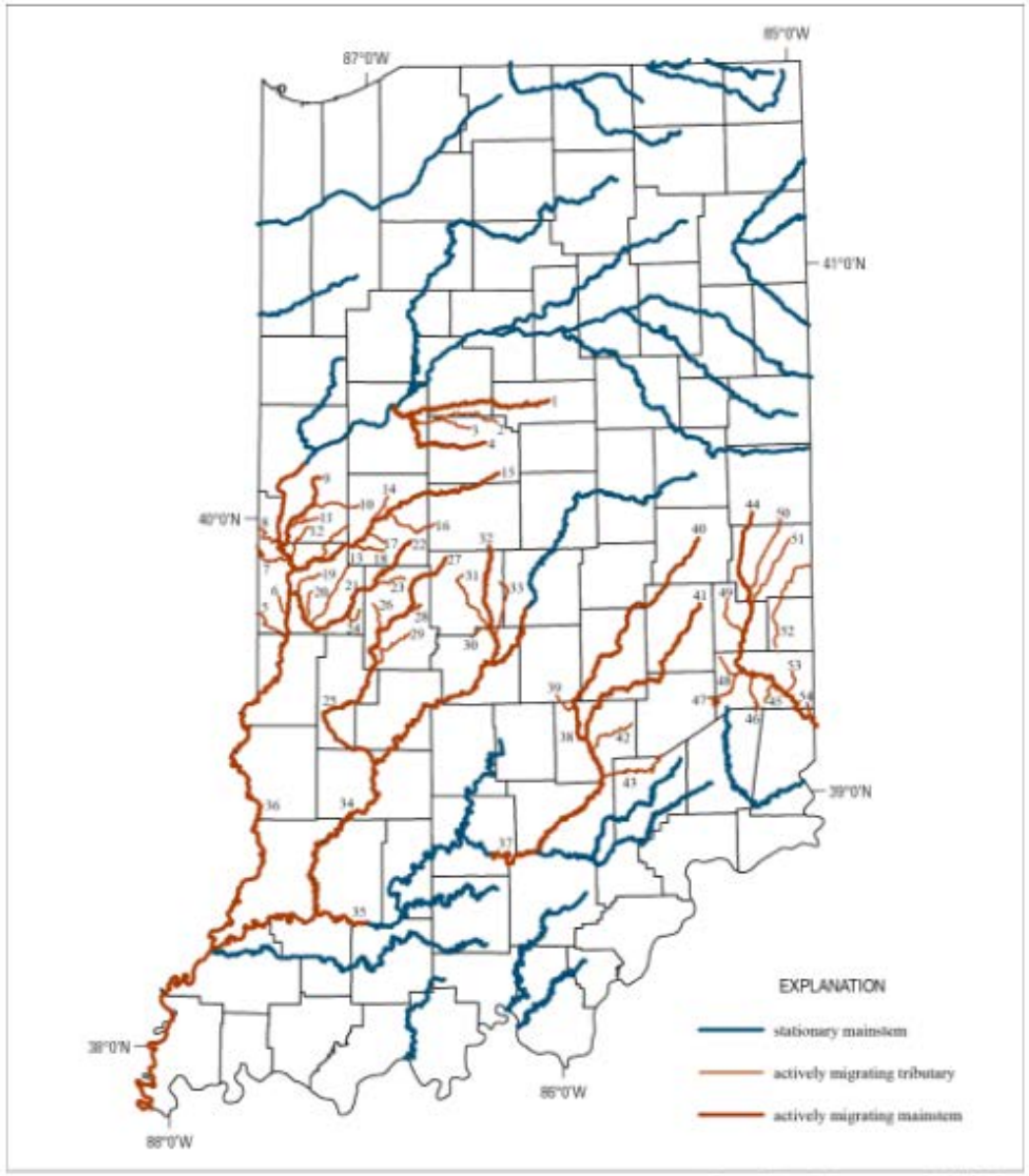
June,2008





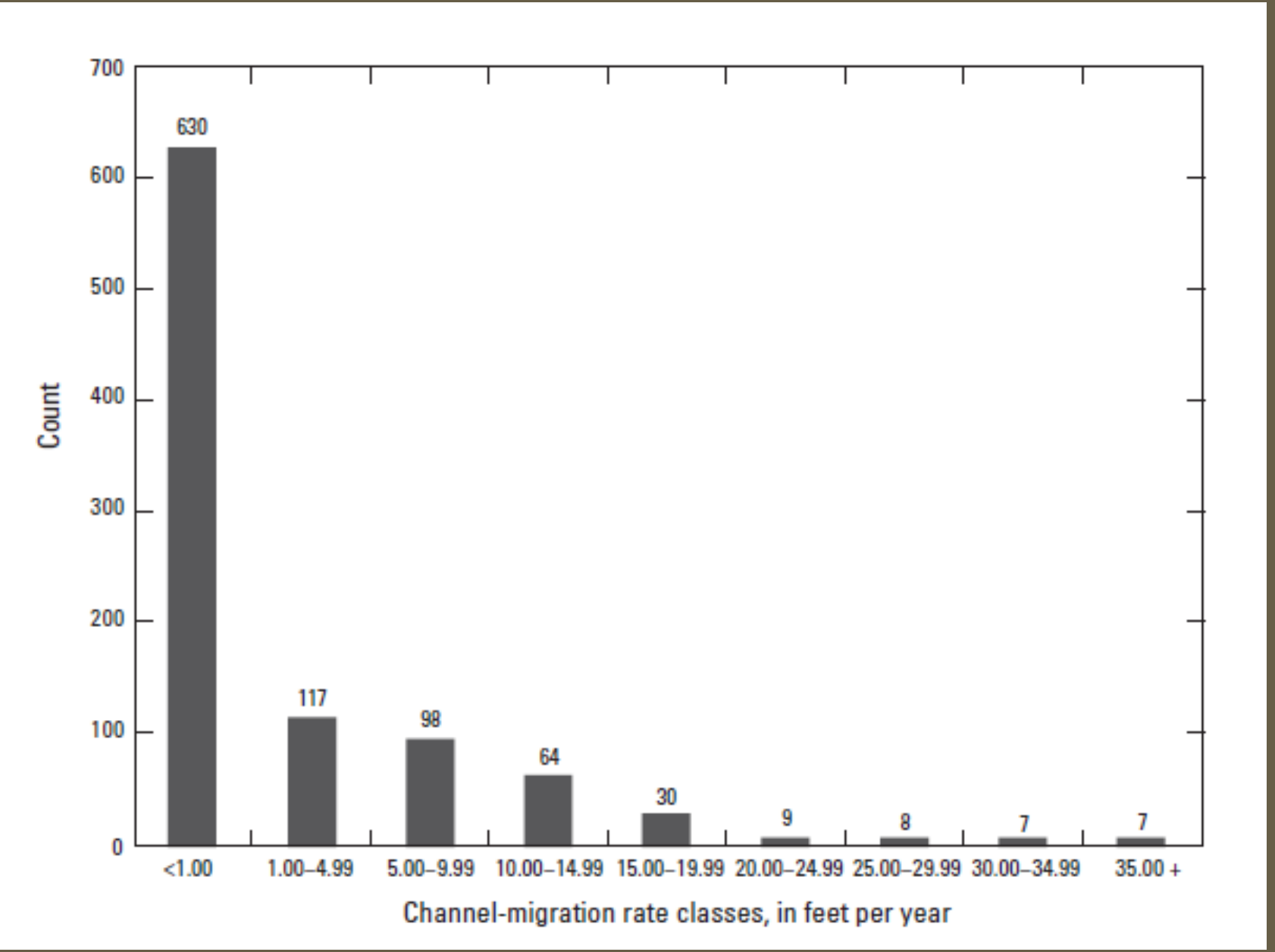
Distribution of relatively stationary and actively migrating stream reaches of the 42 drainage basins where channel-migration-rate values were documented in Indiana

B. A. Robinson, USGS

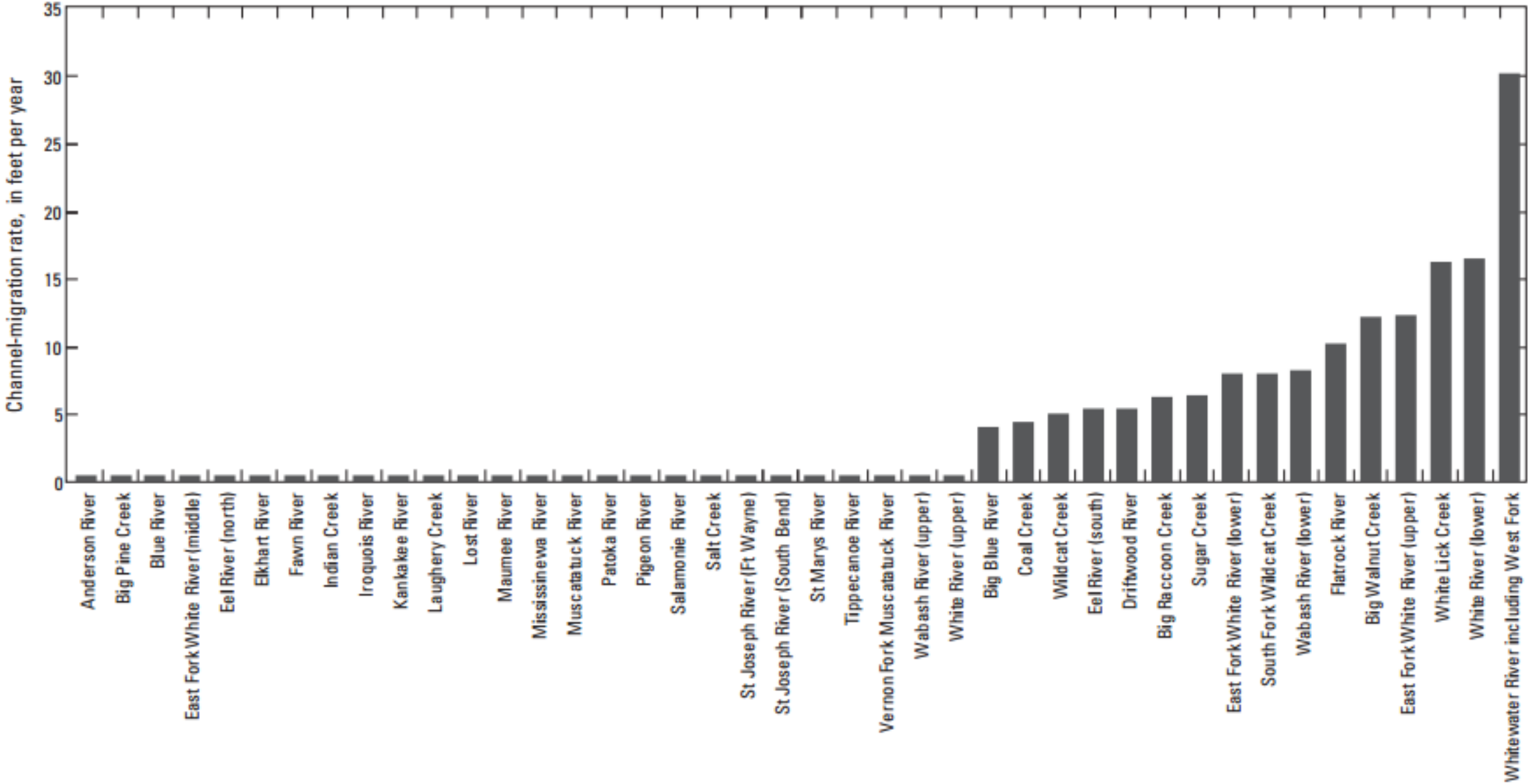


Base from U.S. Geological Survey digital data, 1983, 1:24,000
Universal Transverse Mercator projection
Zone 16

0 15 30 60 MILES
0 15 30 60 KILOMETERS



Distribution of channel migration rates for 970 meander bends where channel-migration rates were documented in Indiana (B. A. Robinson, U. S. Geological Survey)



The 75th percentile channel-migration rate for the 42 stream reaches where channel-migration-rate values were documented in Indiana (B.A. Robinson, USGS)

Meander-Vulnerable Assets

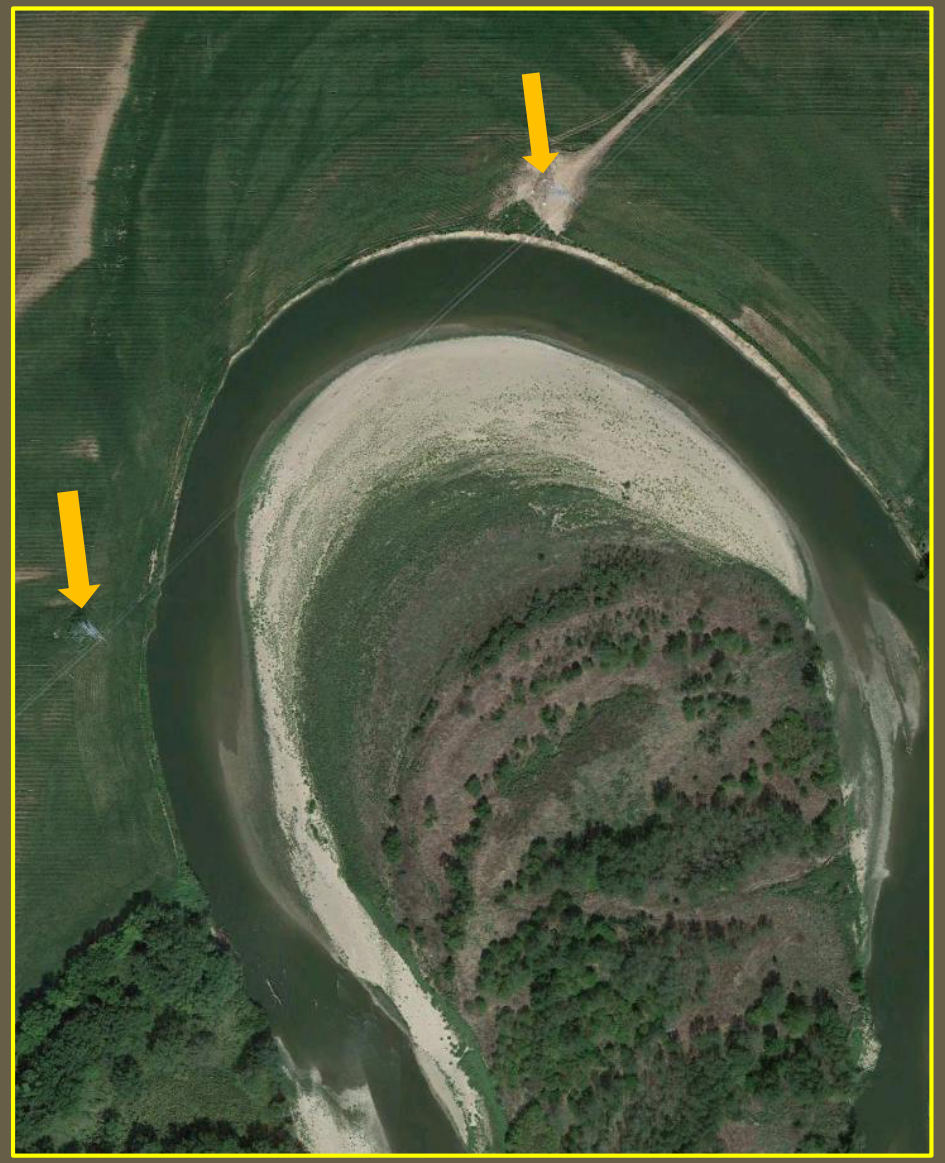
Transportation Assets

- Bridges
- Roads
- Railroads
- Railroad Bridges

Utility Assets

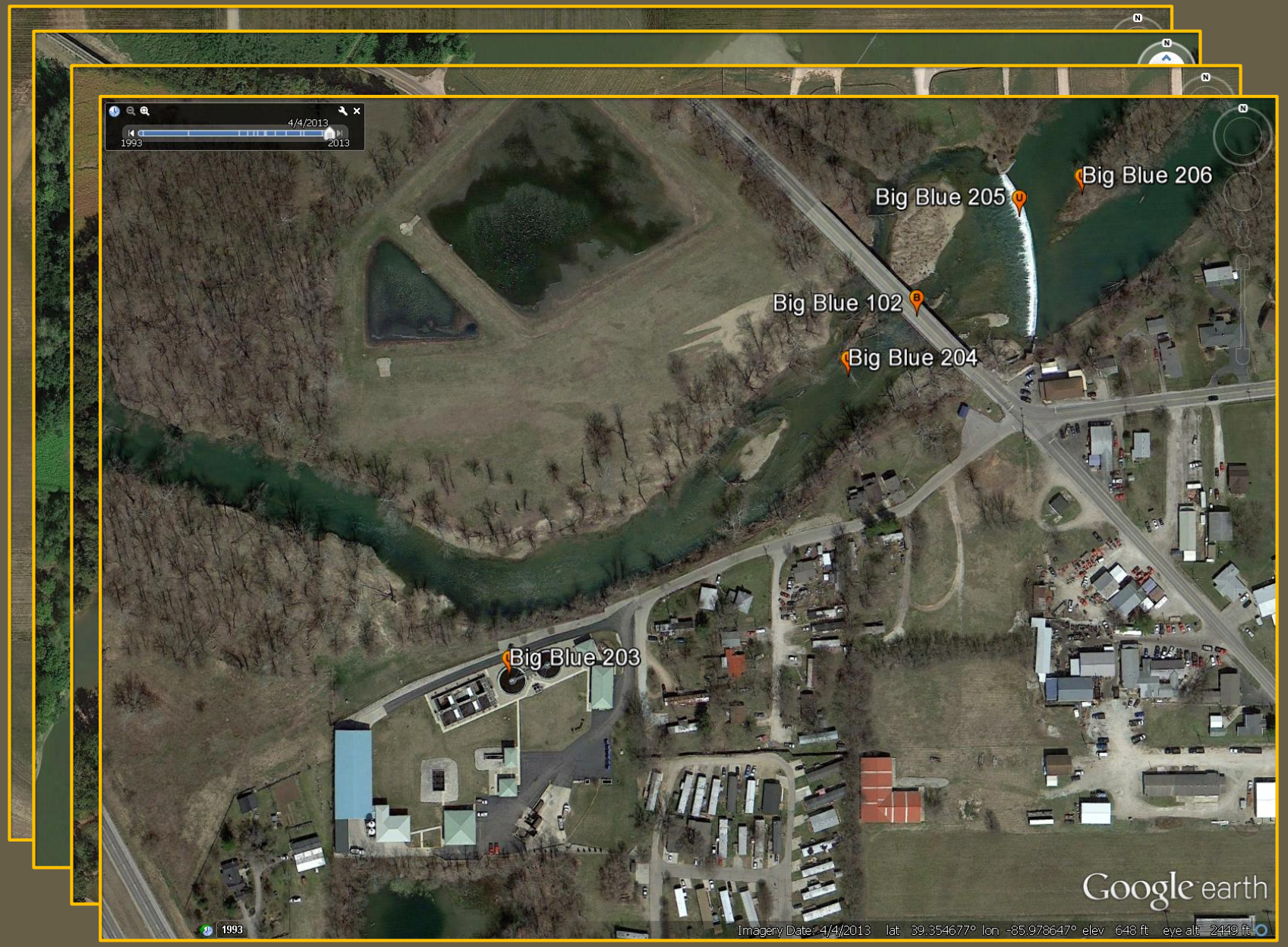
- Power Lines
- Pipelines
- Dams
- Water-treatment Plants

White River near Centerton, Ind.



Google Earth™

B. A. Robinson, U.S. Geological Survey



B. A. Robinson, U.S. Geological Survey

Data set includes:

1,128 Assets

- Asset Class
- Latitude
- Longitude
- Stream
- Proximity
- Asset name
- Ownership

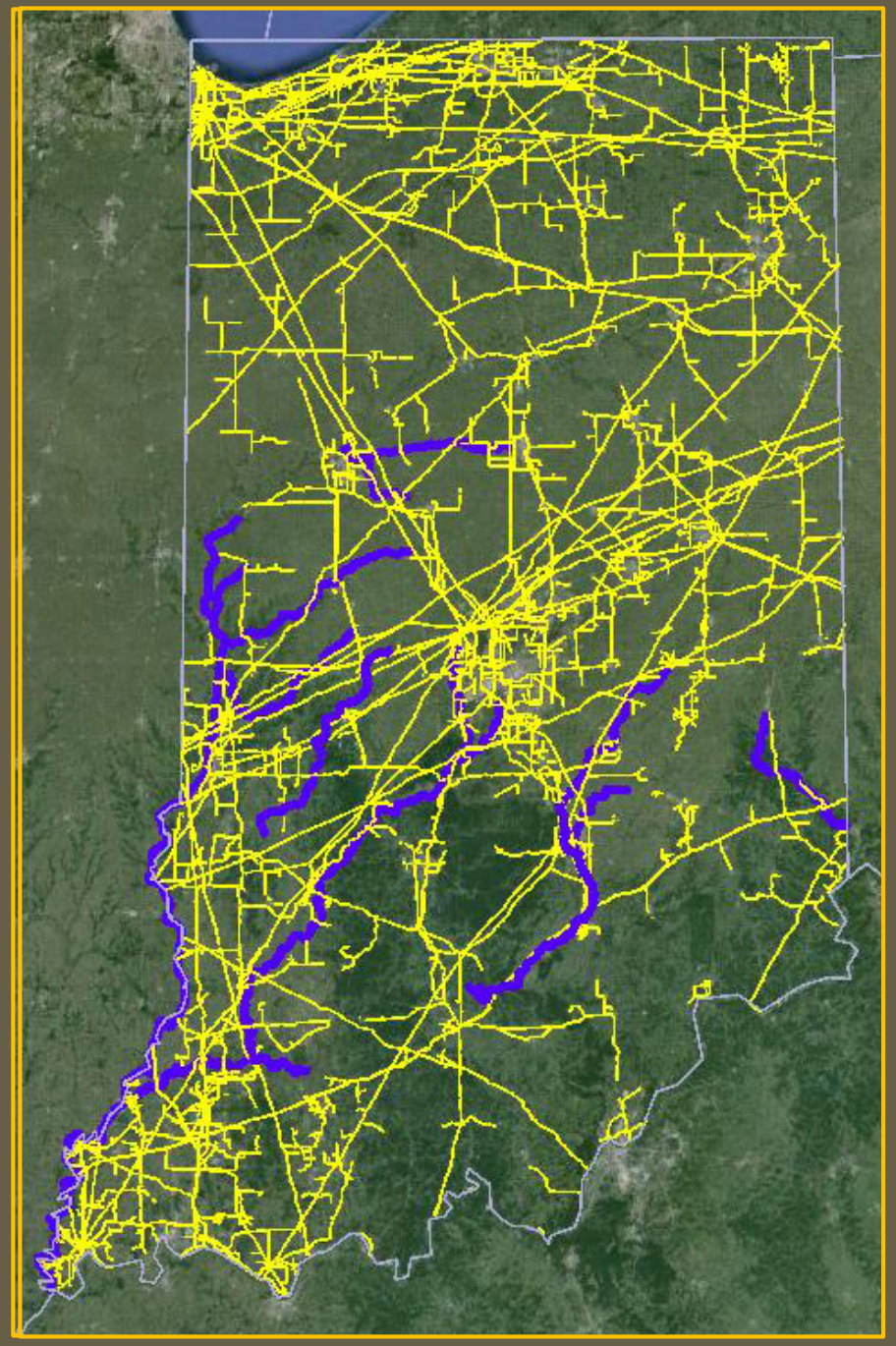
B. A. Robinson, U.S. Geological Survey

Buried Pipelines
(Natural Gas & Oil)

Actively Migrating Streams
(16)

Migrating Tributaries
(38 …not shown)

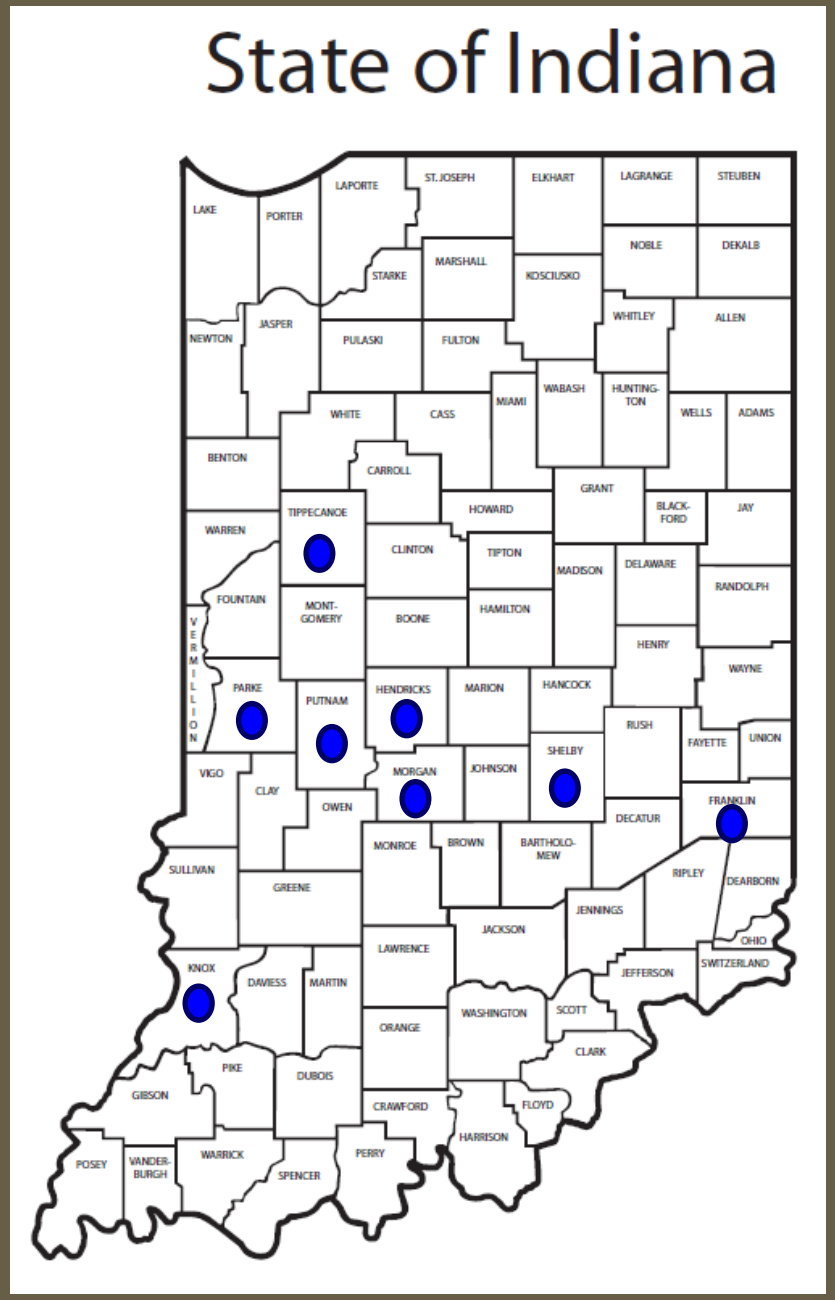
141 Crossings



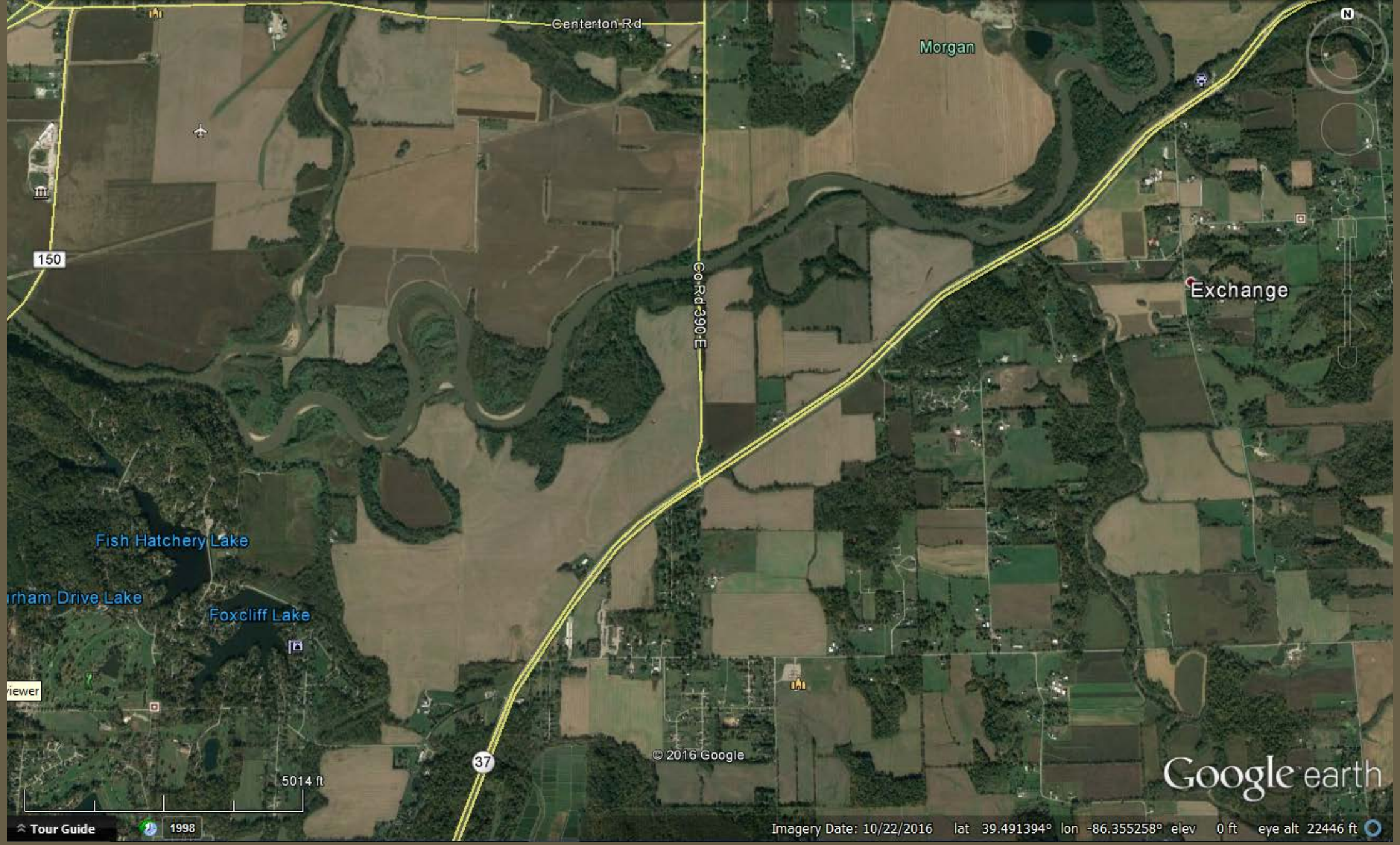
B. A. Robinson, U.S. Geological Survey

Eight counties account for 57% of vulnerable assets

Putnam	115
Parke	110
Franklin	97
Hendricks	85
Morgan	68
Shelby	57
Knox	56
Tippecanoe	56
	644



B. A. Robinson, U.S. Geological Survey

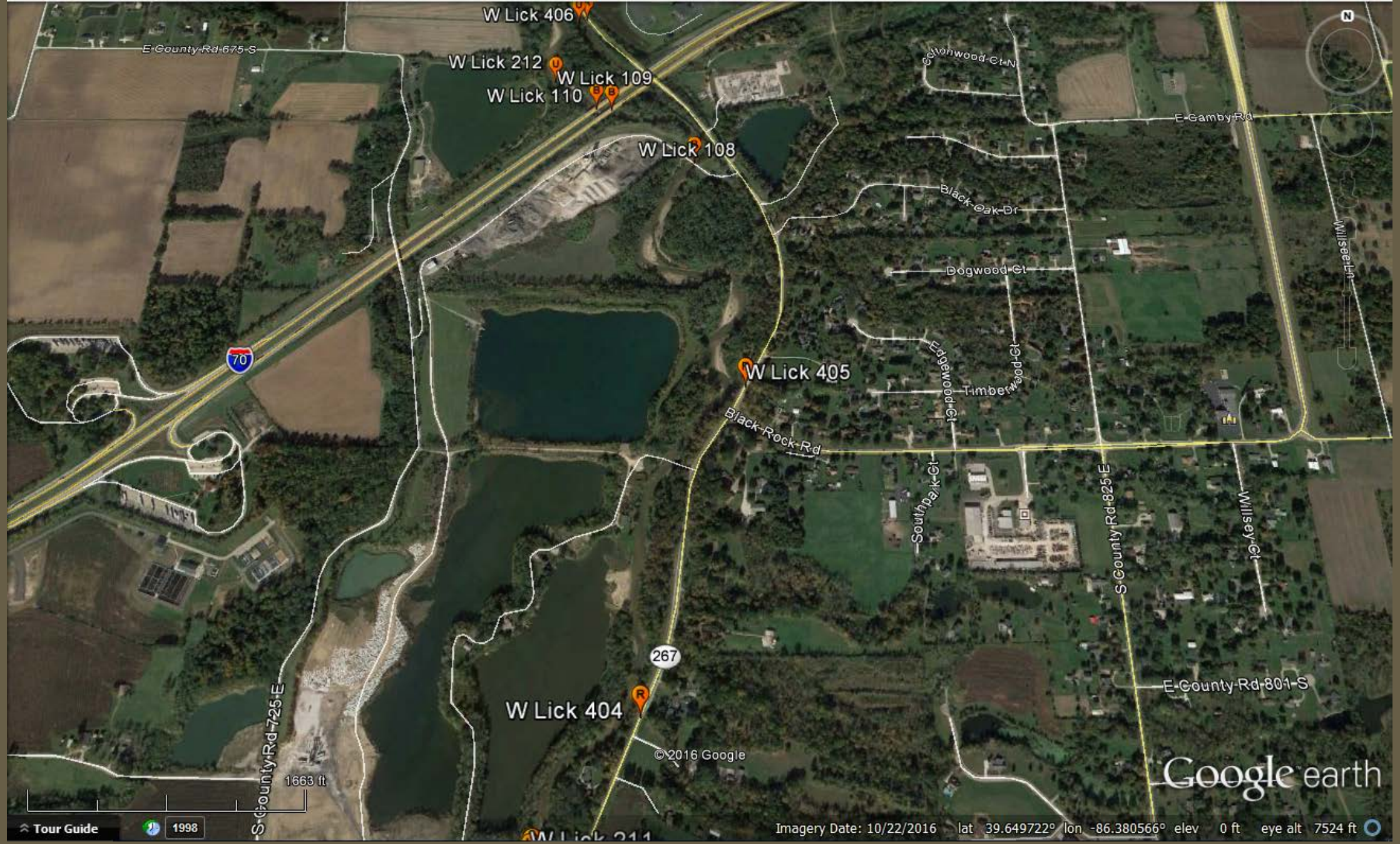


White River at US 37, near Martinsville, Morgan County, Indiana

Beacon Run at US 40, near Brazil, Putnam County, Indiana Note rotational slump (yellow arrow)

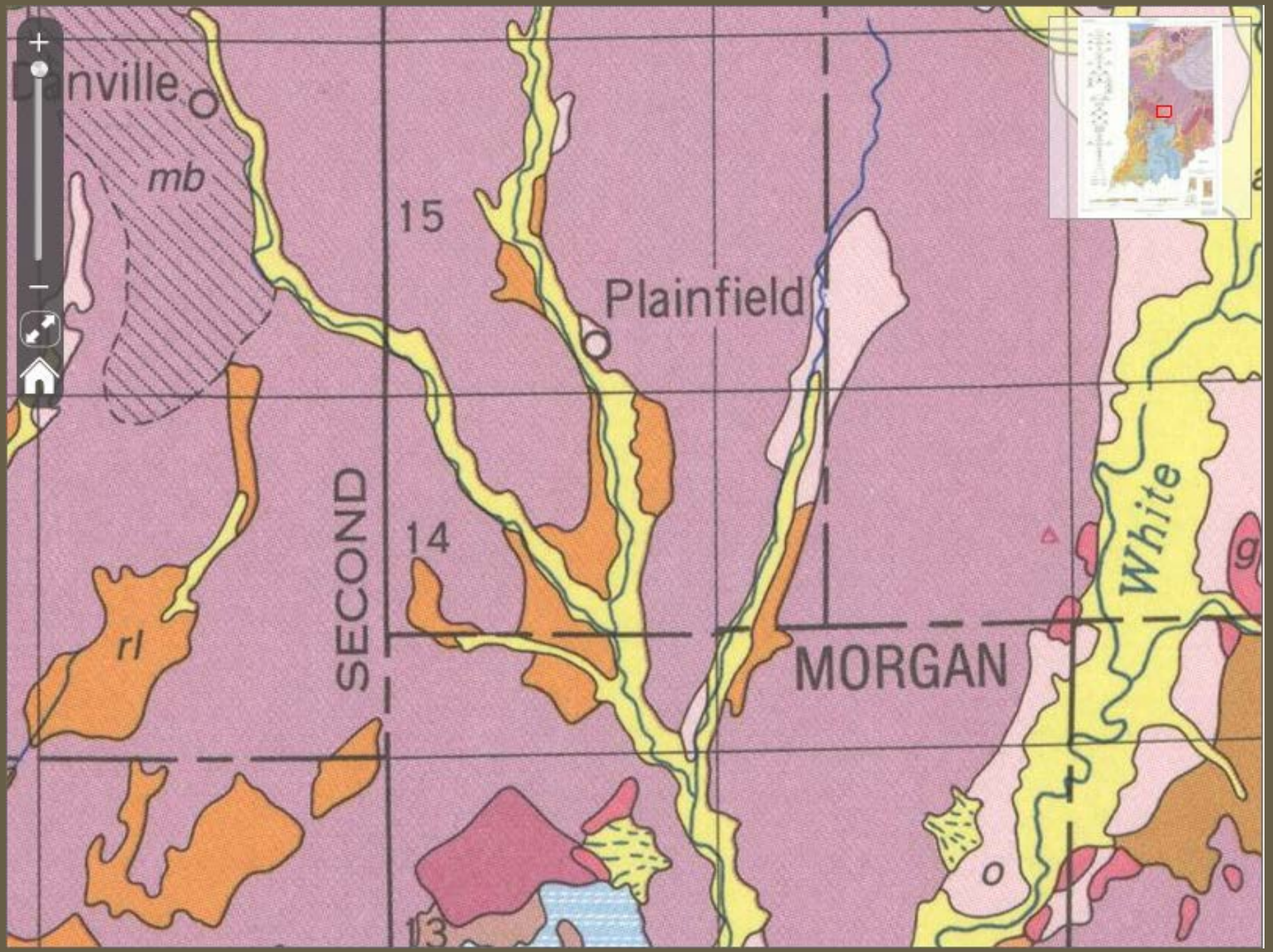
Whitewater River at Levee Road, near Brookville, Franklin County, Indiana

Lessons from White Lick Creek, Hendricks County, Indiana



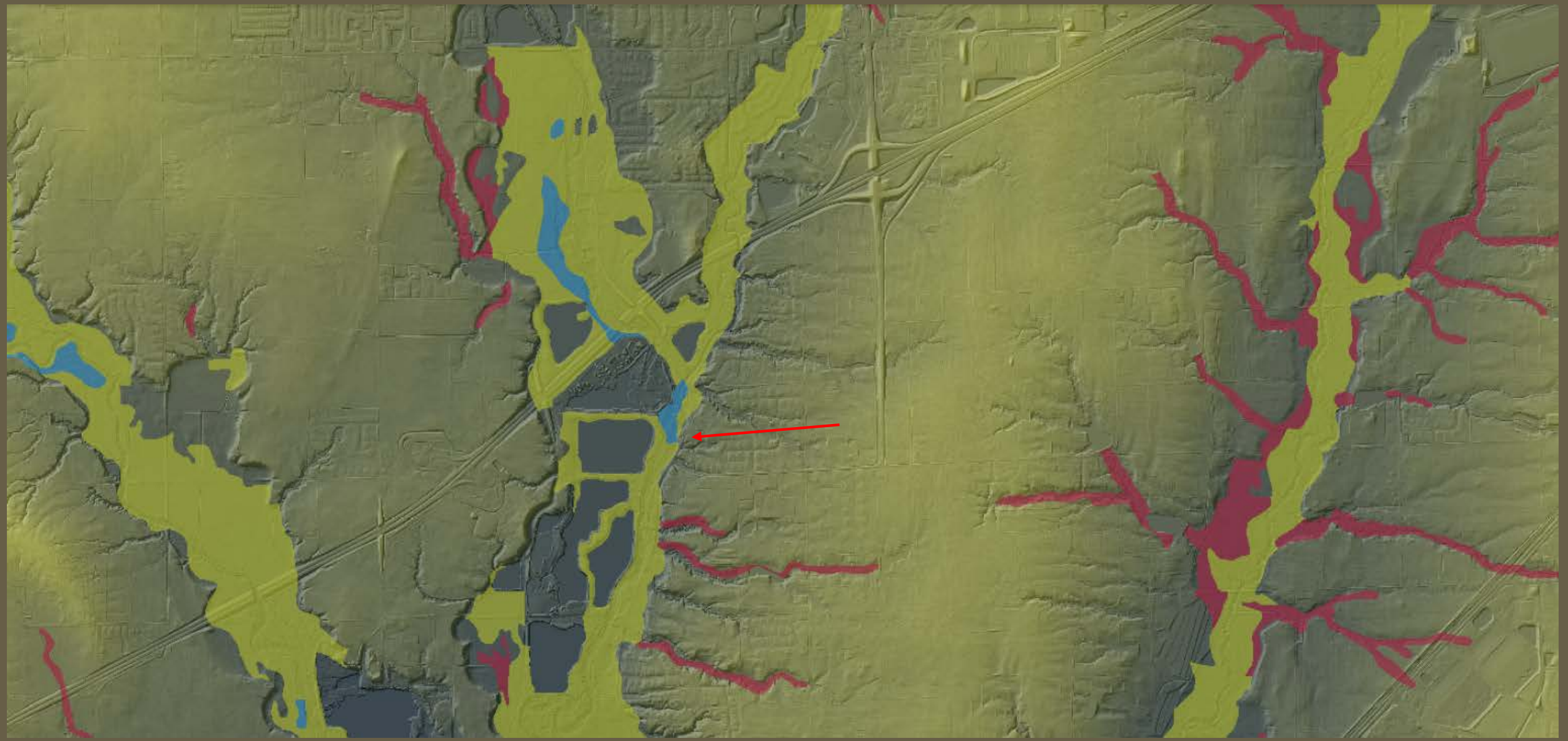
White Lick Creek at SR 267, near Plainfield, Indiana

White Lick Creek at SR 267, near Plainfield, Indiana



Quaternary geologic map of Indiana

Gray, H.H. 1989



White Lick Creek at SR 267, near Plainfield, Indiana

Indiana 2011/2012 LiDAR

White Lick Creek at SR 267, near Plainfield, Indiana (39.6550, -86.3843) left bank, yellow arrow indicates SR 267

White Lick Creek at SR 267, near Plainfield, Indiana (39.6550, -86.3843) right bank

White Lick Creek at SR 267, near Plainfield, Indiana (39.6550, -86.3843) left bank, bank sediment stratigraphy

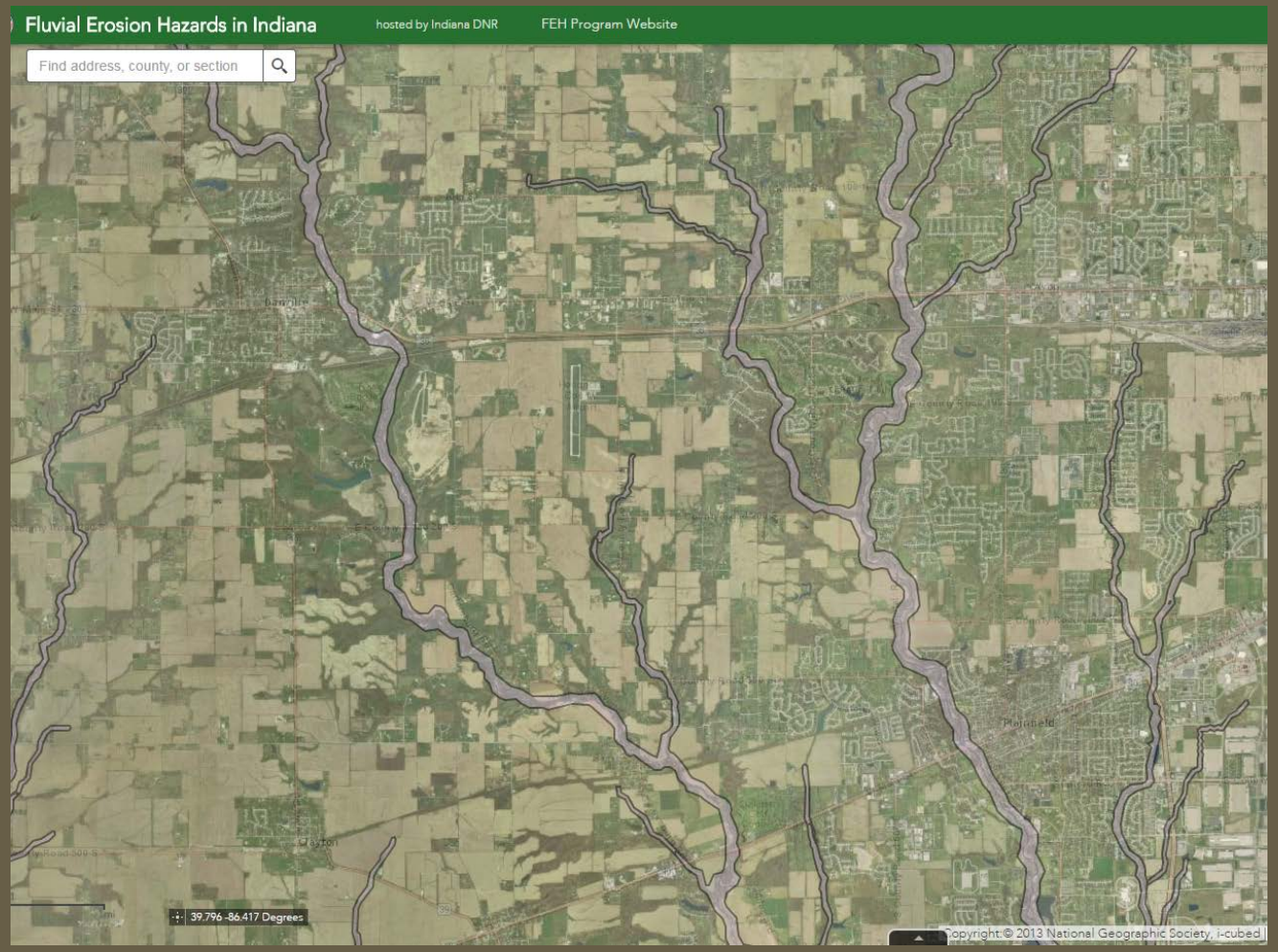
White Lick Creek at SR 267, near Plainfield, Indiana (39.6550, -86.3843) downstream

White Lick Creek at SR 267, near Plainfield, Indiana (39.6550, -86.3843) upstream

Managing the Problems

Risk Reduction Strategies

1. Stay Away
   - Erosion & channel migration will continue
   - Limit exposure
   - When possible, move infrastructure out of stream corridor
   - Increase mitigation requirements to discourage development in stream corridor

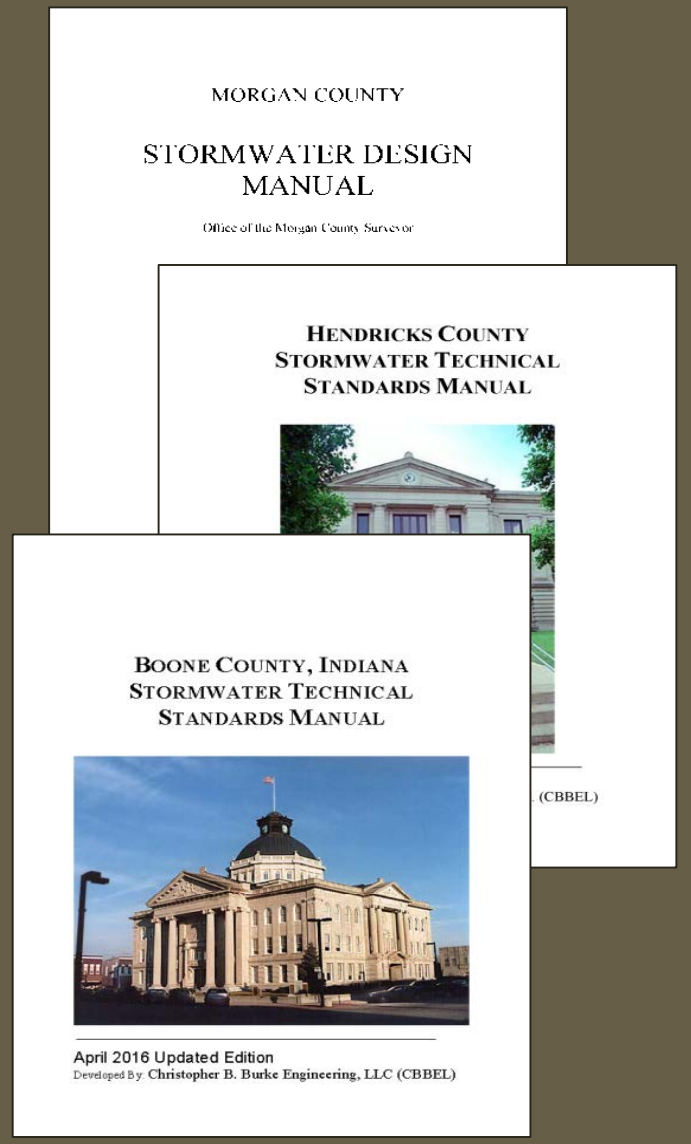


Refined Corridor Map
Available at:
http://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=43e7b307a0184c7c851b5068941e2e23

RCB

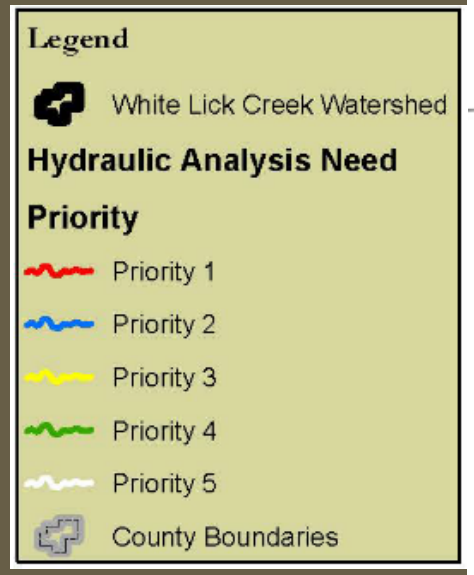
Risk Reduction Strategies

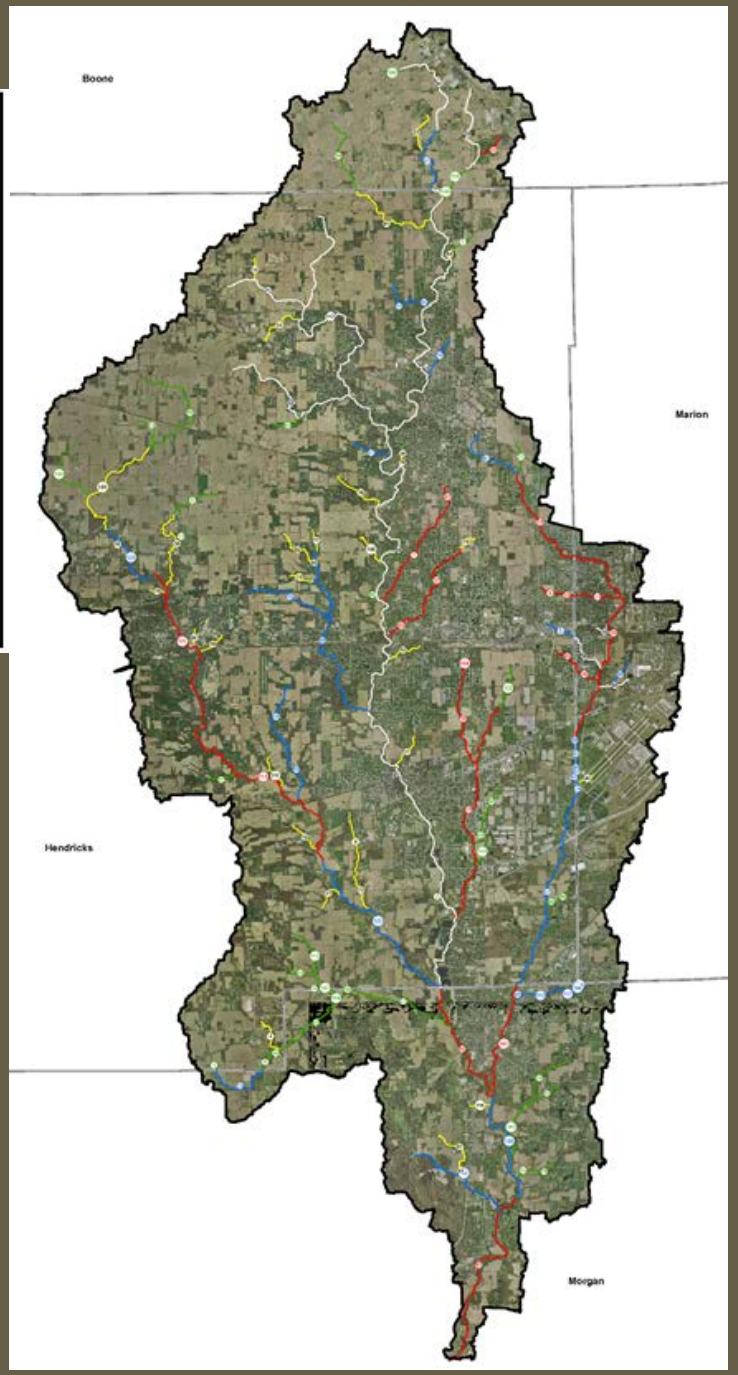
2. More Stringent Development Standards
   - Increase detention requirements (Channel protection volume)
   - Promote / require use of LID & green infrastructure stormwater management strategies
   - Institute riparian corridor with use restrictions



Risk Reduction Strategies

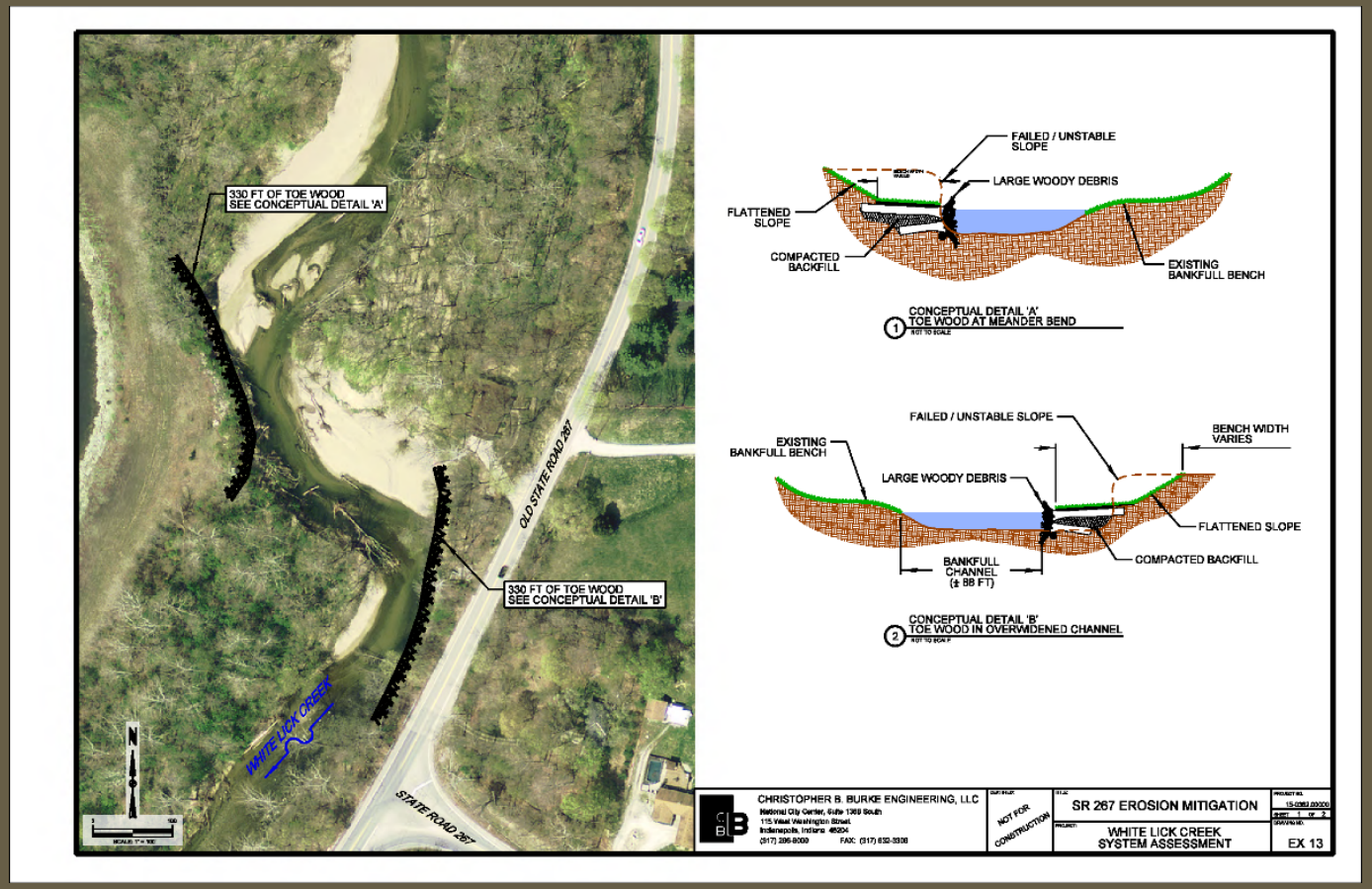
3. Improve Planning & Risk Assessment
   - Update regulatory flow rates
   - Improve / update floodplain models
   - Lateral migration monitoring





Risk Reduction Strategies

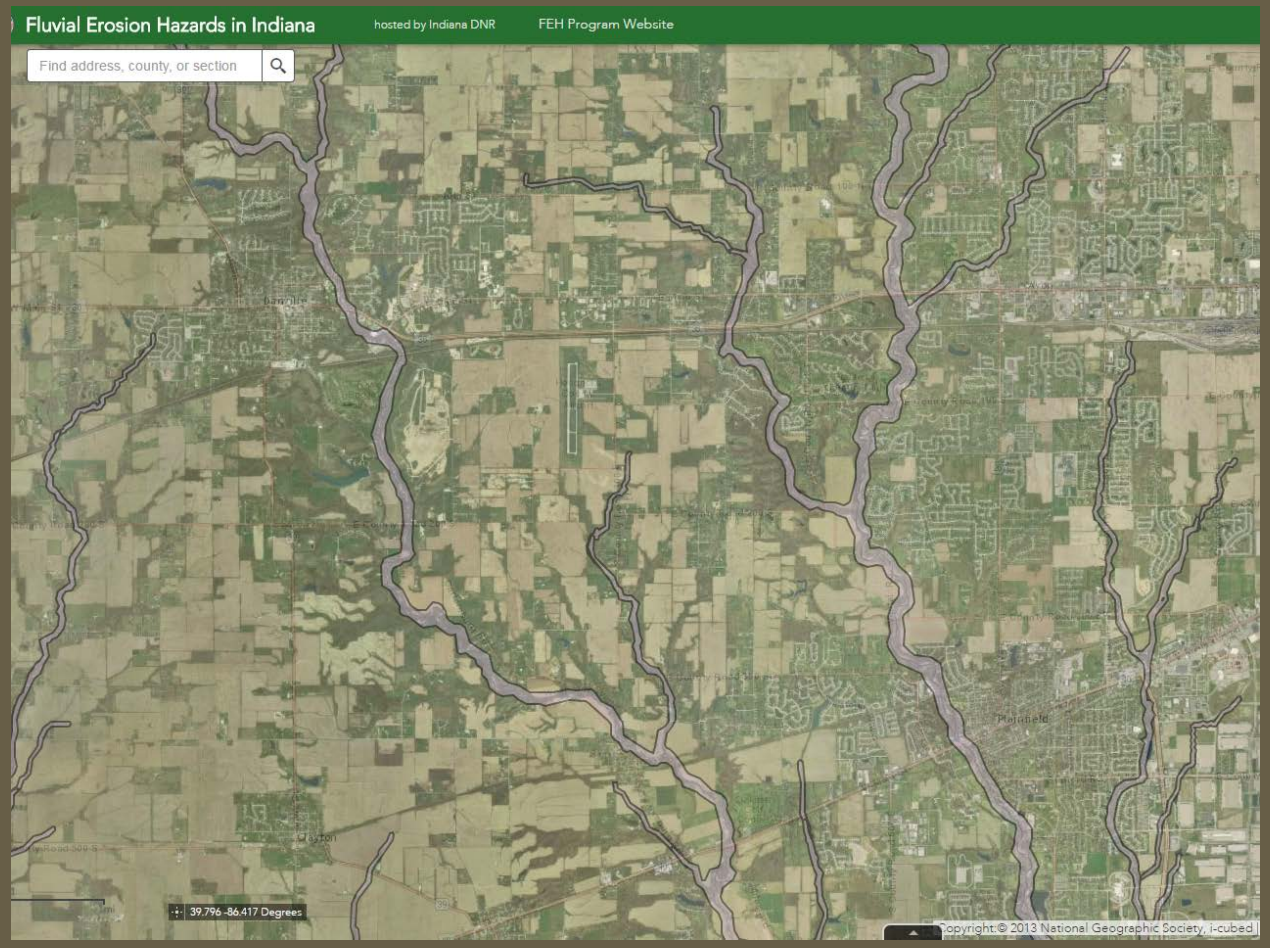
4. Improve Maintenance & Protect Critical Infrastructure
   - Tree maintenance program
   - Strategic / critical erosion mitigation projects



Bottom Line!

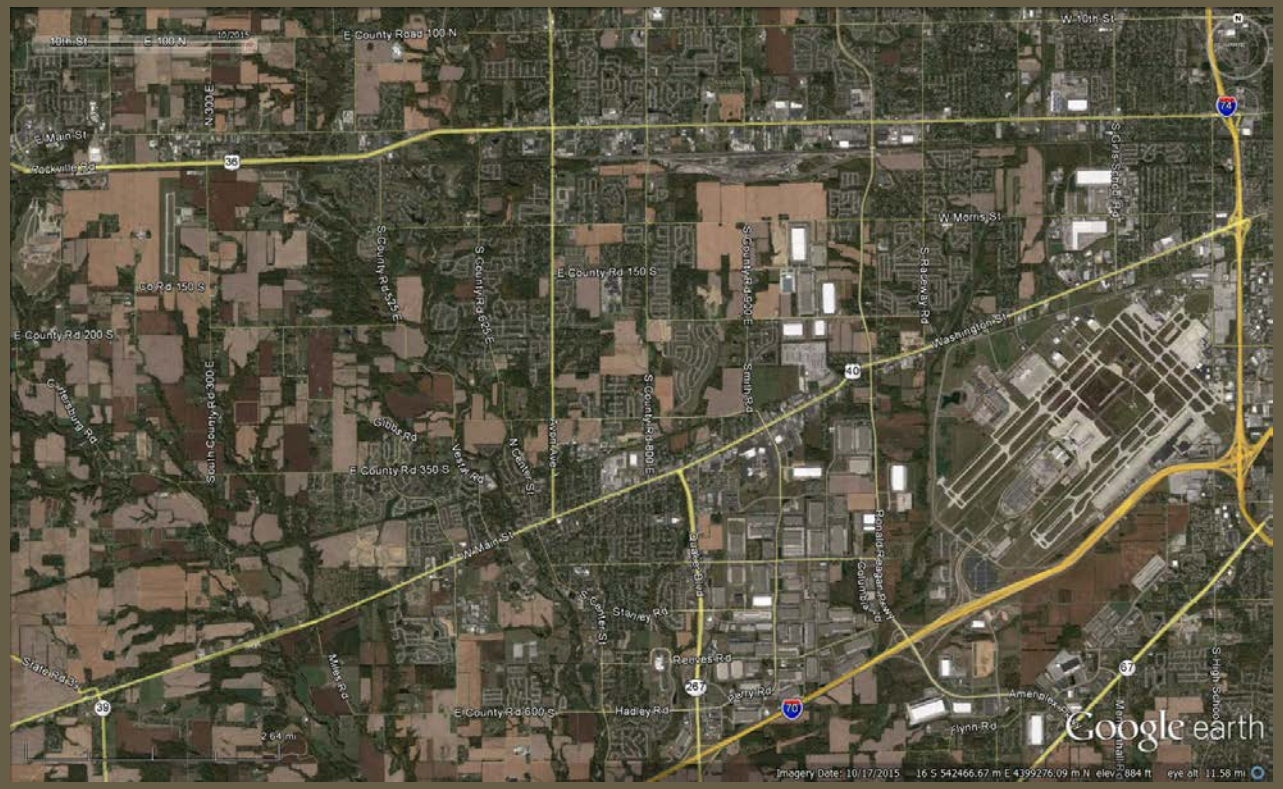
Things to Remember:

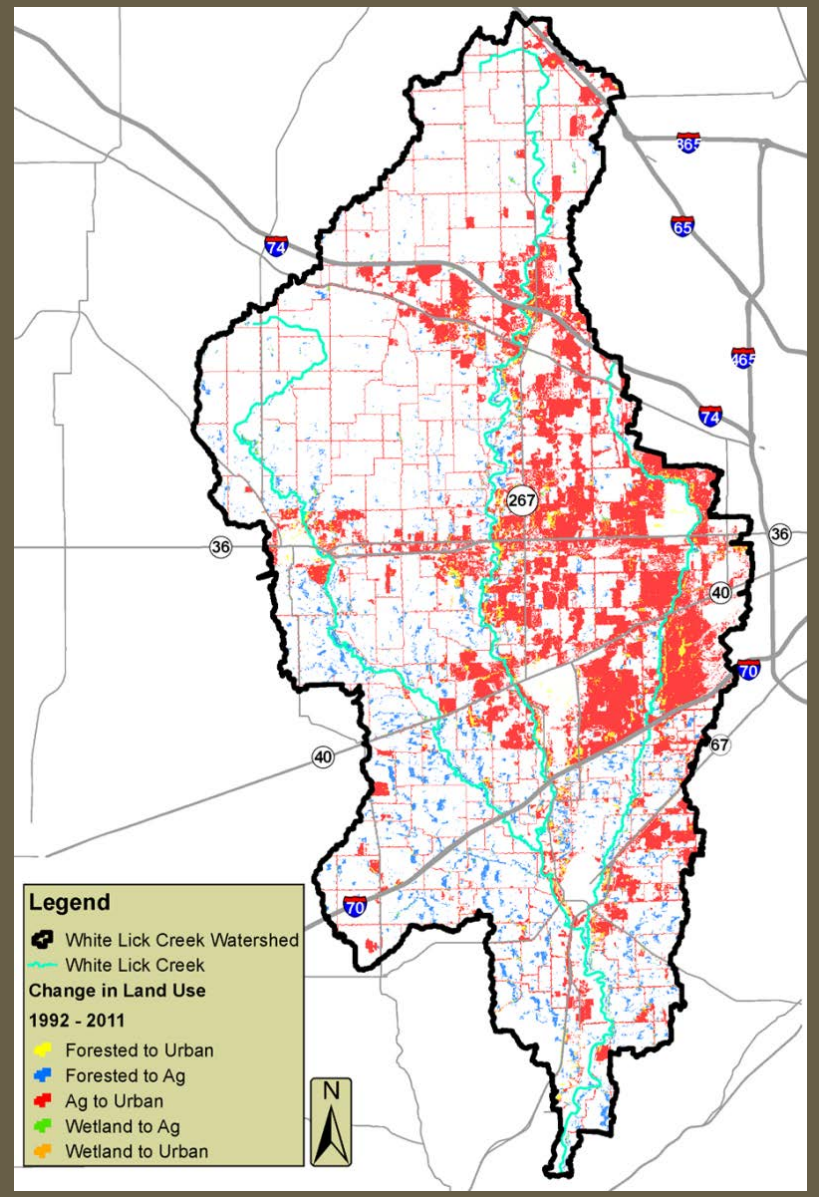
- Expect continued significant migration within expected erosional corridors



Things to Remember:

- Expect continued significant migration within expected erosional corridors
- Increase in urbanization within the watershed has exacerbated the issues





Things to Remember:

- Expect continued significant migration within expected erosional corridors
- Increase in urbanization within the watershed has exacerbated the issues
- “Fixing” the problem not likely feasible

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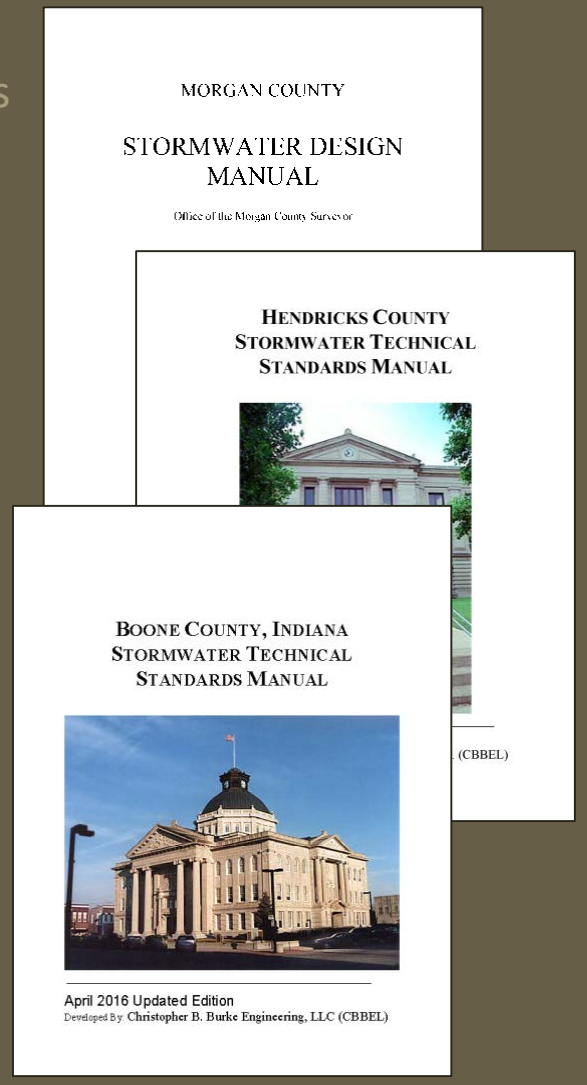


Things to Remember:

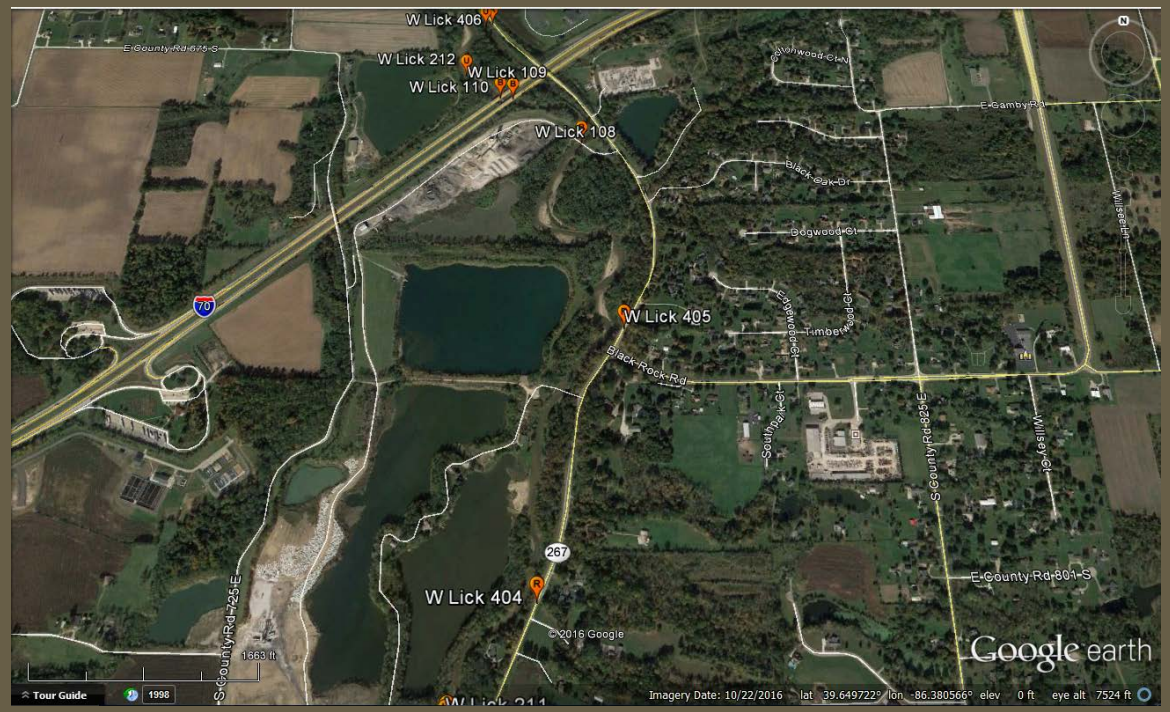
- Expect continued significant migration within expected erosional corridors
- Increase in urbanization within the watershed has exacerbated the issues
- “Fixing” the problem not likely feasible
- The recommended strategies:

➢ Multi-jurisdictional Coordination
➢ Disturbance Avoidance Zones
➢ Channel Protection Volume & GI
➢ Detailed Geomorphic Assessment
➢ Relocating Threatened Assets
➢ Monitoring At-risk Structures
➢ Protecting In-place Infrastructure
➢ Balanced Tree Management Strategies

Riverine Impacts on Transportation Routes "in a Nutshell"

- Several Roads and Bridges in Indiana are Vulnerable to Floods and Stream Movement/Erosion Impacts
- There are ways to Predict, Screen, Monitor, and Prioritize Problem Sites before Potential Service Disruptions Occur
- A Detailed Morphological Stream Assessment is Crucial in Understanding the Overall System, Understanding the underlying System Stressors, and Making the Right Response and Repair Decisions

➢ Early Detection and Mitigation of Problems Saves Time, Money, and Headaches!



QUESTIONS?

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