Encouraging Conservation through Alternative Drain Apportionment

IMAGIN Workshop 1/21/2021

Susan Benston, Kieser & Associates, LLC

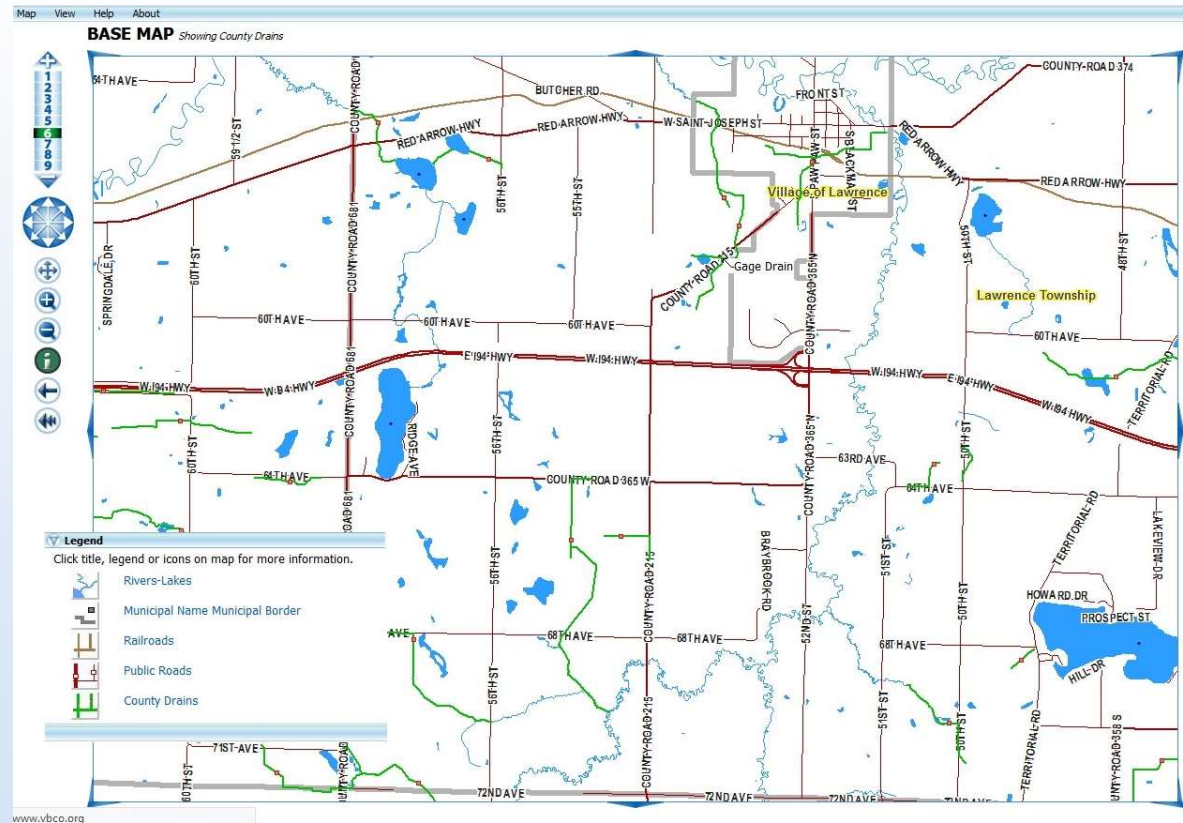Funding by Great Lakes Protection Fund

Outline

- Introduction to Drains and Alternative Drain Apportionment
- Generating the Land Cover Layer
- Generating Outputs Needed for Drainage Authorities
- Piloting Use-based Alternative Drain Apportionment in LaGrange County, IN
- Case Study: Results of Use-Based Apportionment with BMP Inclusion

Drains

Michigan, like most of the Midwest, is covered by county drains

Each drain has a contributing area, its own watershed or drainage district, that is taxed to maintain the drain

The drainage authority is responsible for drain maintenance and fee assessment

Van Buren County, Michigan, GIS showing Drains in Green

Photo Credit: Van Buren County Services and Information Center. 2020. Interactive Maps. Available online at: https://www.vbco.org/vanburenmaps.asp.

Drain Apportionment Law
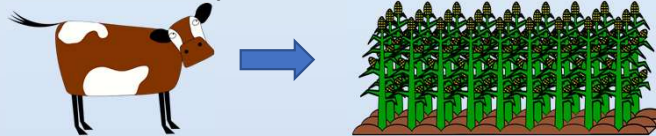
Michigan Drain Code of 1956, 280.152:

All apportionments… shall be upon the principle of benefits derived.

Application of Michigan Drain Code:

Currently, usually based on static factors like acreage.

In the real world, benefit to a parcel changes over time based on use and management.

For example:

Technology makes it easier than ever to understand how much each parcel is benefitting from the drain.

Text Credit: Kerr, J.M., Meersman, M., Fuller, E., and Fales, M.K. 2016. Exploring the potential role of public drain managers in motivating agricultural conservation practices. *Journal of Great Lakes Research.* 42: 1386-1394.
Photo Credit: Parman, J. 2013. Van Buren County Drain and Lake Level Assessments. Available online at: https://www.vbco.org/downloads/2013_annual_report_assessments.pdf.

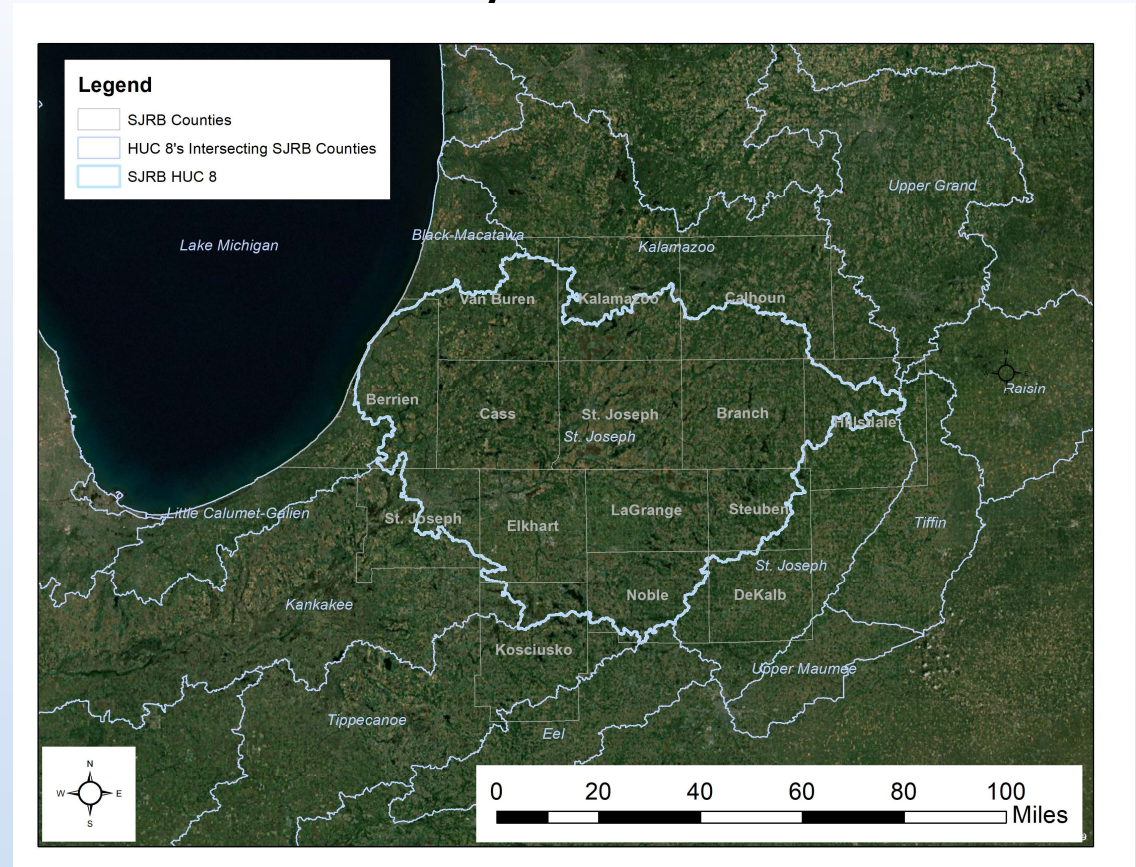# Use-Based Alternative
Drain Apportionment Calculations
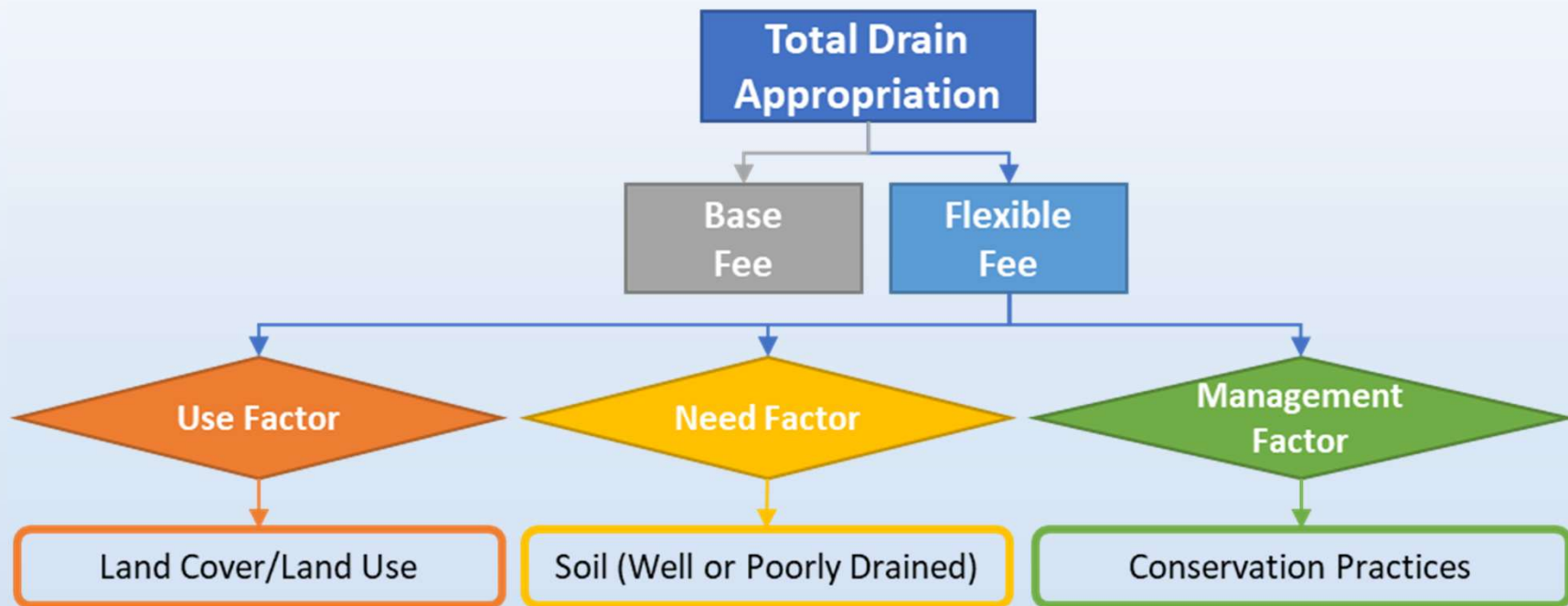
Factors set using HAWQS (SWAT) modeling and GIS analysis

# Generating the Land Cover Layer

- Use
  - Five Years of Cropland Data Layer
  - Open Street Map Buildings

- Need
  - Soils Layer

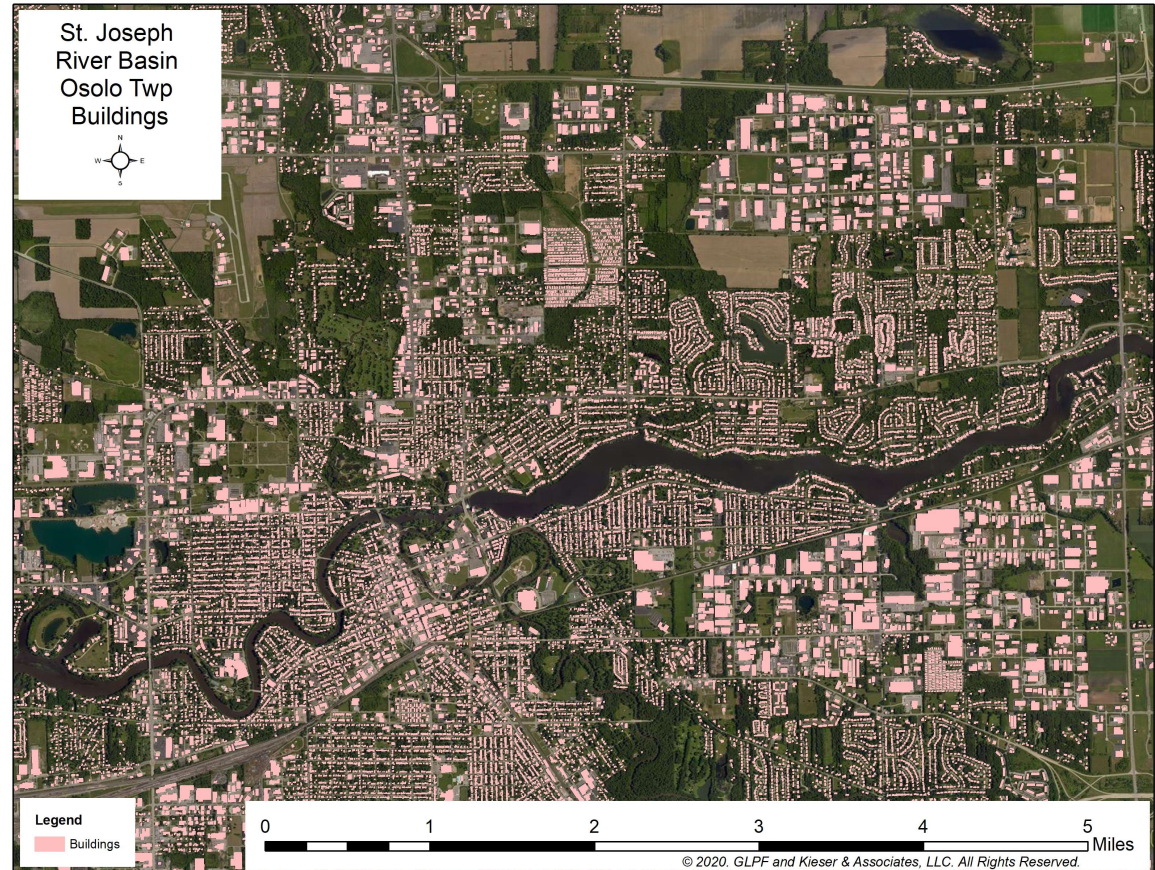# Use - 5 Years of Cropland Data Layer Land Cover

ArcGIS model builder was used to combine 5 years of cropland data for the mean land use.

USDA Natural Resource Conservation Service Geospatial Data Gateway https://datagateway.nrcs.usda.gov/GDGHome.aspx and USDA National Agricultural Statistical Service CropScape https://nassgeodata.gmu.edu/CropScape/
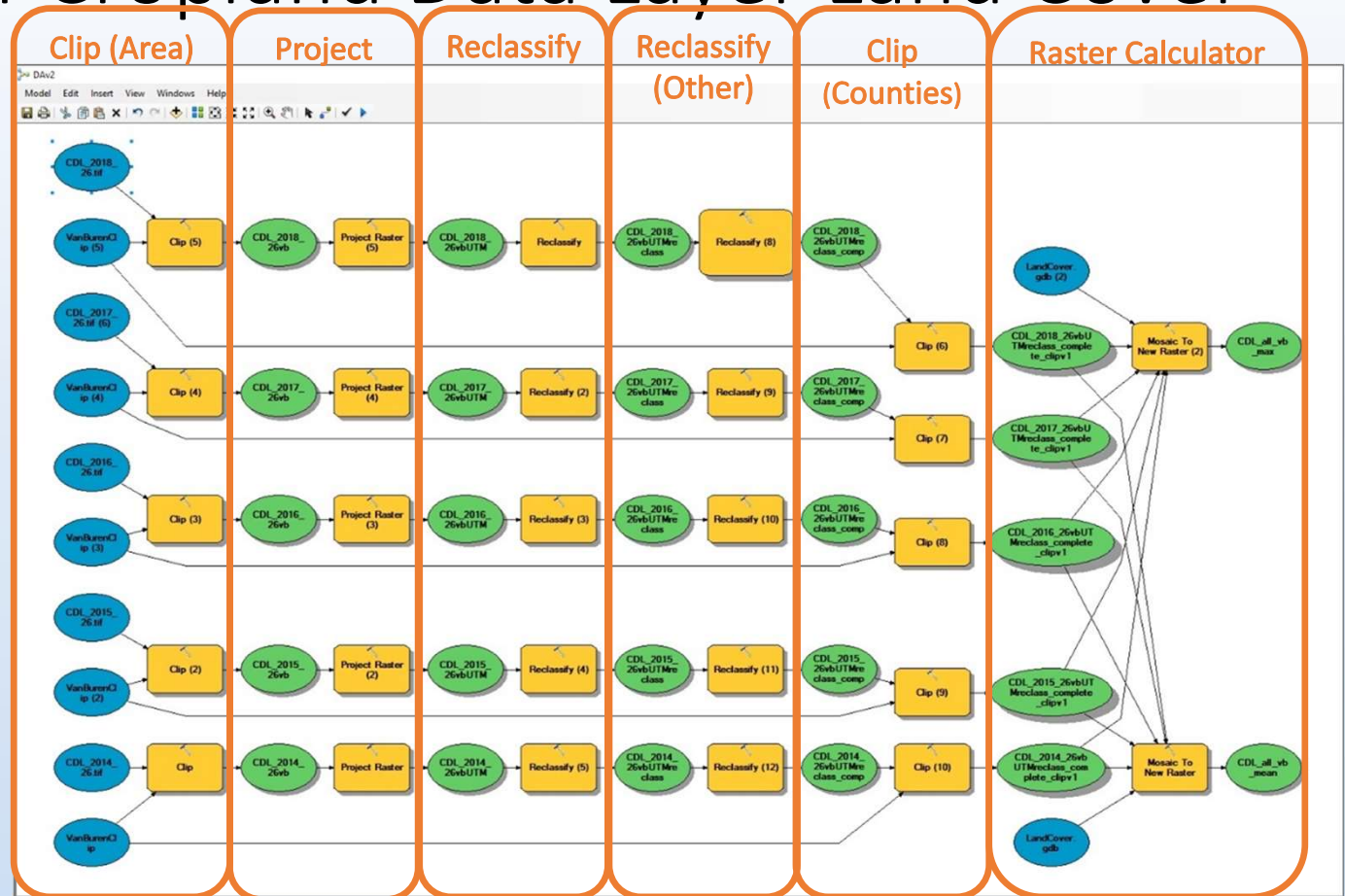
Use - Open Street Map

- Openstreetmap.org is a potential way to address ongoing changes to land cover/land use.

- Microsoft US building footprint layer added to increase accuracy.
  https://github.com/microsoft/usbuildingfootprints

St. Joseph River Basin Osolo Twp Buildings

Legend
Buildings
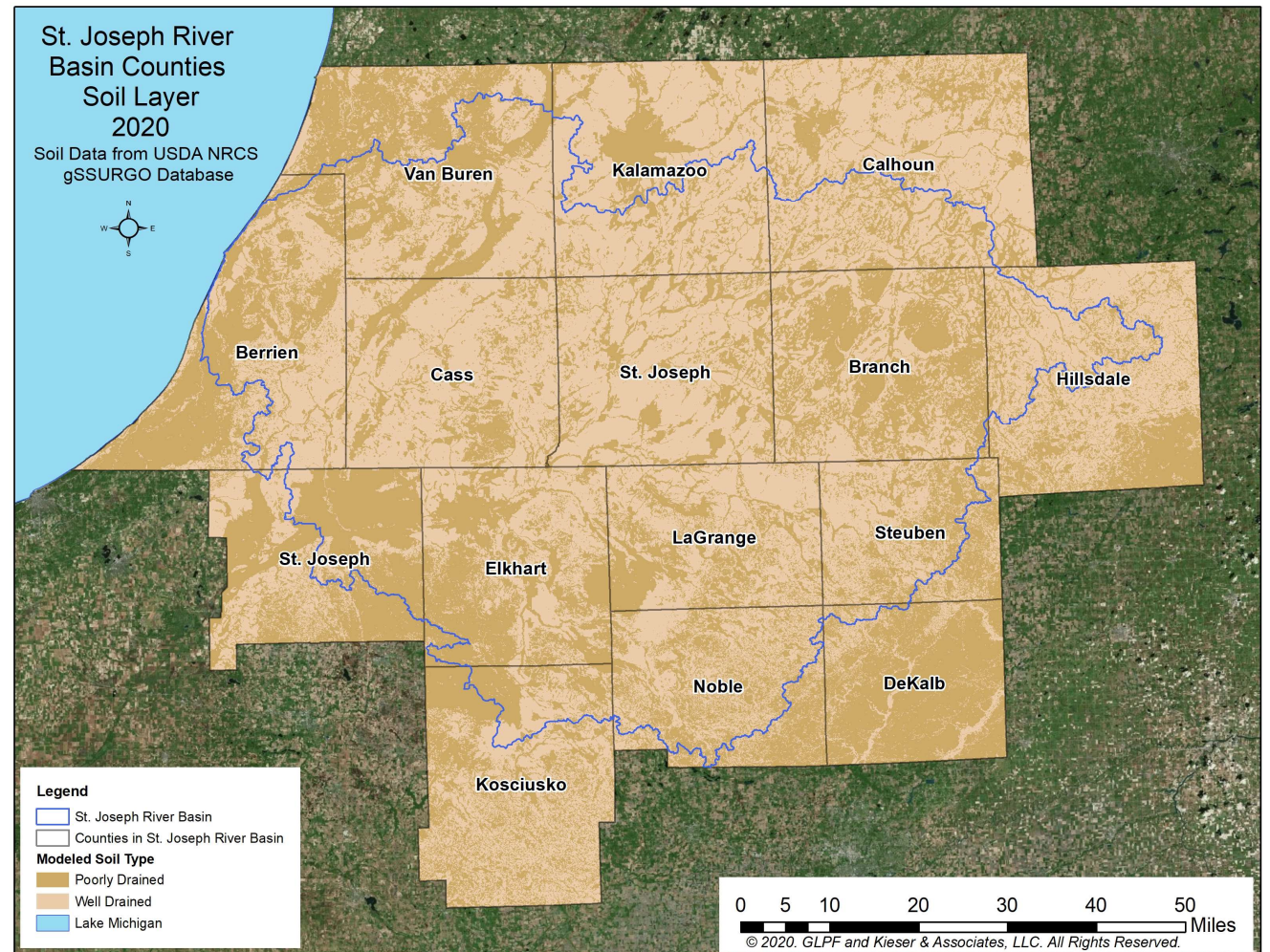
0   1   2   3   4   5
Miles

Need

Well and poorly drained soils identified based on USDA NRCS Web Soil Survey classification of hydrologic soil groups:

- Well drained = Group A, B or C
- Poorly drained = Group A/D, B/D, C/D or D

gSSURGO layer used to gather soils data.
https://gdg.sc.egov.usda.gov/

St. Joseph River Basin Counties Soil Layer 2020
Soil Data from USDA NRCS gSSURGO Database

Legend
- St. Joseph River Basin
- Counties in St. Joseph River Basin

Modeled Soil Type
- Poorly Drained
- Well Drained
- Lake Michigan

0 5 10 20 30 40 50 Miles

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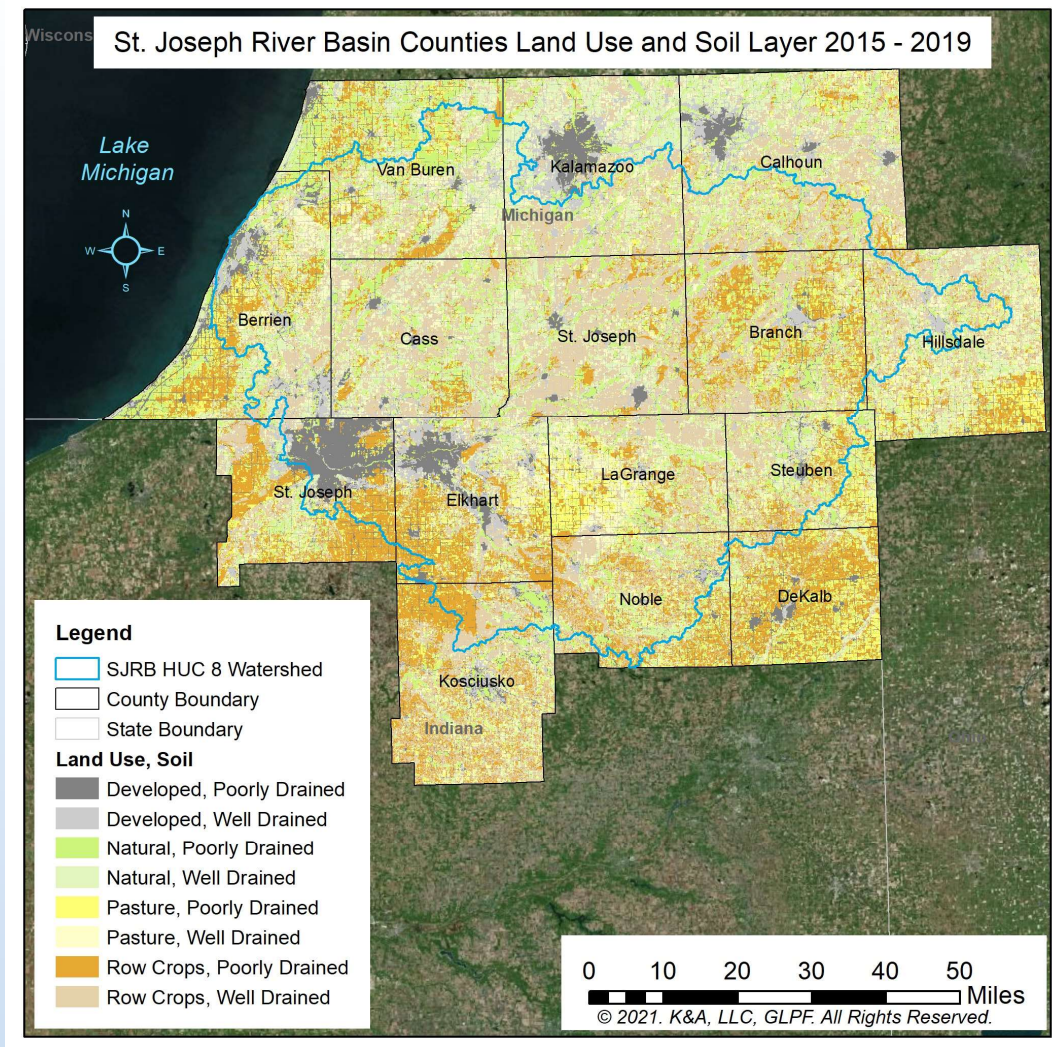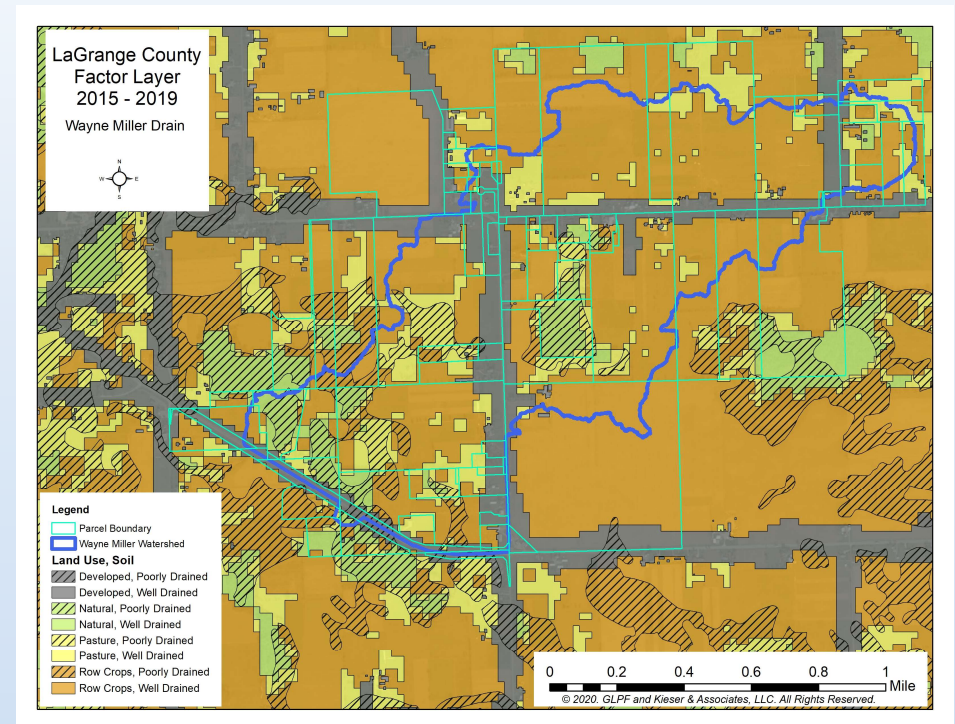
Union of all Layers

- 5-year Mean Cropland Data Layer (CDL) converted to polygon

- Union of polygons:
  - 5-year mean CDL
  - US Buildings
  - Soils (well or poorly drained)

St. Joseph River Basin Counties Land Use and Soil Layer 2015 - 2019

Legend
- SJRB HUC 8 Watershed
- County Boundary
- State Boundary

Land Use, Soil
- Developed, Poorly Drained
- Developed, Well Drained
- Natural, Poorly Drained
- Natural, Well Drained
- Pasture, Poorly Drained
- Pasture, Well Drained
- Row Crops, Poorly Drained
- Row Crops, Well Drained

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Generating Outputs Needed for Drainage Authorities

- Timed just prior to apportionment

- Output is GIS map and Microsoft Excel table

- Generated using a combination of ArcGIS and Web App tools.

LaGrange County Factor Layer 2015 - 2019 Wayne Miller Drain

Legend
Parcel Boundary
Wayne Miller Watershed
Land Use, Soil
Developed, Poorly Drained
Developed, Well Drained
Natural, Poorly Drained
Natural, Well Drained
Pasture, Poorly Drained
Pasture, Well Drained
Row Crops, Poorly Drained
Row Crops, Well Drained

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ArcGIS Tool

Script within ArcGIS Toolbox unions all parcels within the drainage district with the land use layer and calculates acreage within the drainage district.
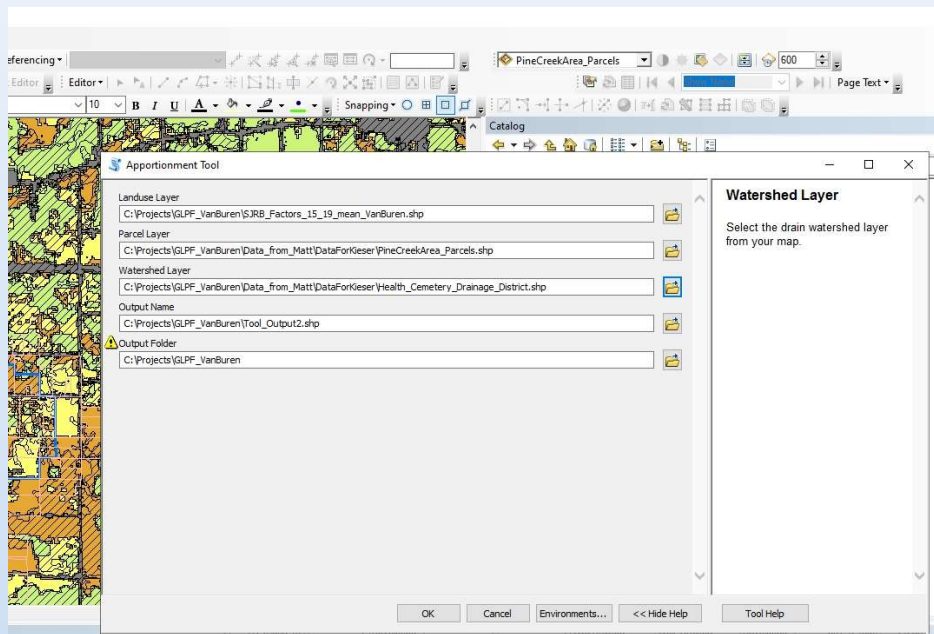
- User adds parcels, drainage district (watershed) boundary and land use/soil layer to tool.

- Output is shapefile and csv of data needed for web app.

Drain Apportionment Web App

- Web App output is percentages/fees for each parcel.

- Fees are based on factors determined by HAWQS (SWAT) analysis of SJRB.

- Factors are adjustable by the drain authorities.

- Output can be used to generate meeting notices, tax letters, etc.

Piloting Use-based Alternative Drain Apportionment in LaGrange County, IN

- 4 Drain Projects re-apportioned involving a total of:
  - 401 Parcels
  - 4,700 acres
  - $93,000 in project cost re-distributed based on use

Clinton Case Drain

Legend
Land Use, Soil
- Developed, Poorly Drained
- Developed, Well Drained
- Natural, Poorly Drained
- Natural, Well Drained
- Pasture/Hay, Poorly Drained
- Pasture/Hay, Well Drained
- Row Crops, Poorly Drained
- Row Crops, Well Drained

Approximate Cost Per Acre:
(after $20 per parcel)

Land Use, Soil	Cost
Developed, Poorly Drained	$19.82
Row Crops, Poorly Drained	$18.44
Developed, Well Drained	$11.10
Row Crops, Well Drained	$10.32
Grass/Hay, Poorly Drained	$9.52
Grass/Hay, Well Drained	$5.33
Natural, All Soils	$4.96

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Results of LaGrange County, Indiana Use-based Re-apportionments

- Fee burden shifted from less drainage-intensive parcels to parcels with land-use/soil type combinations with greater drainage needs.

- 55% of parcels were charged less under the new method.

- 56% of parcels were charged roughly the same amount (+/- $10).

How fees shifted from traditional to new apportionment methods for pilot drains

Pie chart segments:
- 7% — Saved $100+
- 19% — Saved $10-100
- 29% — Saved $0-10
- 27% — Additional $0-10
- 13% — Additional $10-100
- 5% — Additional $100+
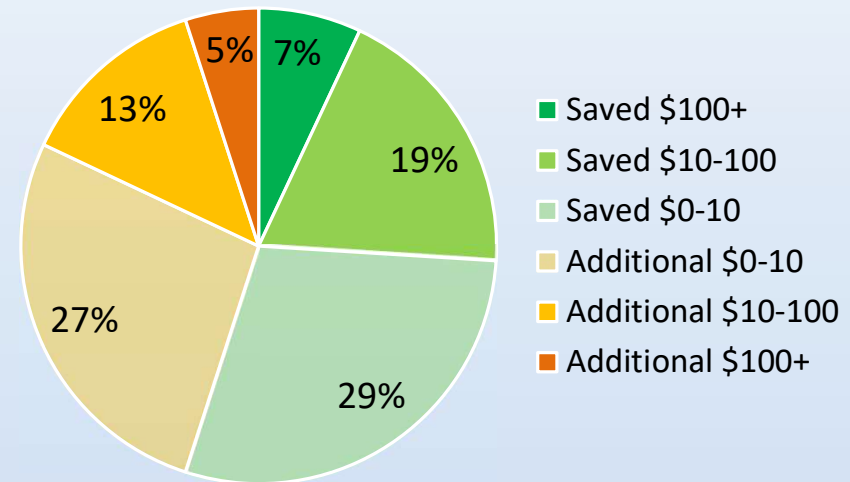
Case Study: Results of Use-Based Apportionment with BMP Inclusion

- Clinton Case Drain case study modelled the benefits generated if the parcel with the largest sediment contribution in the drain installed field borders and switched to no-till.

- Modelled results show that including BMPs in use-based apportionment can create substantial benefits for taxpayers and the environment.
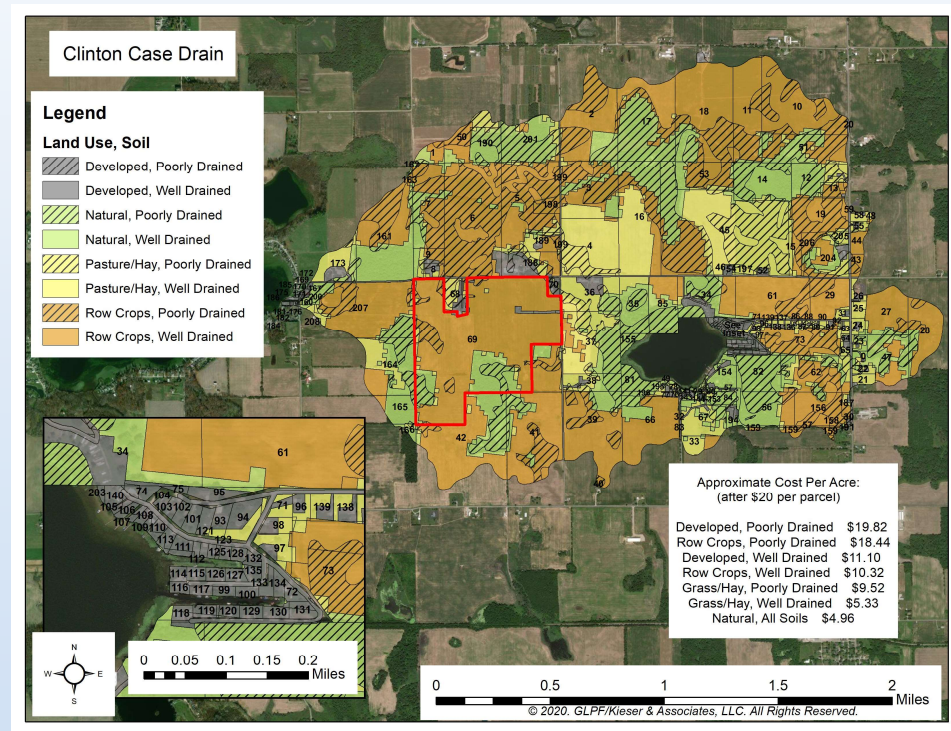
Case Study: Results of Use-Based Apportionment with BMP Inclusion (continued)

- Environmental benefits include the reduction of **172.8 tons of sediment** to drain receiving waters.

- Average yearly maintenance goes down due to decreased sediment inputs.

- Owner of parcel installing BMP's reduced their own fee by **38%.**

- All other parcels on average received a fee reduction of **11%.**

Modelled Environmental and Fee Results for Clinton Case Drain

Parcel(s)	Sediment Contribution (tons)		Average Yearly Fees	
	Before BMP's	After BMP's	Before BMP's	After BMP's
All	1367.8	**1195.0**	$13,678	**$11,950**
BMP Parcel	230.4	**57.6**	$1,132	**$700**
All Other Parcels (Average)	5.5	5.5	$61	**$54**

Questions?

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