Managing Flooding & Sediment in Rivers and Streams

19th Annual St. Joseph River Basin Symposium

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May 10, 2019

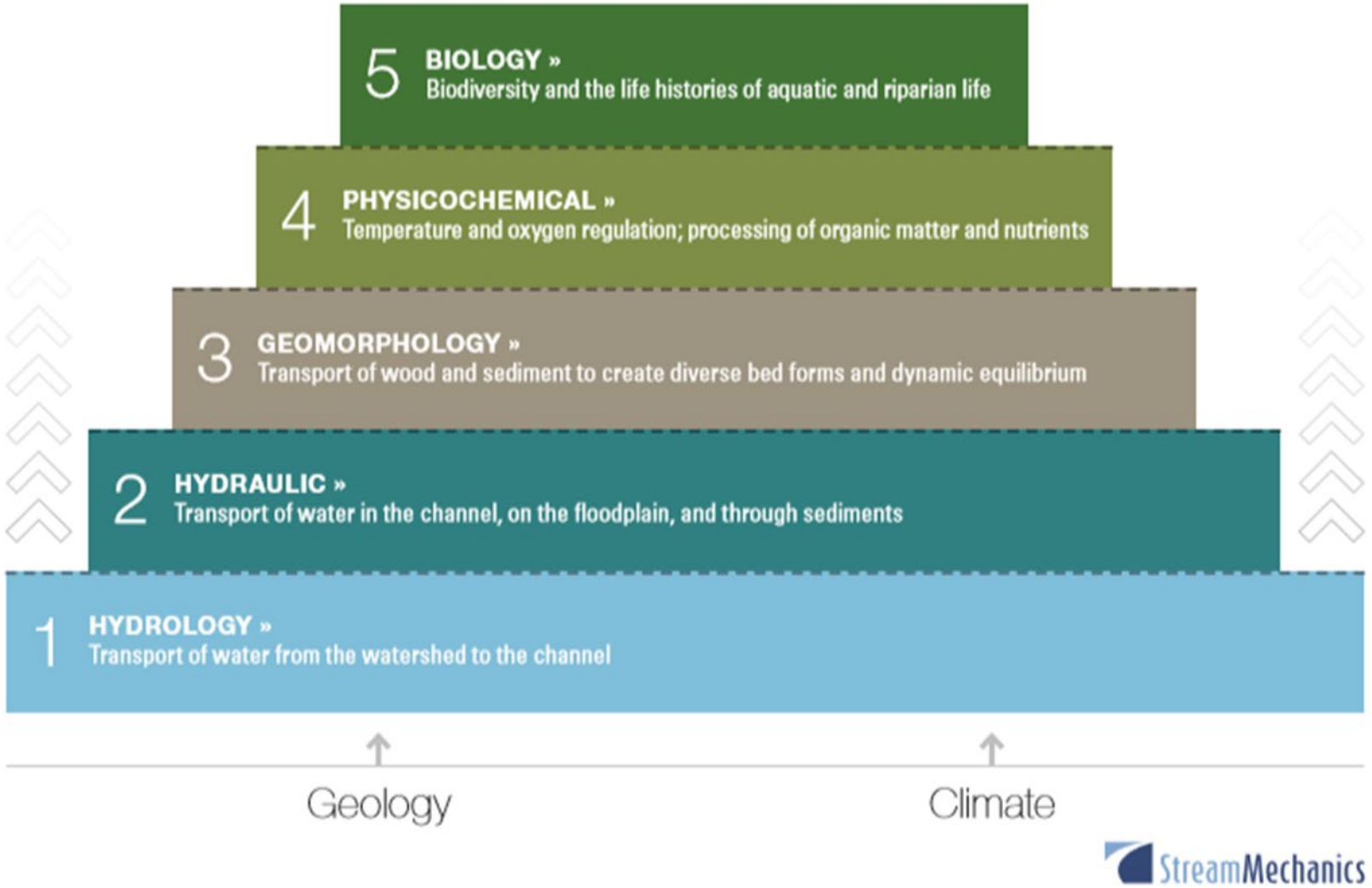
CHRISTOPHER B. BURKE ENGINEERING, LLC

SJRBC St. Joseph River Basin Commission

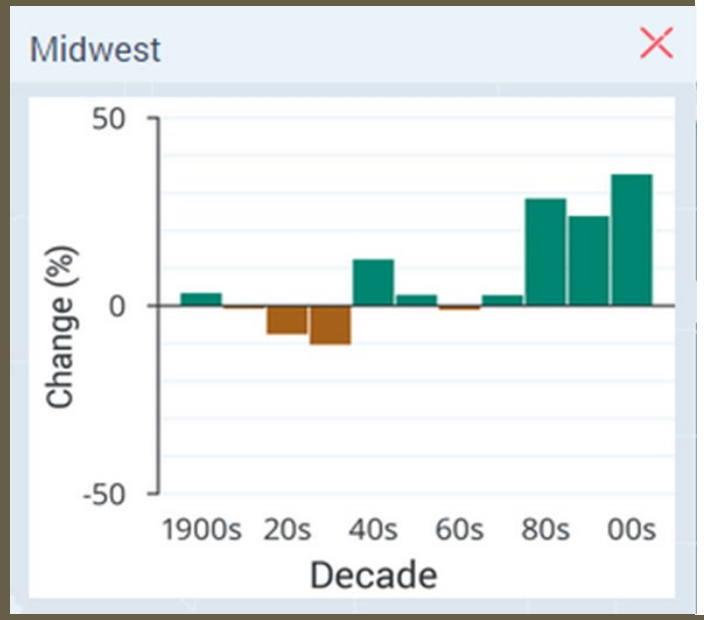
CEES

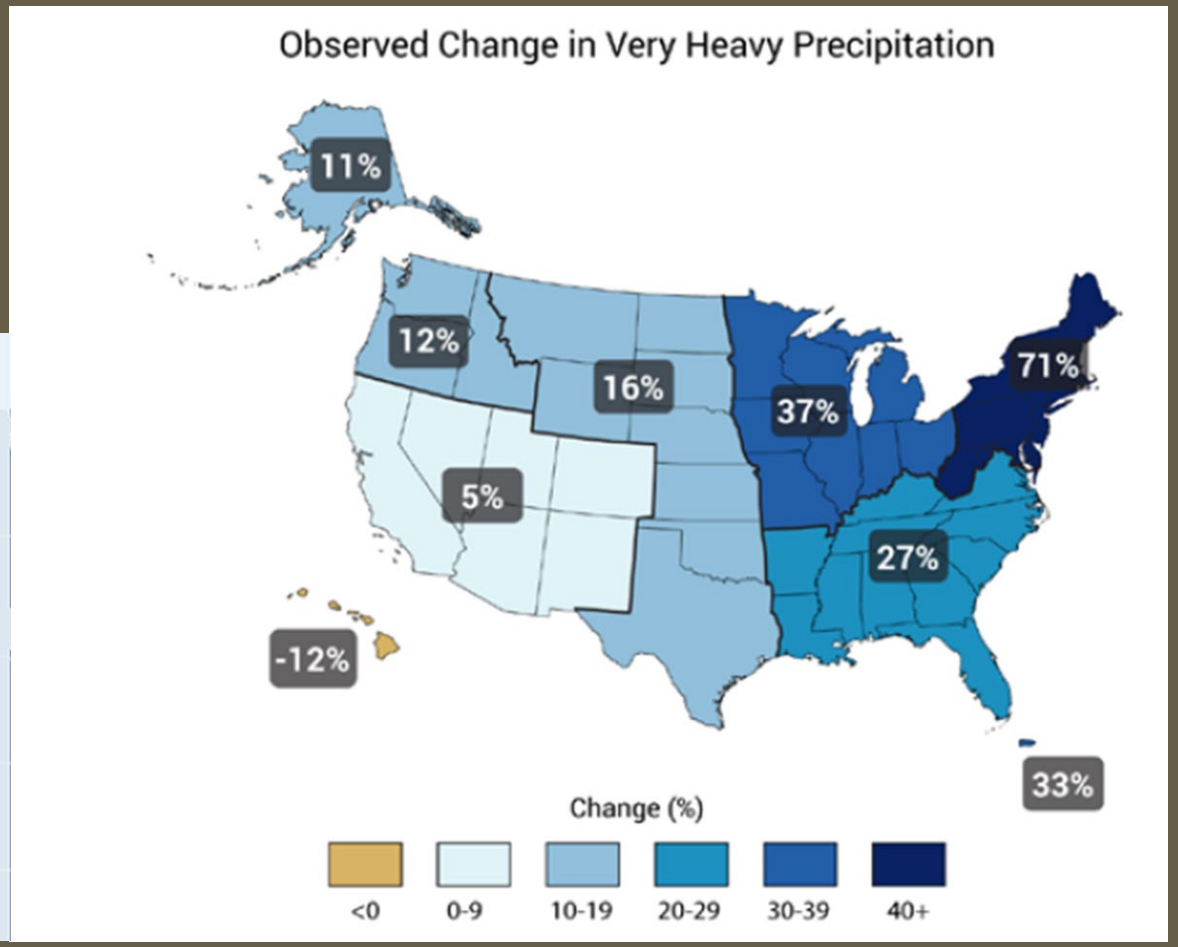
Stream Functions Pyramid

A Guide for Assessing & Restoring Stream Functions » OVERVIEW

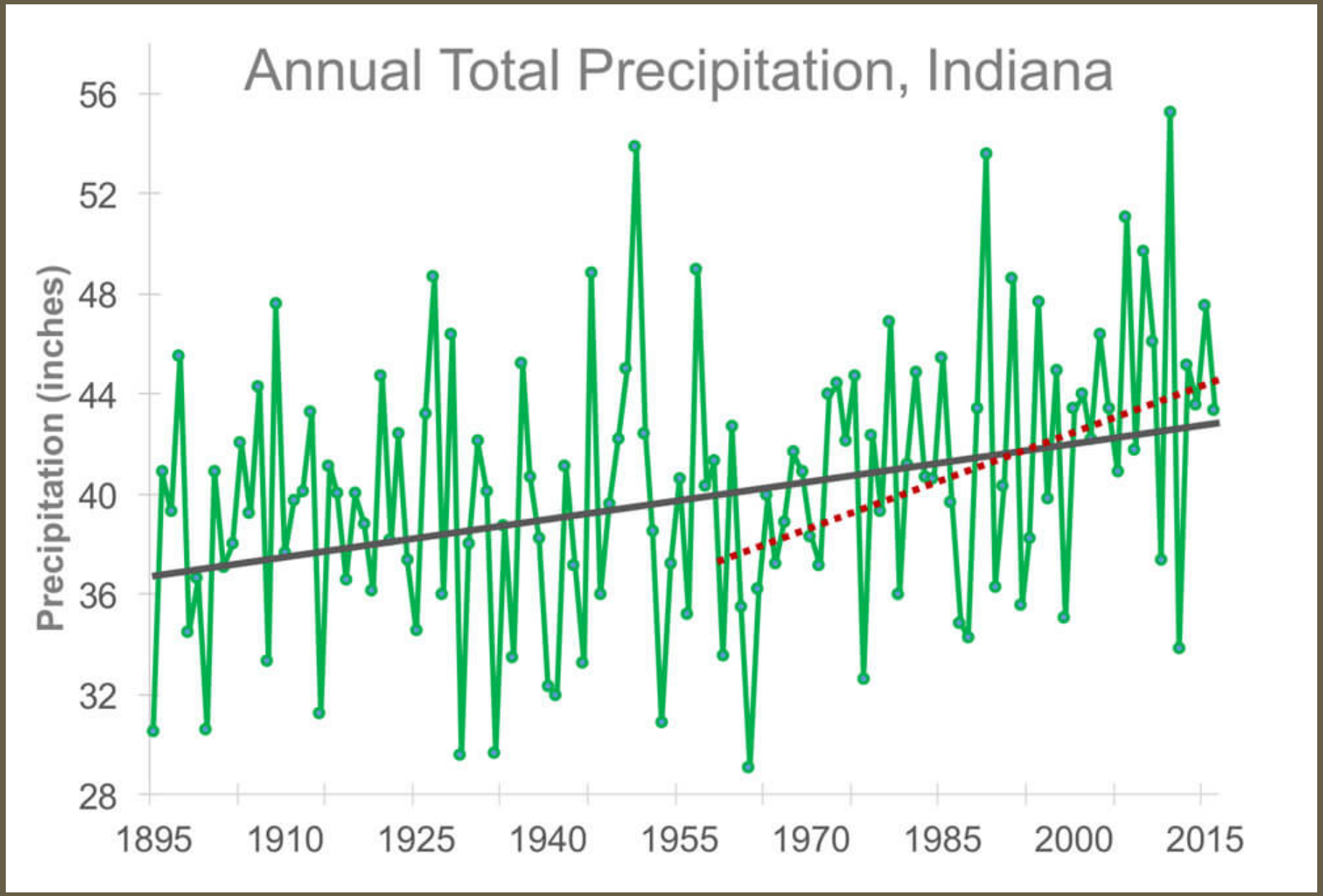


StreamMechanics

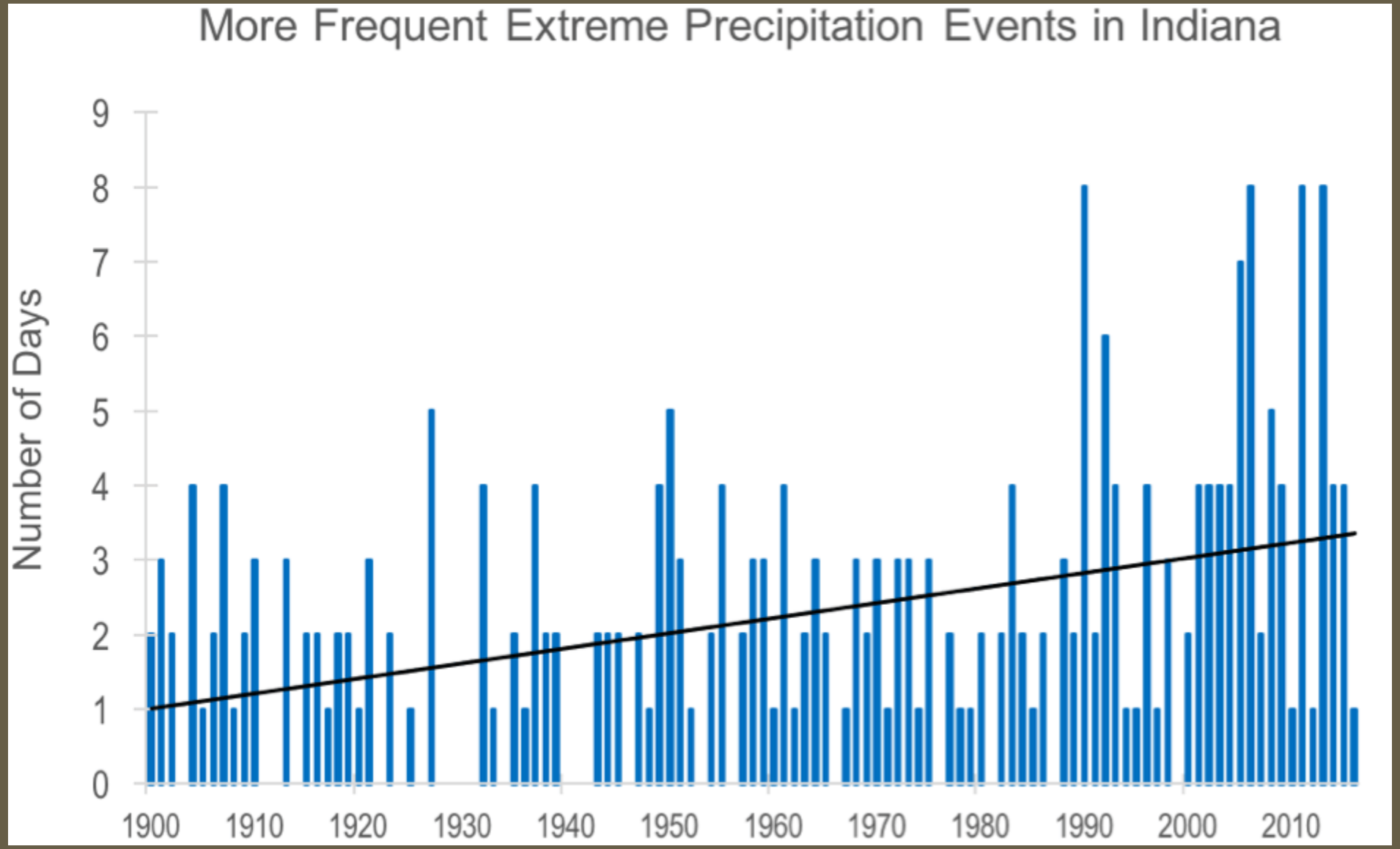




Percent changes in the annual amount of precipitation falling in very heavy events, defined as the heaviest 1% of all daily events from 1901 to 2012 for each region. (2014 National Climate Assessment)



Purdue Climate Change Research Center (2019)



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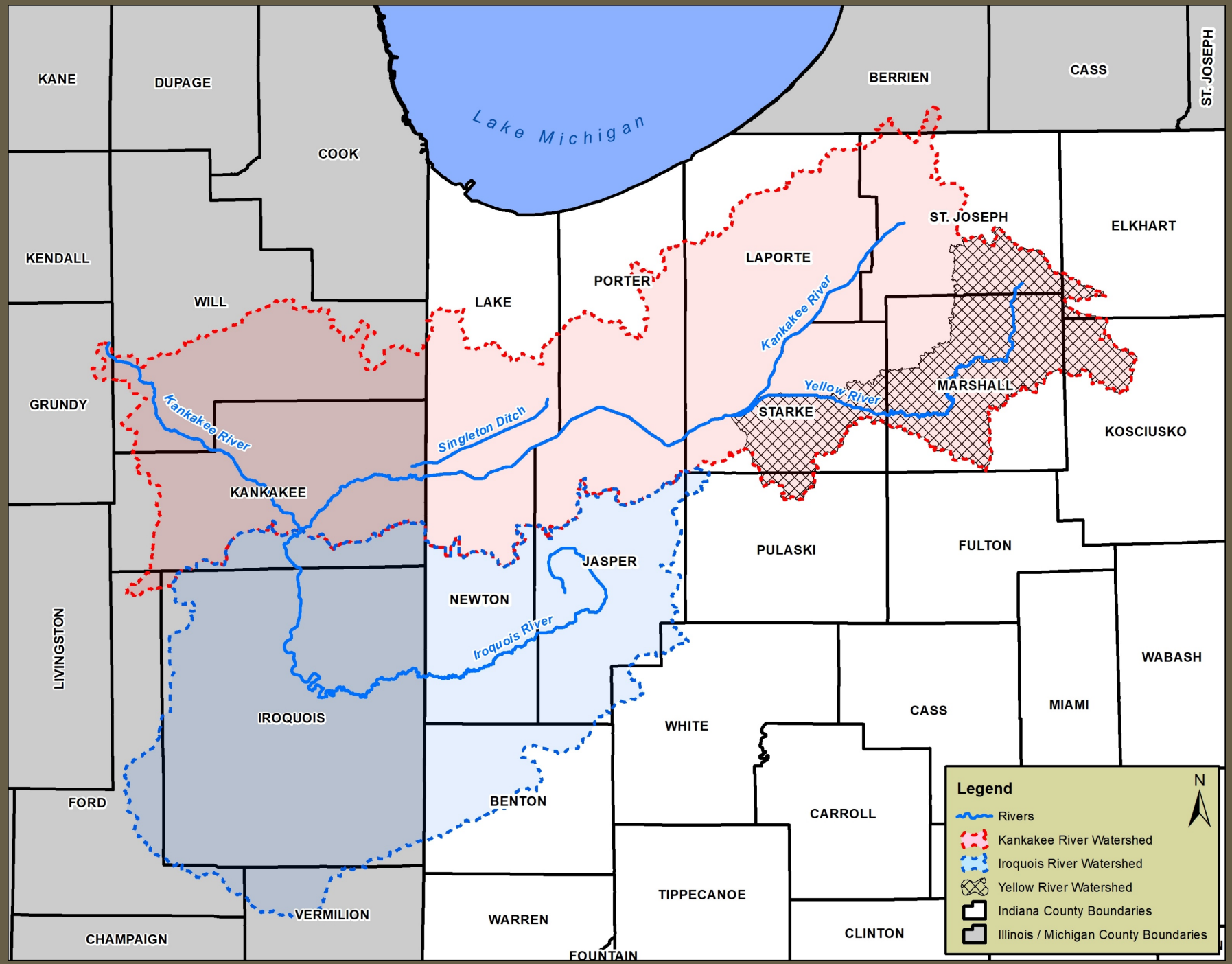

KANE
DUPAGE
COOK
Lake Michigan
BERRIEN
CASS
ST. JOSEPH
KENDALL
WILL
LAKE
PORTER
LAPORTE
ST. JOSEPH
ELKHART
GRUNDY
Kankakee River
Singleton Ditch
Kankakee River
Yellow River
MARSHALL
STARKE
KOSCIUSKO
KANKAKEE
JASPER
PULASKI
FULTON
LIVINGSTON
NEWTON
Iroquois River
WABASH
IROQUOIS
WHITE
CASS
MIAMI
FORD
BENTON
CARROLL
VERMILION
WARREN
TIPPECANOE
CLINTON
CHAMPAIGN
FOUNTAIN
Legend
N
Rivers
Kankakee River Watershed
Iroquois River Watershed
Yellow River Watershed
Indiana County Boundaries
Illinois / Michigan County Boundaries

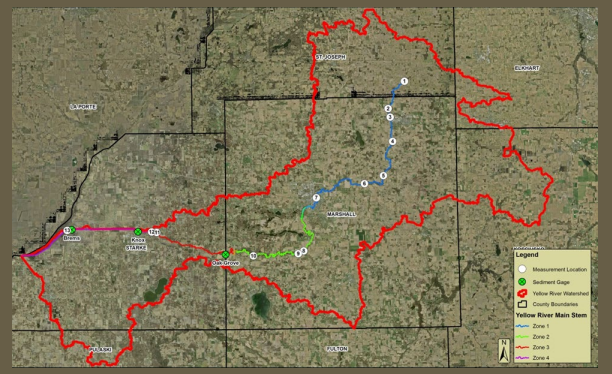
Yellow River Flooding, Erosion, and Sedimentation Management Work Plan

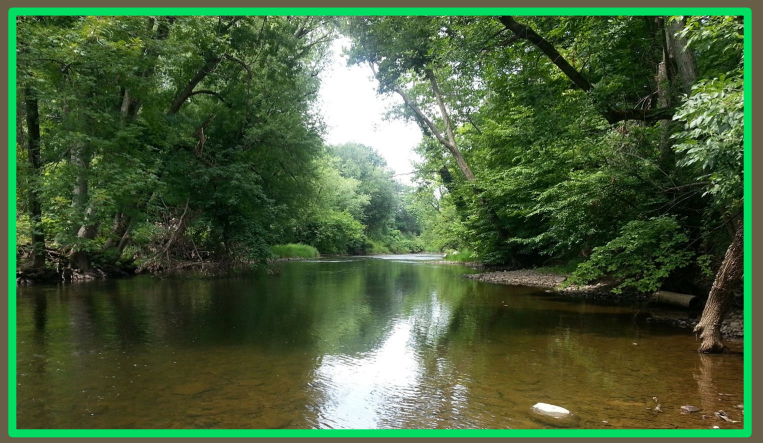
- Problem Statement
  - Too much, repeated maintenance expenditures needed to deal with significant bank failures, erosion, and sediment aggradation
  - Too much sediment is going to Illinois
  - Yellow River cited as a major sediment source
  - Yellow River plan could be regarded as a Pilot for the Kankakee watershed
- System Assessment initiated and funded by KRBC
- Our Charge
  - Pinpoint the root causes of instabilities
  - Develop a Work Plan with sustainable solutions (where to do what)

Channel Geometry Analysis

Location	Approx. Bankfull Width (ft)	Regional Equation Bankfull Width (ft)	Description of Measurement Location
1	22	33	Man-made ditch
2	30	48	Man-made ditch
3	45	54	Man-made ditch
4	49	63	Man-made ditch
5	54	68	Man-made ditch
6	70	78	Natural channel
7	84	82	Natural channel
8	89	84	Natural channel
9	96	87	Natural channel
10	88	88	Natural channel
11	101	90	Channelized stream
12	102	92	Channelized stream
13	129	93	Man-made ditch

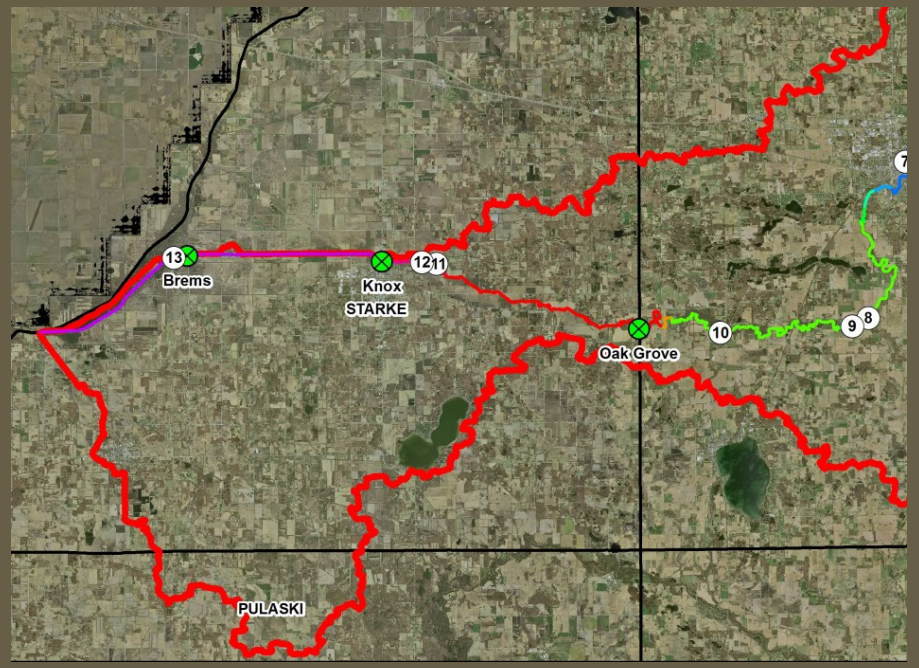
Detailed Field Assessment





Sediment Gage Data Analysis

- Variability from year-to-year
- Sharp increase in sediment between Oak Grove & Knox
- Knox sediment load ≈ Brems sediment load



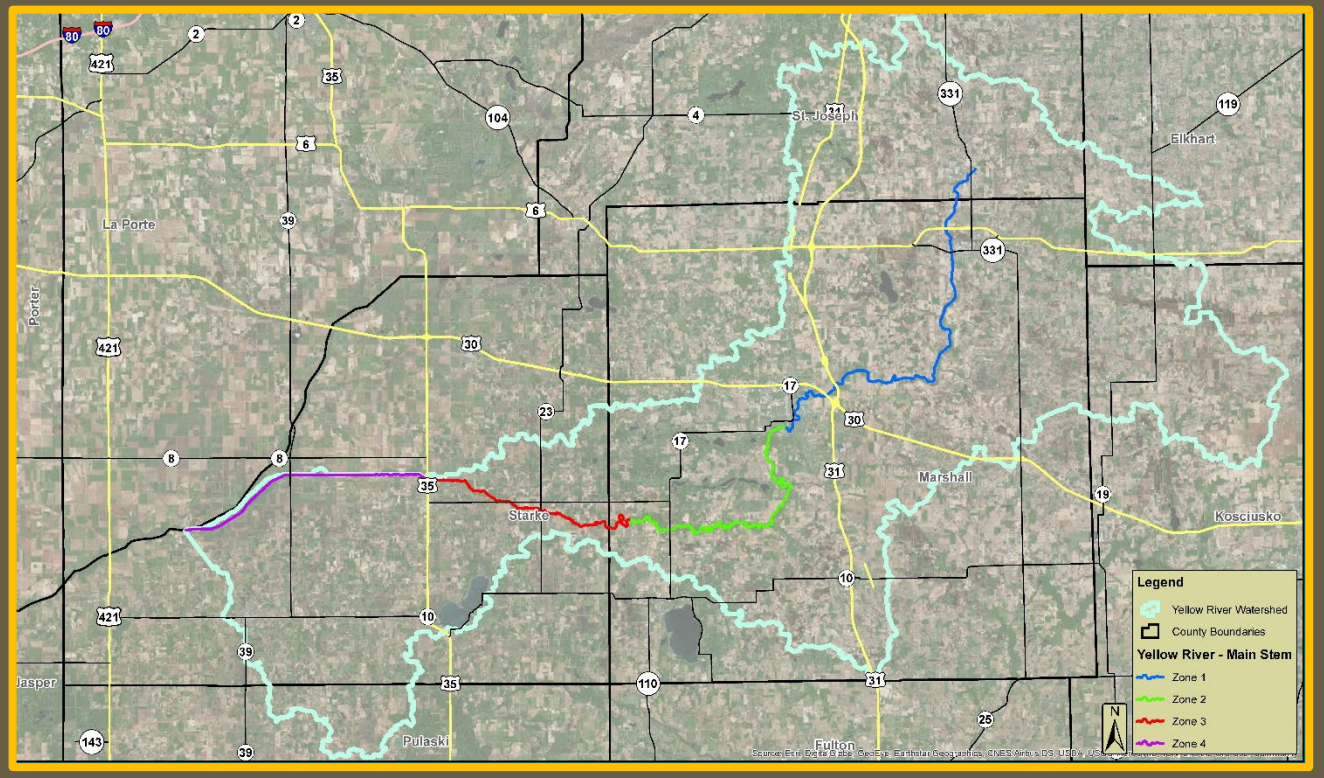
Location	Contributing Drainage Area (sq. mi.)	Adjusted Annual Suspended Sediment Load (tons)				
		2013	2014	2015	2016	Average Annual
Oak Grove	377	20,340	12,682	15,012	29,372	**19,351**
Knox	435	61,179	29,028	38,791	40,776	**44,443**
Brems	438	70,232	19,392	32,434	39,110	**40,292**

Yellow River Erosion and Sediment Management Plan Findings

- Major sources of sediment production:
  - Sand on headwater land surfaces
  - Severe streambank erosion between Knox and Starke-Marshall County line
- Major cause for severe aggradation in lower reaches:
  - Too much incoming sand
  - Lack of an efficient sediment transport mechanism

Yellow River Erosion and Sediment Management Plan Recommendations

- **Watershed:** Soil Health, Flatter Bank Slopes/ 2-Stage Laterals where poss.
- **Zone 1:** Establish/Maintain Buffer, Flatter Bank Slopes/ 2-Stage where poss.
- **Zone 2:** Monitor, Maintain Riparian Corridor
- **Zone 3:** Stabilize Banks Using Toe Wood (Start with a Pilot Project)
- **Zone 4:** Narrow Bankfull Width by Building Floodplain Benches Using Toe Wood



Addressing Streambank Erosion Sediment Source

Yellow River in Starke County, Indiana - Pilot project location

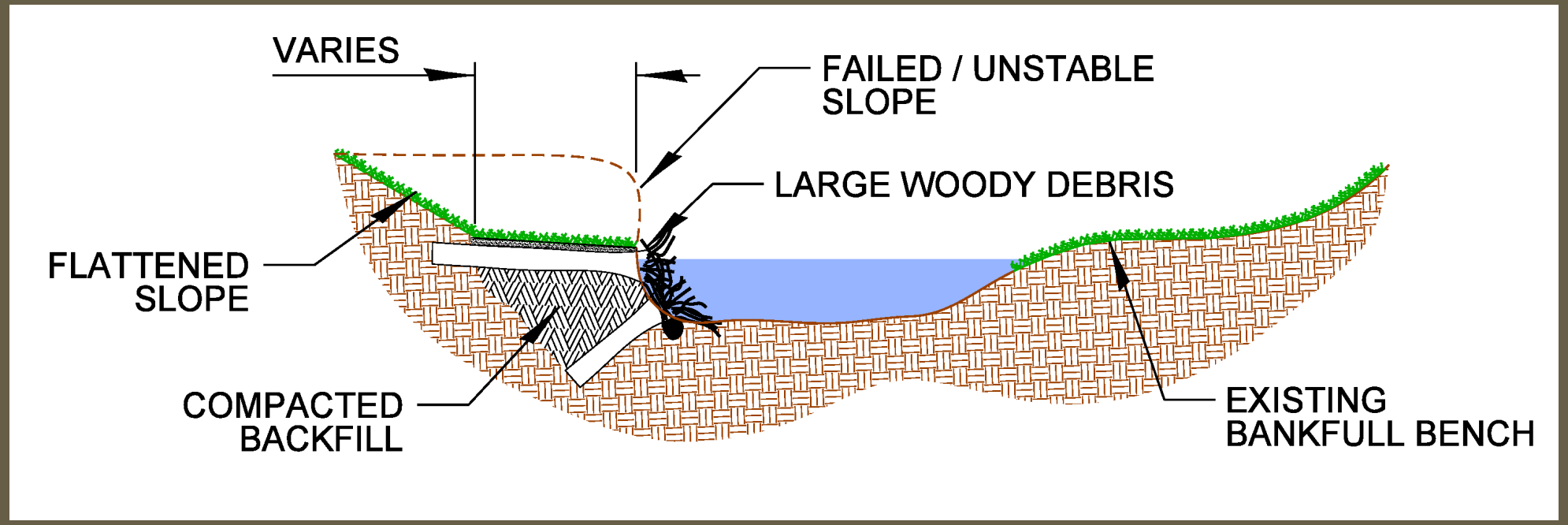
02.17.2017

Yellow River in Starke County, Indiana (Pilot Project Site – Before)

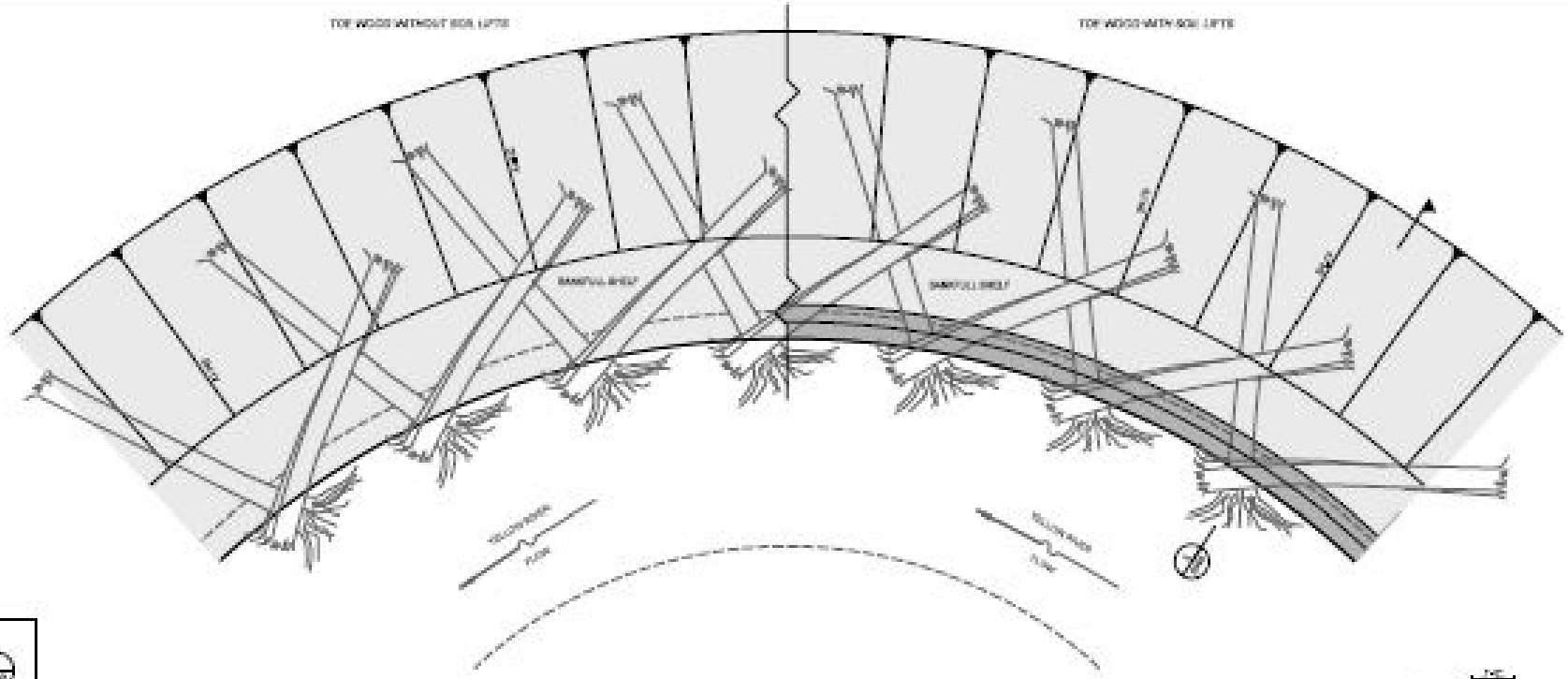
07.08.2016

Addressing Streambank Erosion Sediment Source

- Stabilize banks - Use “Toe wood” technique for bank stabilization
  - Develop typical cross sections for bank reconstruction
  - Develop cost estimates for reach
  - Initiate pilot projects to refine model




LEGEND
NOTES
RIVER
MATCHLINE-SEE PLAN
INSET



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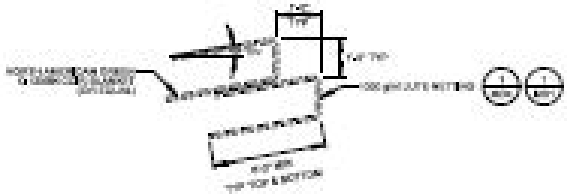
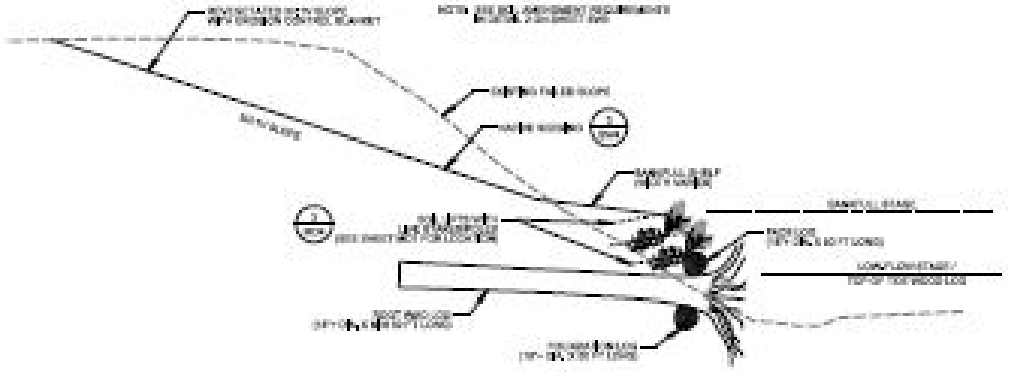
LEGEND

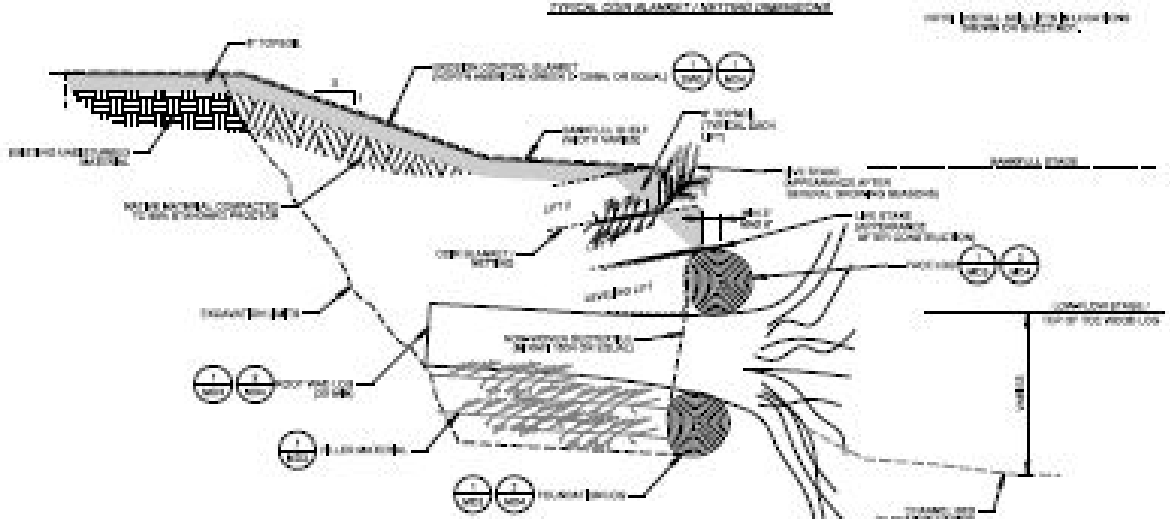
- COIR BIOLOGS
- SOIL LIFTS

1 PLAN VIEW - TOE WOOD AND SOIL LIFTS
NOT TO SCALE



TYPICAL COIR BLANKET / MATTING DIMENSIONS





Yellow River near Knox, Starke County, Indiana (Pilot Project Site – During Construction) 11.02.2017

Yellow River in Starke County, Indiana (Pilot Project Site – During Construction) 12.06.2017

Yellow River in Starke County, Indiana (Pilot Project Site – During the record February 2018 Flood) 2/23/2018

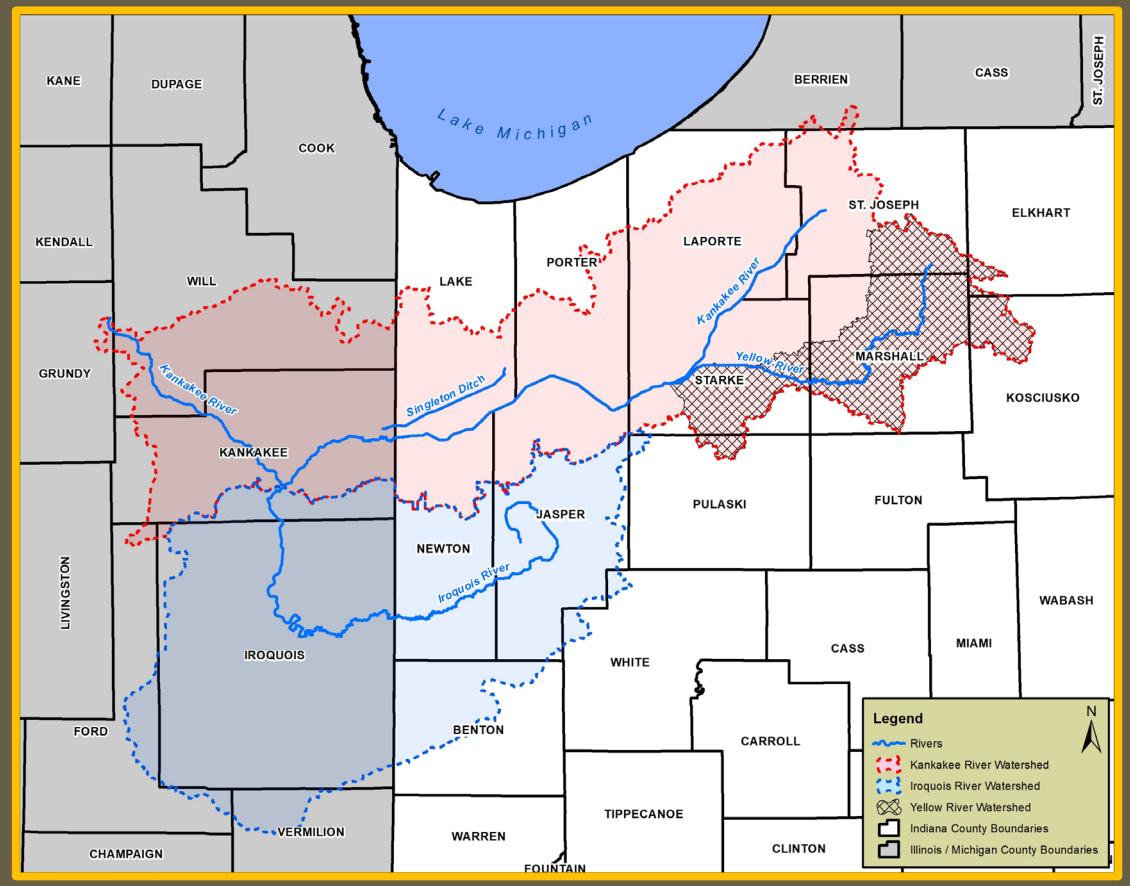

July 27, 2017
Oct 31, 2017
July 27, 2018


07.26.2018

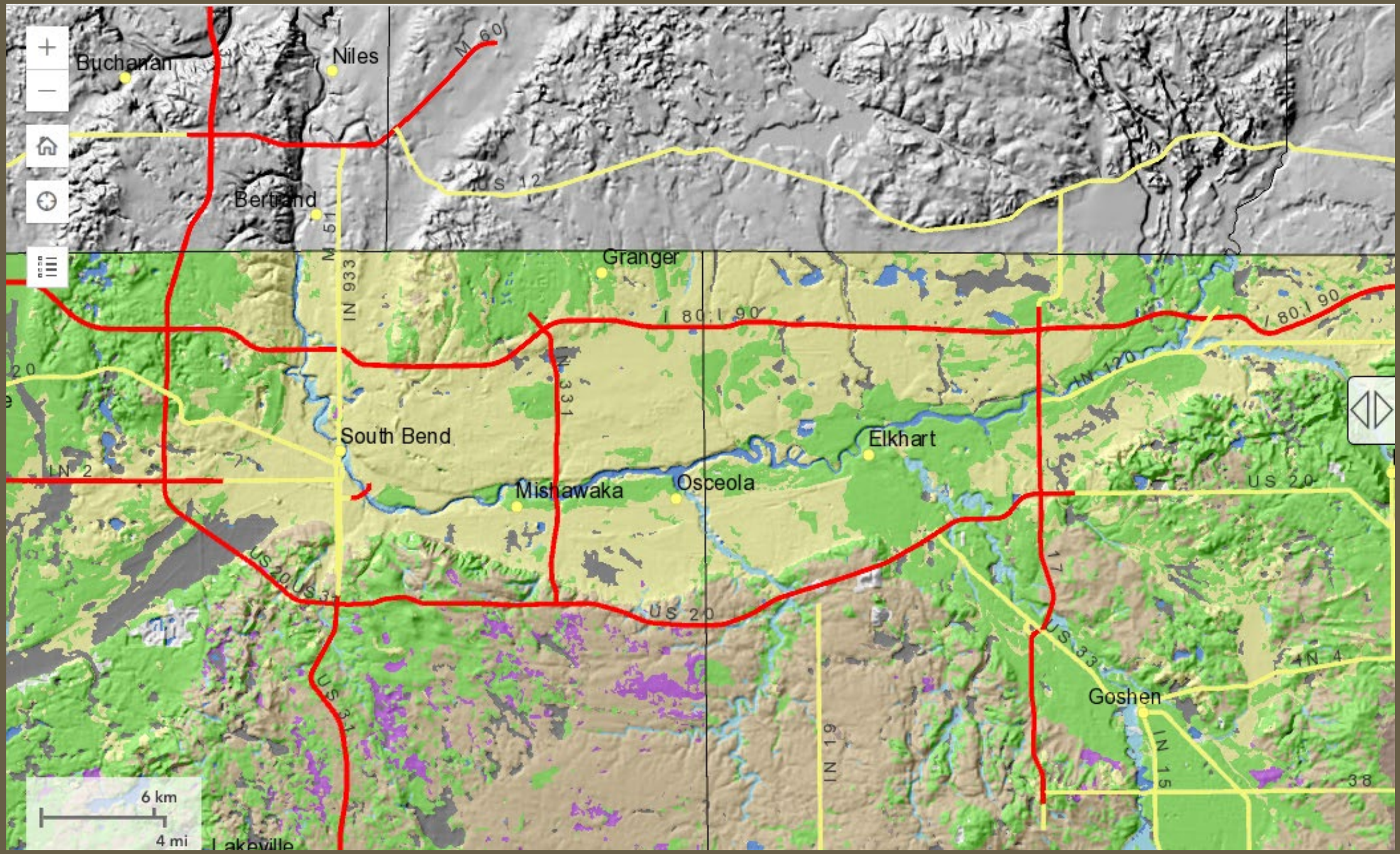
Summer After Installation (7/26/18)

Kankakee River Erosion, Sediment, and Flood Risk Management Work Plan

- **Diagnose** the Root Causes of Erosion, Sedimentation, and Flooding through Detailed Field and Desktop Assessment
- **Communicate** the Extent of Existing Risks and Expected Trends (Changing Climate)
- **Identify** Strategies for Addressing the Issues in a System-wide Approach
- **Develop** a Work Plan for Implementing Various Strategies Specific to Each Area Within the Watershed (Main Stem Reaches, Laterals, Urban Areas, Ag Areas)

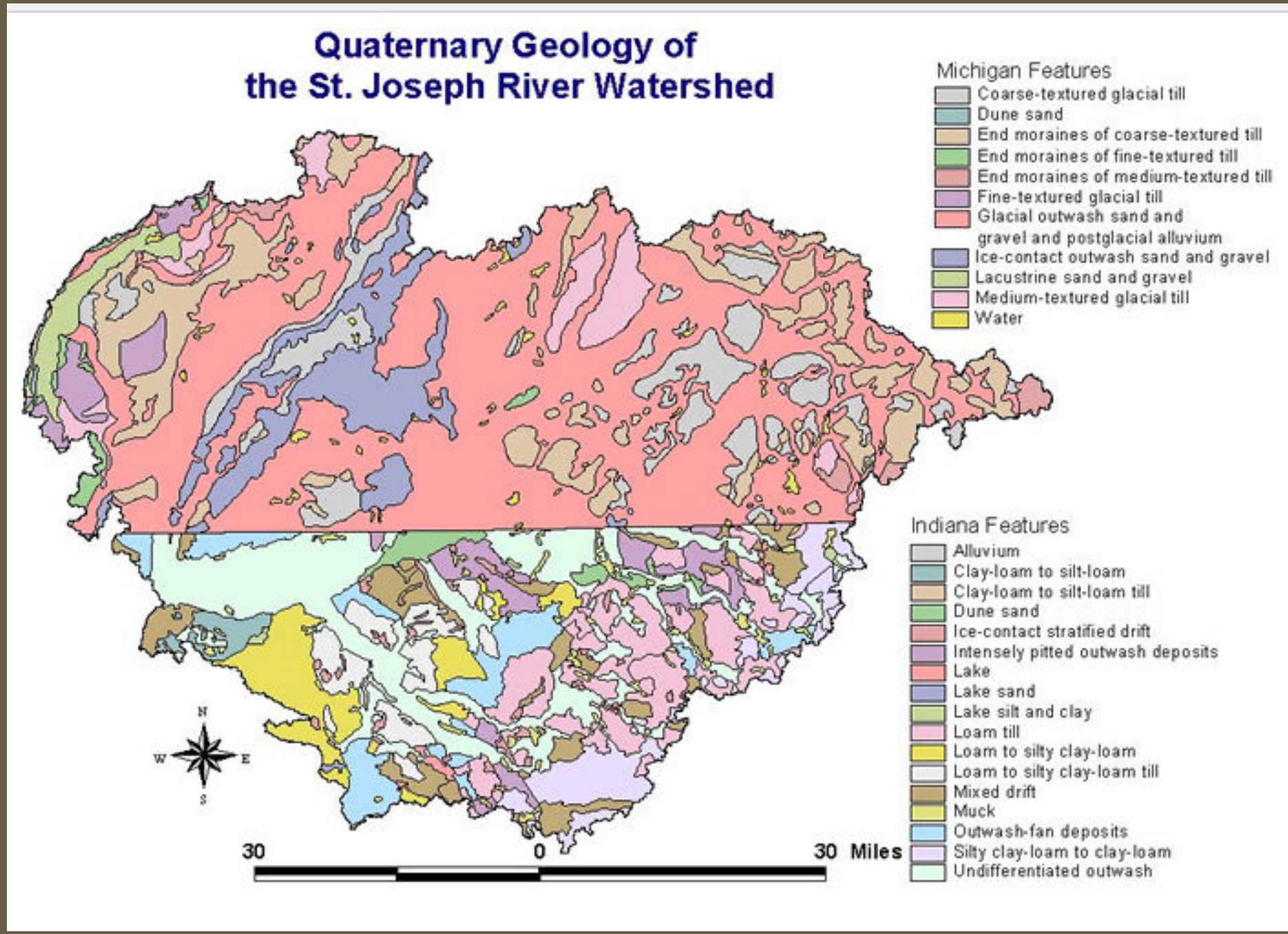


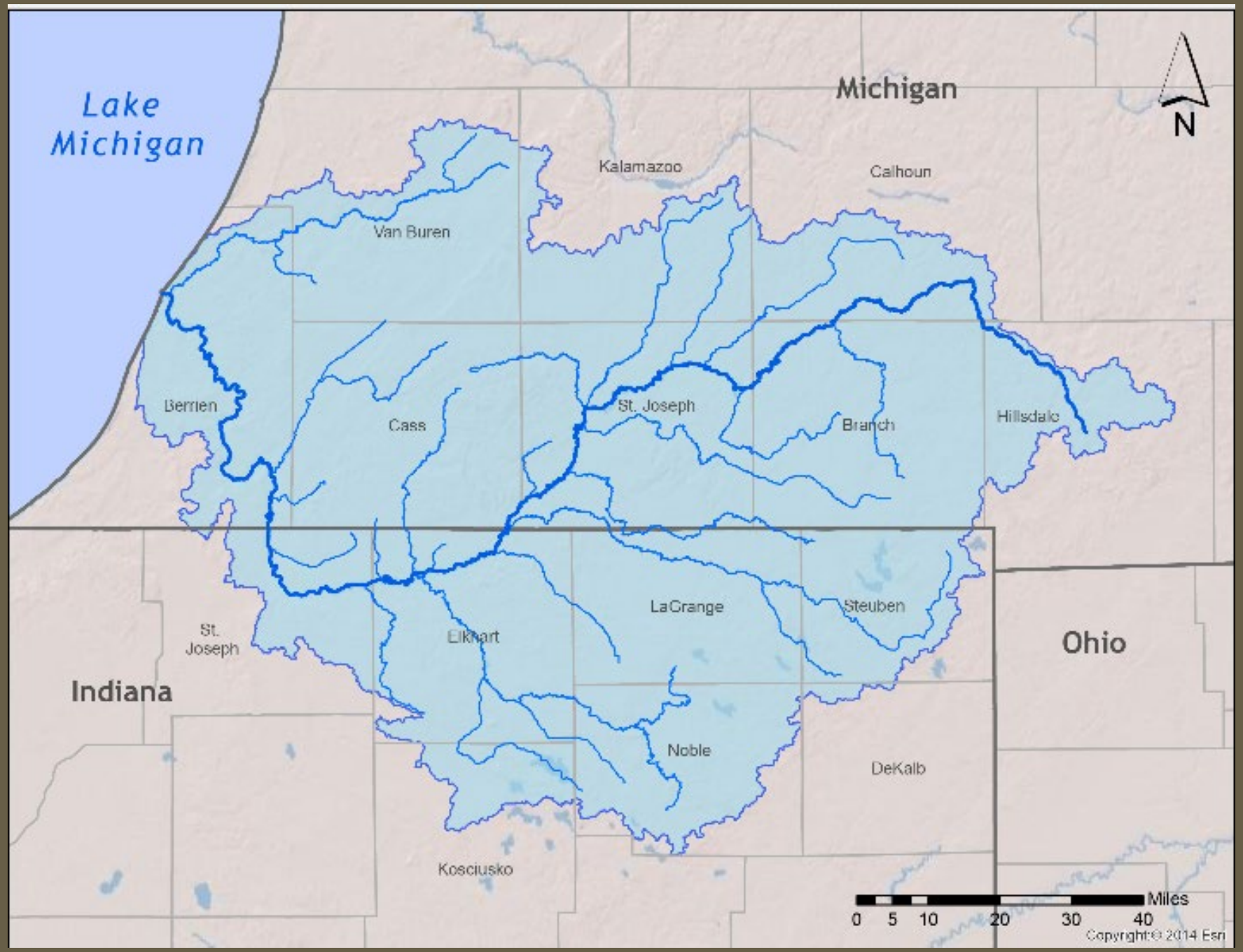
A Joint Indiana – Illinois Effort to Address a Legacy Problem Facing Both States!



Surficial Geology in the St Joseph River Basin

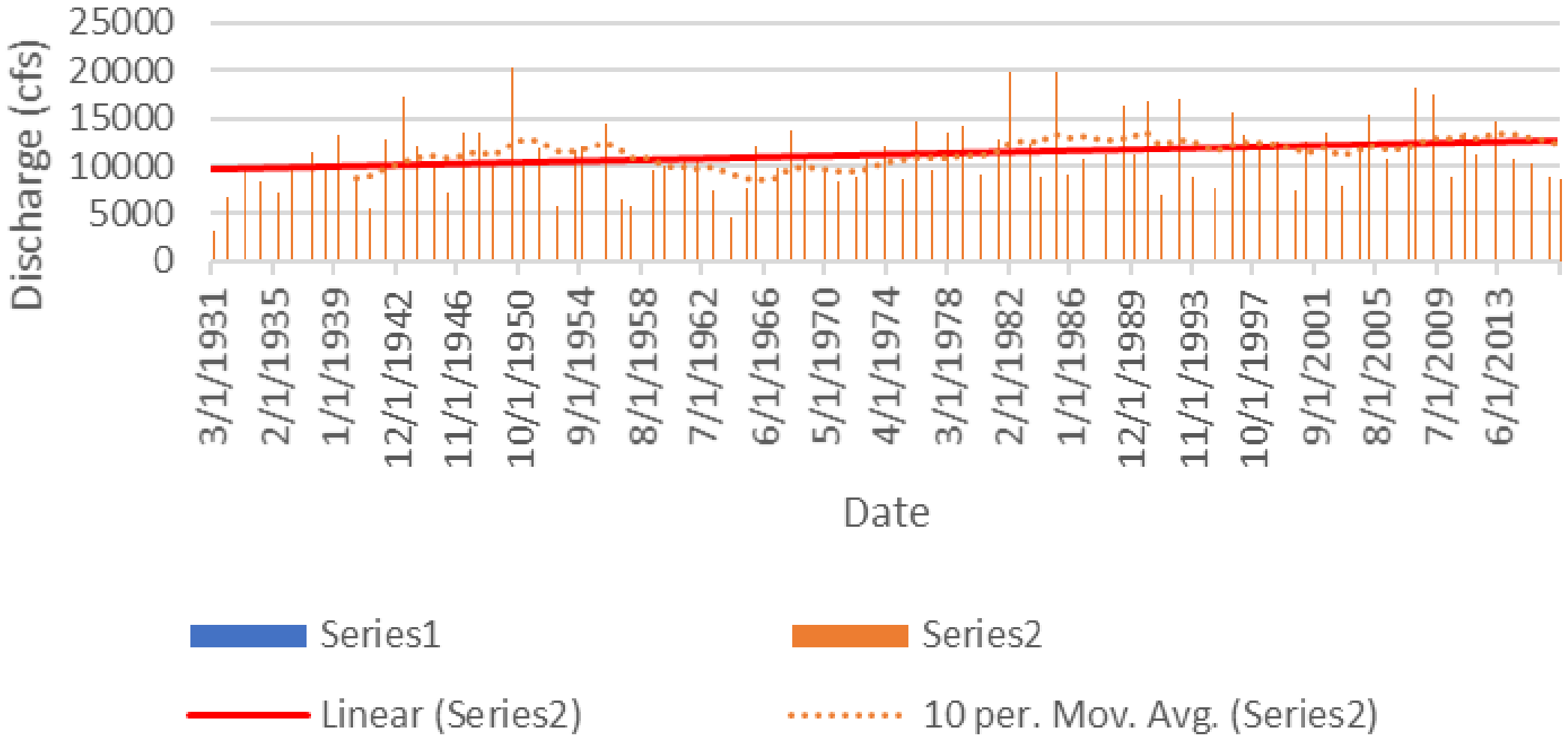
Purdue Soil Explorer


Quaternary Geology of
the St. Joseph River Watershed
Michigan Features
Coarse-textured glacial till
Dune sand
End moraines of coarse-textured till
End moraines of fine-textured till
End moraines of medium-textured till
Fine-textured glacial till
Glacial outwash sand and gravel and postglacial alluvium
Ice-contact outwash sand and gravel
Lacustrine sand and gravel
Medium-textured glacial till
Water
Indiana Features
Alluvium
Clay-loam to silt-loam
Clay-loam to silt-loam till
Dune sand
Ice-contact stratified drift
Intensely pitted outwash deposits
Lake
Lake sand
Lake silt and clay
Loam till
Loam to silty clay-loam
Loam to silty clay-loam till
Mixed drift
Muck
Outwash-fan deposits
Silty clay-loam to clay-loam
Undifferentiated outwash
N
W
E
S
30
0
30 Miles



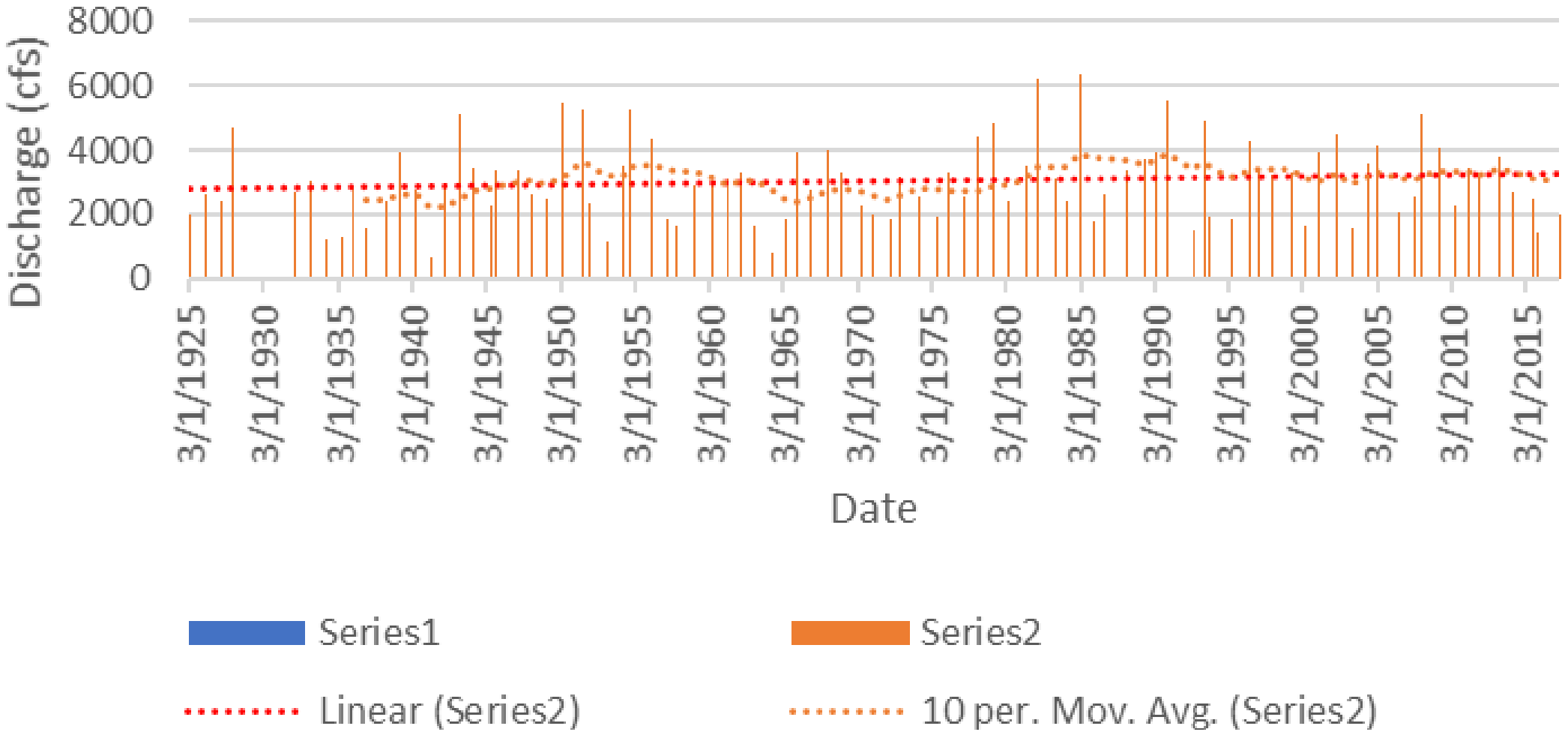
St Joseph River Basin, Michigan and Indiana, DA = 4682 mi^2 www.stjoeriver.net

Peak Annual Discharge, St Joseph River at Niles, MI USGS Gage 4101500



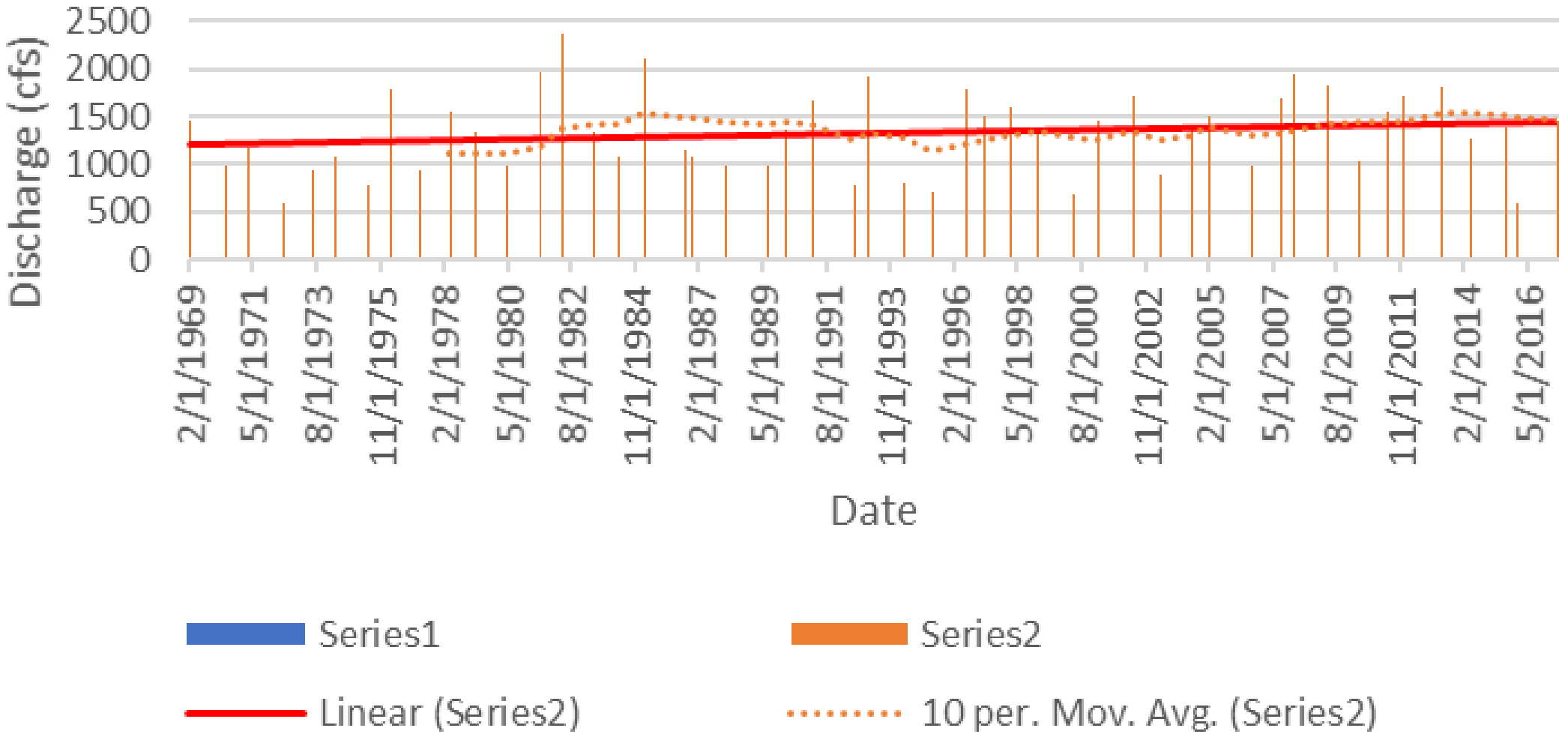
DA = 3660 mi2

Peak Annual Discharge, Elkhart River at Goshen, Indiana, USGS Gage 4100500



DA = 1560 mi^2

Annual Peak Discharge, Pigeon River near Scott, IN USGS Gage 4099750



DA = 361 mi^2

QUESTIONS?

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