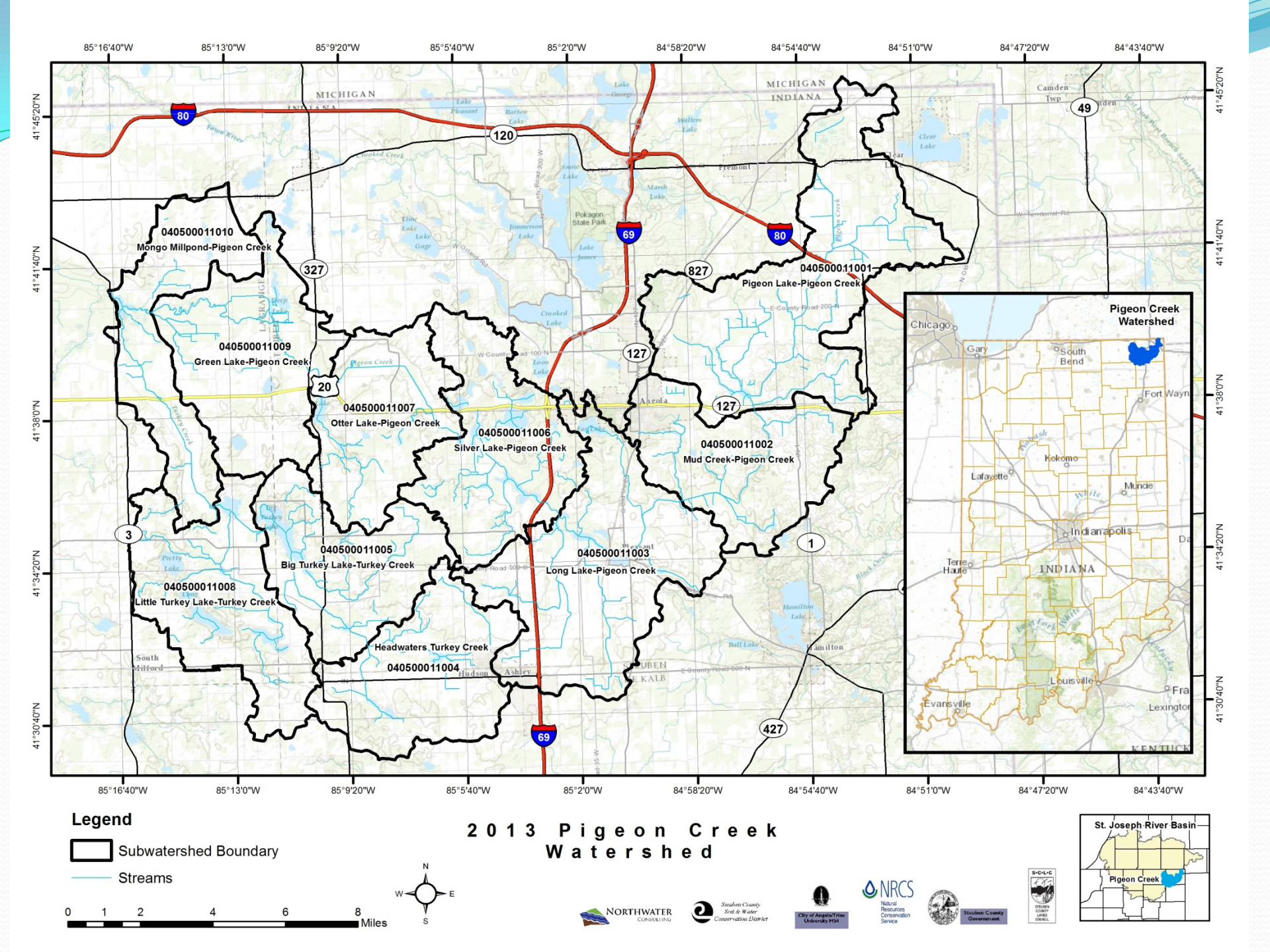
Pigeon Creek Watershed Management Plan

2014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Green Lake-Pigeon Creek
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Otter Lake-Pigeon Creek
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Silver Lake-Pigeon Creek
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Pigeon Lake-Pigeon Creek
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Big Turkey Lake-Turkey Creek
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Long Lake-Pigeon Creek
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Little Turkey Lake-Turkey Creek
Headwaters Turkey Creek
040500011004
Pigeon Creek Watershed
Chicago
Gary
South Bend
Fort Wayn
Kokomo
Lafayette
Muncie
Indianapolis
Terre Haute
Louisville
Evansville
Fra
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KENTUCK
Legend
Subwatershed Boundary
Streams
0 1 2 4 6 8 Miles
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2013 Pigeon Creek Watershed
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Tri-State University MS4
NRCS Natural Resources Conservation Service
Steuben County Government
S•G•L•C
St. Joseph River Basin
Pigeon Creek

Summary

- Key findings and what is unique about this plan
- Watershed features and characteristics
- Problems, causes, and pollution loading
- Critical areas
- Recommendations and Best Management Practices
  - Load reductions
- Cost estimates
- Responsible parties and available resources
- Monitoring

Key Differences with the Pigeon Creek Plan

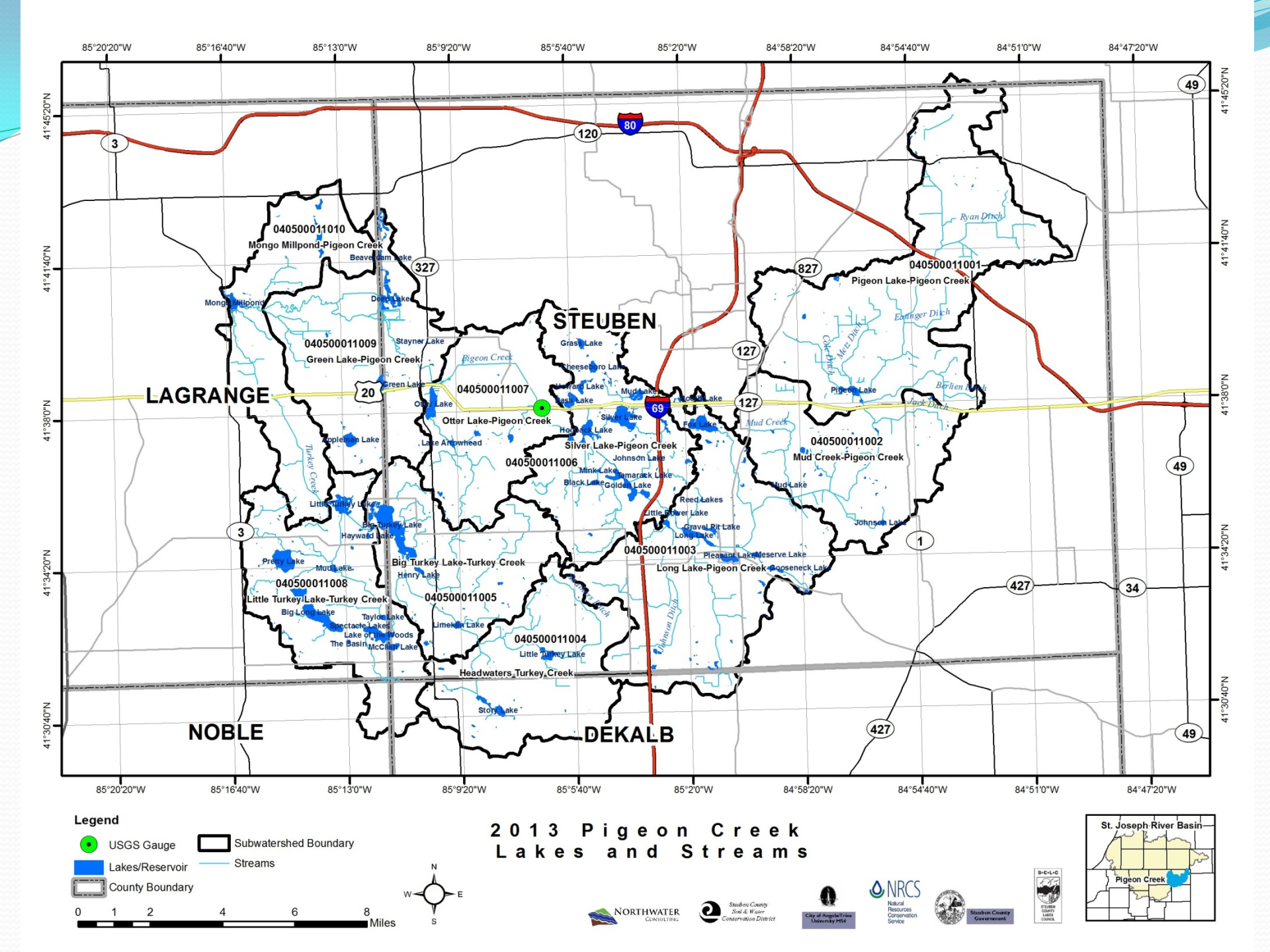
- Emphasis on fully utilizing GIS rather than just making maps
  - Custom Landuse layer
  - Advanced spatial analysis
- Data driven critical areas analysis
- Watershed survey and meetings with individual landowners
  - Site-specific practices identified
- Parcel specific pollution load model
  - Ability to analyze loading by property
- Direct linkage with TMDL

Key Findings

- The watershed produces high bacteria and nutrient loading, and a moderate sediment load
  - 1.16 lbs/acre/year for phosphorus
  - 7.13 lbs/acre/year of nitrogen
  - 0.94 tons/acre/year of sediment
  - 2.72 billion colony-forming units/acre/year
- Water quality sampling indicates frequent exceedences in bacteria
- 9 lakes and 179 stream miles impaired (70%)

Key Findings

- Sediment and nutrient loads originating from crop and pasture
- Bacteria load originating from failing septics, concentrated feed areas, and residential runoff
- Wastewater plants operating well within permitted limits
- Much work in the watershed has already been completed
- To meet pollution reduction targets, large scale practice implementation is required



Legend

- USGS Gauge
- Lakes/Reservoir
- County Boundary
- Subwatershed Boundary
- Streams

0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek Lakes and Streams

St. Joseph River Basin

Pigeon Creek

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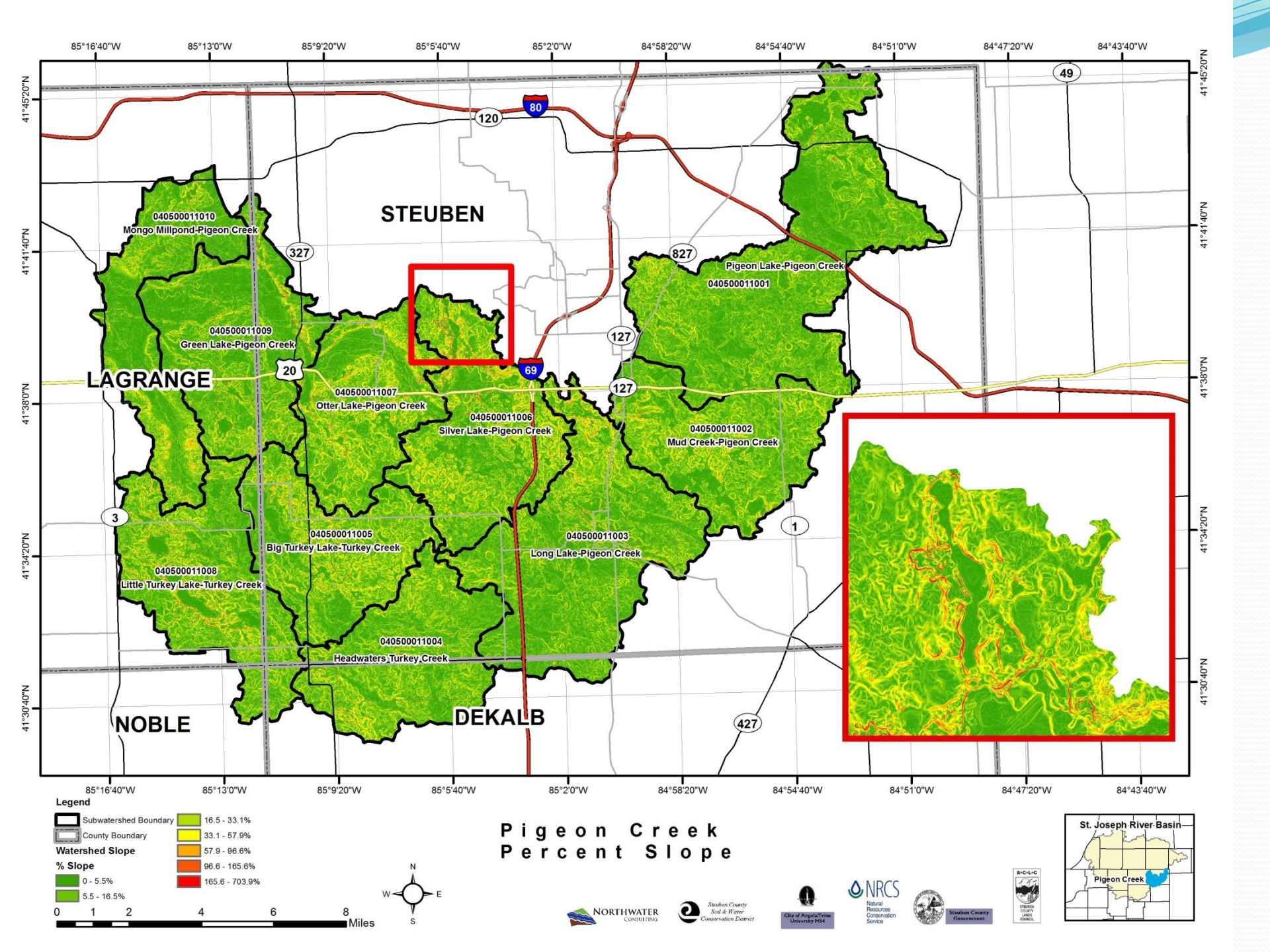
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LAGRANGE
NOBLE
DEKALB
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Green Lake-Pigeon Creek
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Otter Lake-Pigeon Creek
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Silver Lake-Pigeon Creek
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Big Turkey Lake-Turkey Creek
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Little Turkey Lake-Turkey Creek
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Headwaters Turkey Creek
040500011003
Long Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
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Pigeon Lake-Pigeon Creek
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120
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Legend
Subwatershed Boundary
County Boundary
Watershed Slope
% Slope
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5.5 - 16.5%
16.5 - 33.1%
33.1 - 57.9%
57.9 - 96.6%
96.6 - 165.6%
165.6 - 703.9%
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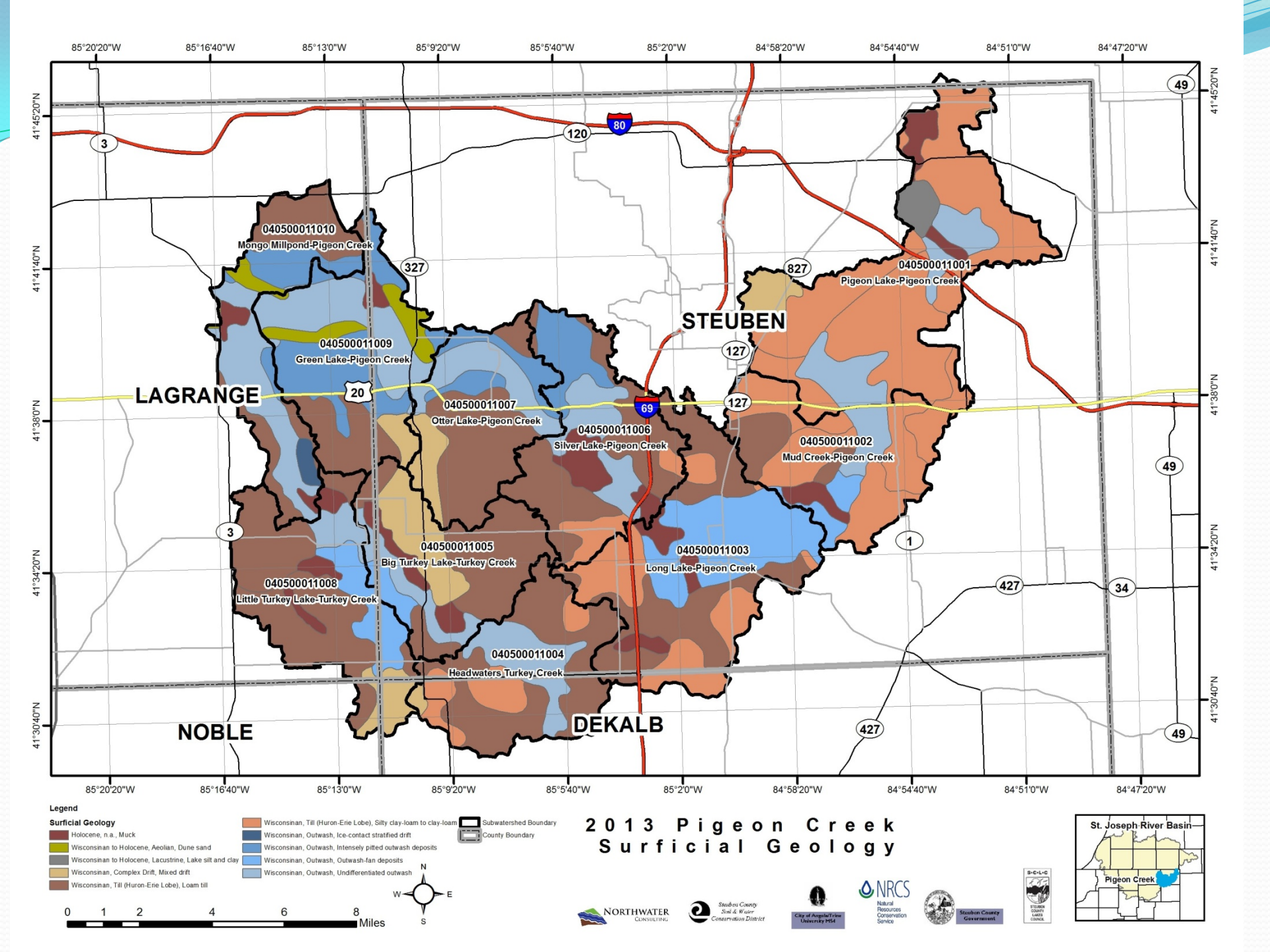
Pigeon Creek
Percent Slope
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University MS4
NRCS Natural Resources Conservation Service
Steuben County Government
S-C-L-C
STEUBEN COUNTY LAKES COUNCIL



Legend

Surficial Geology

- Holocene, n.a., Muck
- Wisconsinan to Holocene, Aeolian, Dune sand
- Wisconsinan to Holocene, Lacustrine, Lake silt and clay
- Wisconsinan, Complex Drift, Mixed drift
- Wisconsinan, Till (Huron-Erie Lobe), Loam till
- Wisconsinan, Till (Huron-Erie Lobe), Silty clay-loam to clay-loam
- Wisconsinan, Outwash, Ice-contact stratified drift
- Wisconsinan, Outwash, Intensely pitted outwash deposits
- Wisconsinan, Outwash, Outwash-fan deposits
- Wisconsinan, Outwash, Undifferentiated outwash
- Subwatershed Boundary
- County Boundary

N W E S

0 1 2 4 6 8 Miles

2013 Pigeon Creek Surficial Geology

St. Joseph River Basin

Pigeon Creek

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Steuben County Soil & Water Conservation District

City of Angola/Trine University MS4

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Steuben County Government

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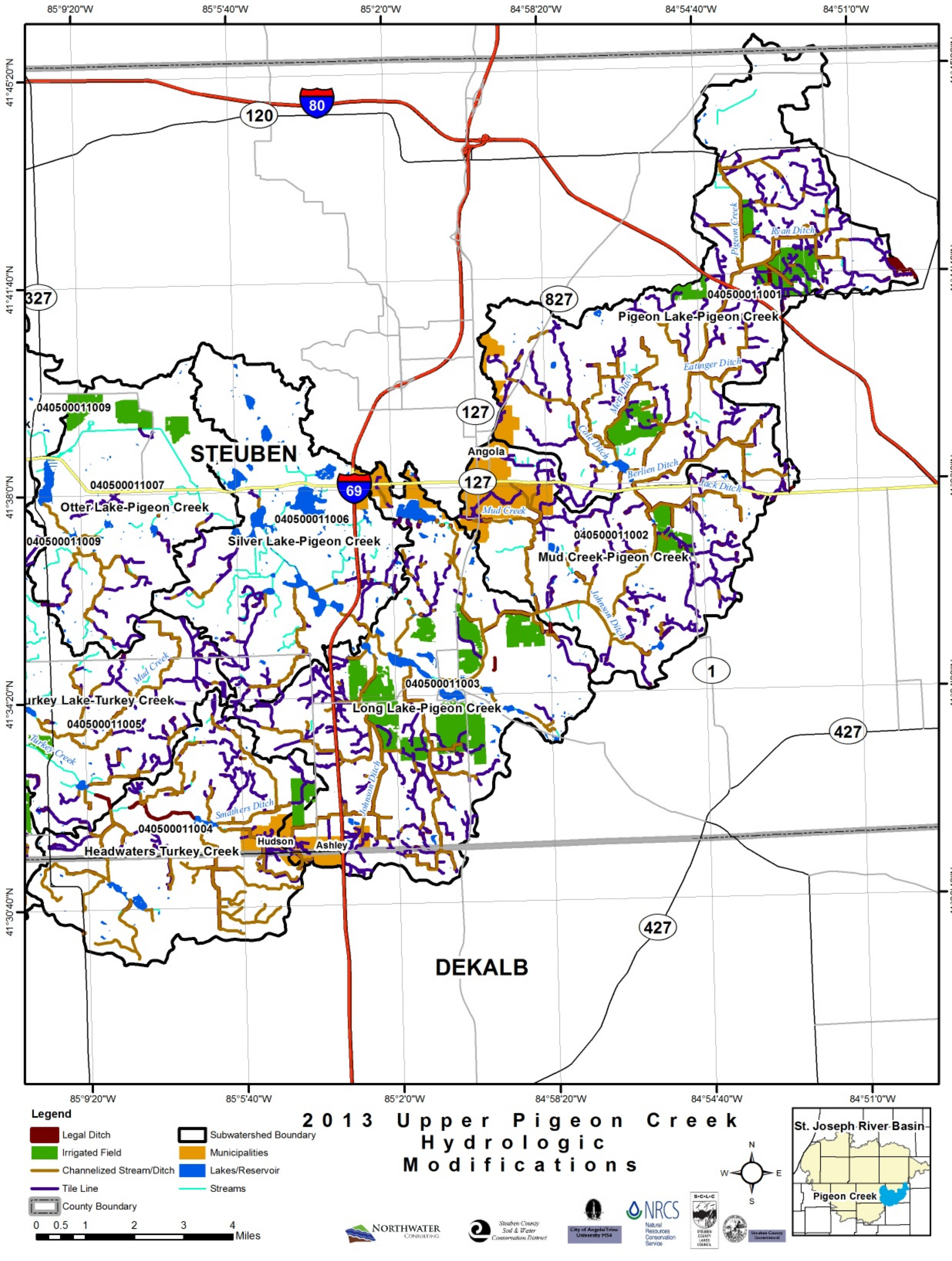
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STEUBEN
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Pigeon Lake-Pigeon Creek
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Mud Creek-Pigeon Creek
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Long Lake-Pigeon Creek
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Headwaters Turkey Creek
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Turkey Lake-Turkey Creek
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Silver Lake-Pigeon Creek
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Otter Lake-Pigeon Creek
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Pigeon Creek
Ryan Ditch
Eatinger Ditch
Berlien Ditch
Jack Ditch
Mud Creek
Johnson Ditch
Smathers Ditch
Turkey Creek
Legend
Legal Ditch
Irrigated Field
Channelized Stream/Ditch
Tile Line
County Boundary
Subwatershed Boundary
Municipalities
Lakes/Reservoir
Streams
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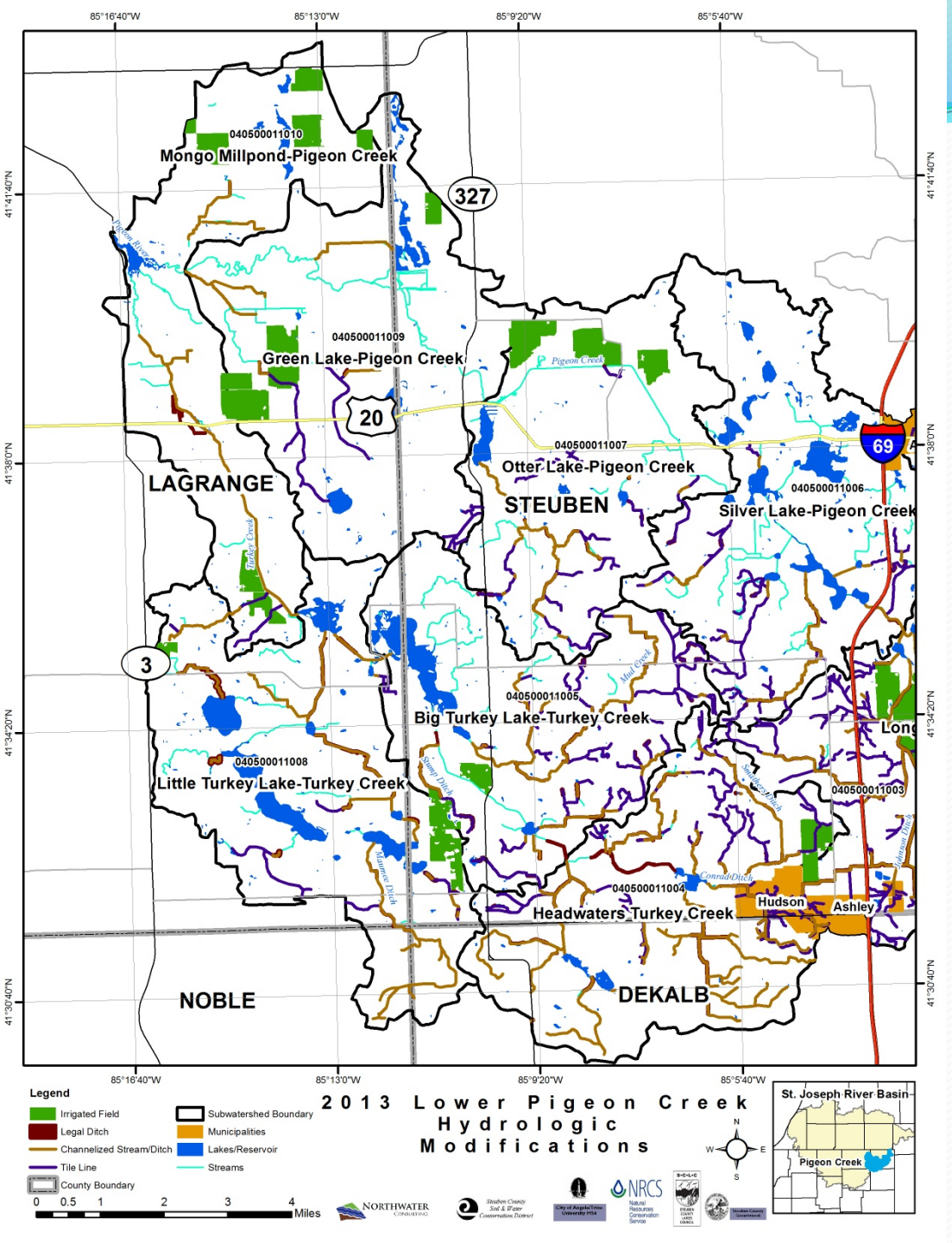
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
NRCS Natural Resources Conservation Service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Channelized Stream/Ditch
Tile Line
County Boundary
Subwatershed Boundary
Municipalities
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2013 Lower Pigeon Creek Hydrologic Modifications
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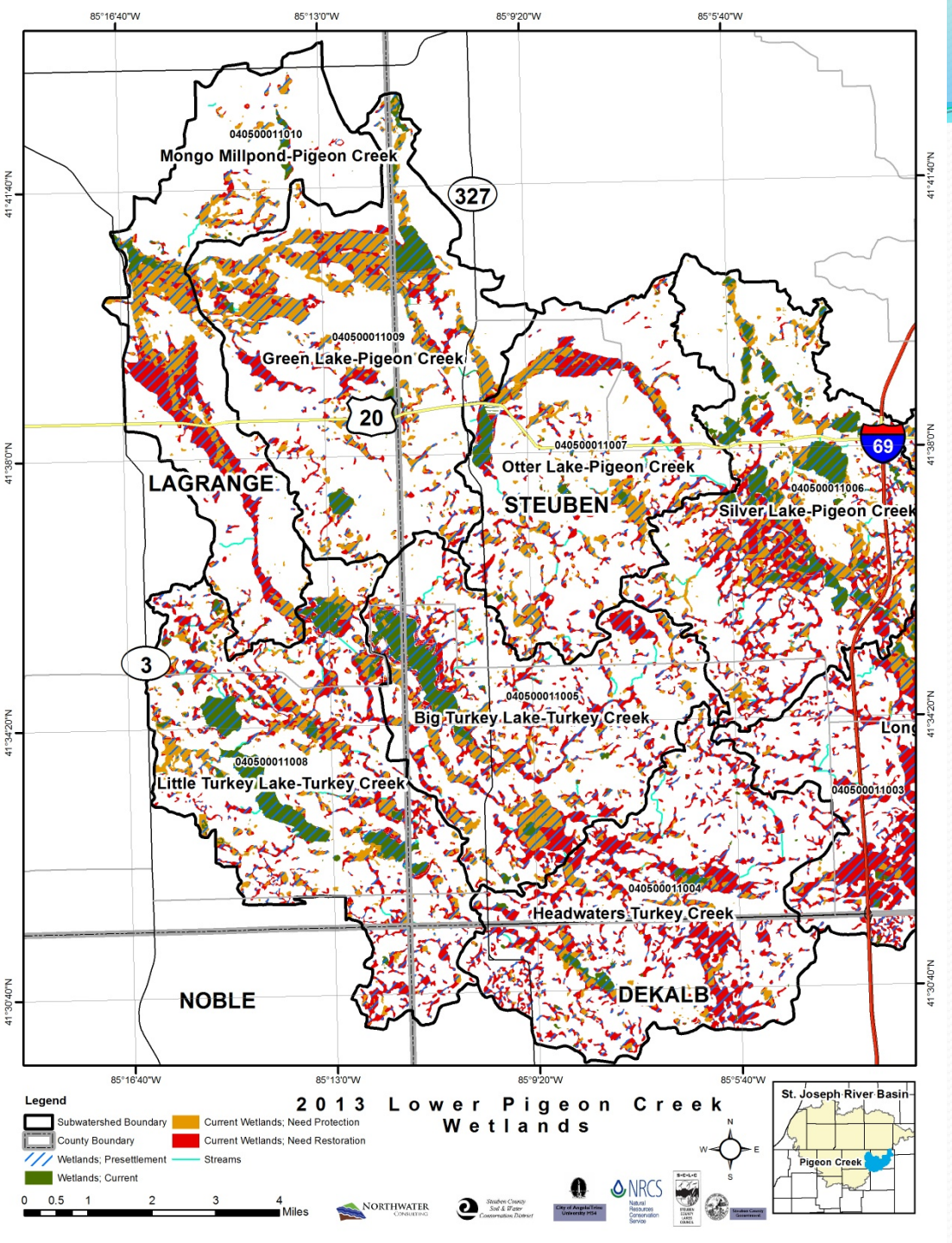
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Headwaters Turkey Creek
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Legend
Subwatershed Boundary
County Boundary
Wetlands; Presettlement
Wetlands; Current
Current Wetlands; Need Protection
Current Wetlands; Need Restoration
Streams
0 0.5 1 2 3 4 Miles
2013 Lower Pigeon Creek Wetlands
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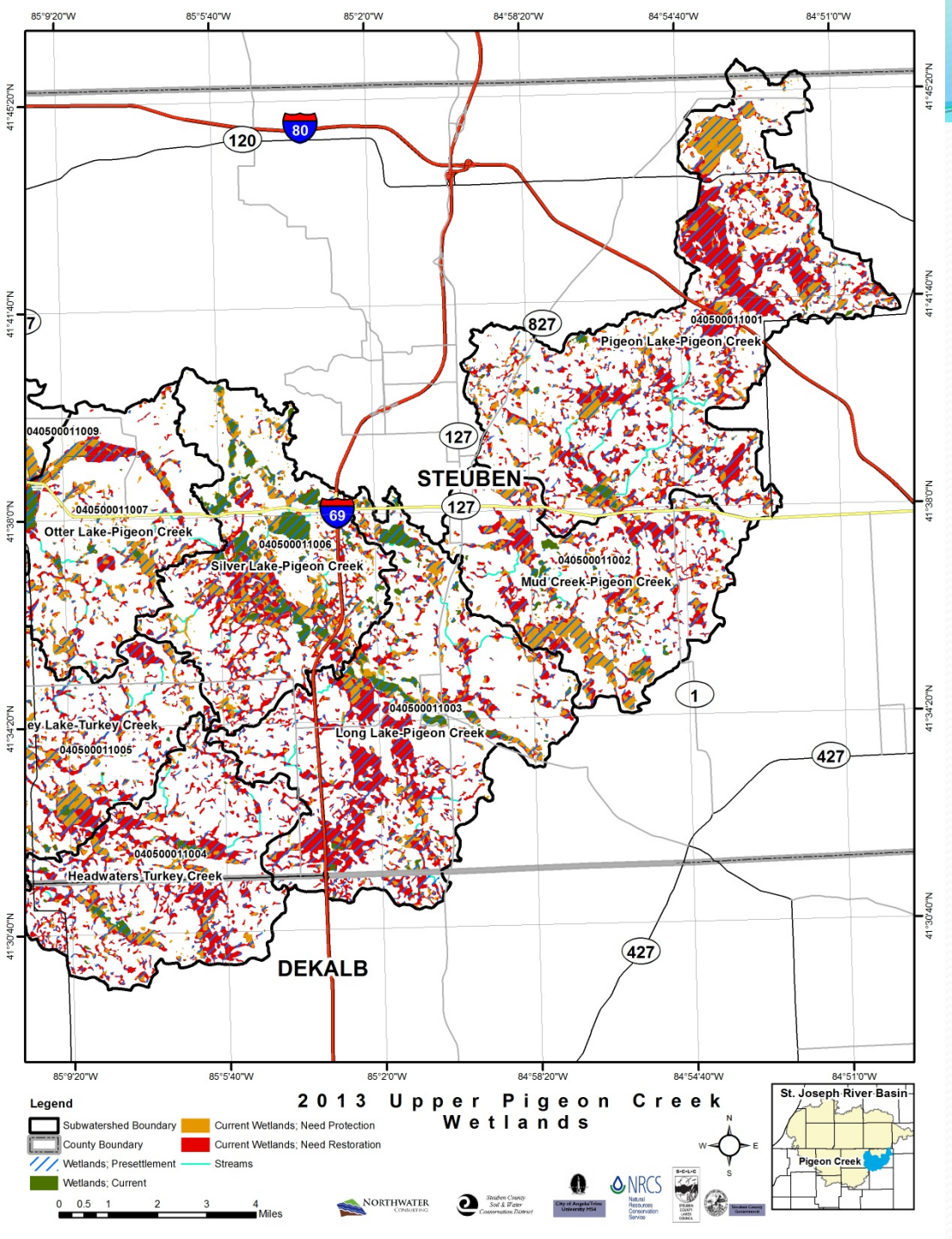
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
NRCS Natural Resources Conservation Service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Headwaters Turkey Creek
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2013 Upper Pigeon Creek Wetlands
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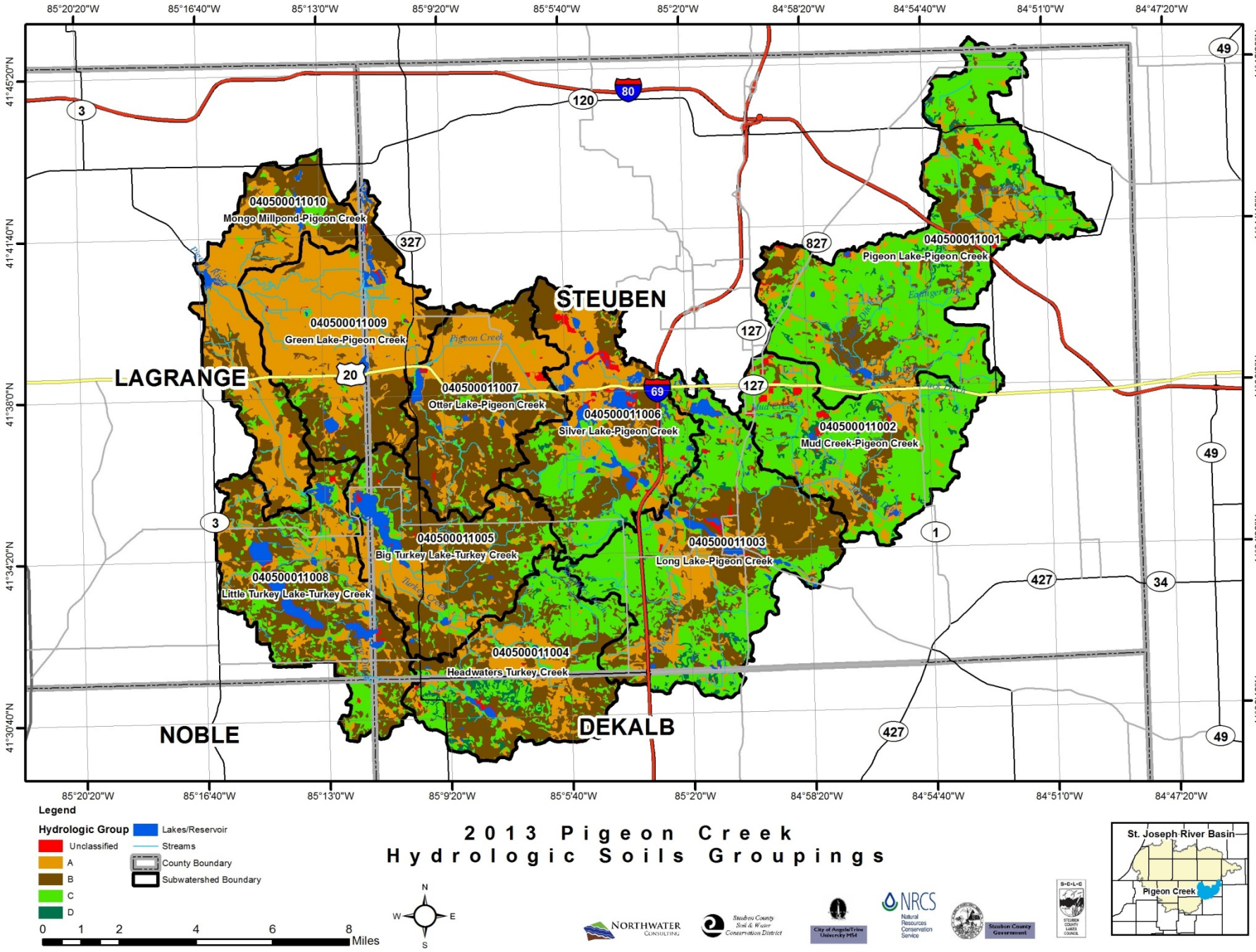
St. Joseph River Basin
Pigeon Creek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Headwaters Turkey Creek
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Lakes/Reservoir
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County Boundary
Subwatershed Boundary
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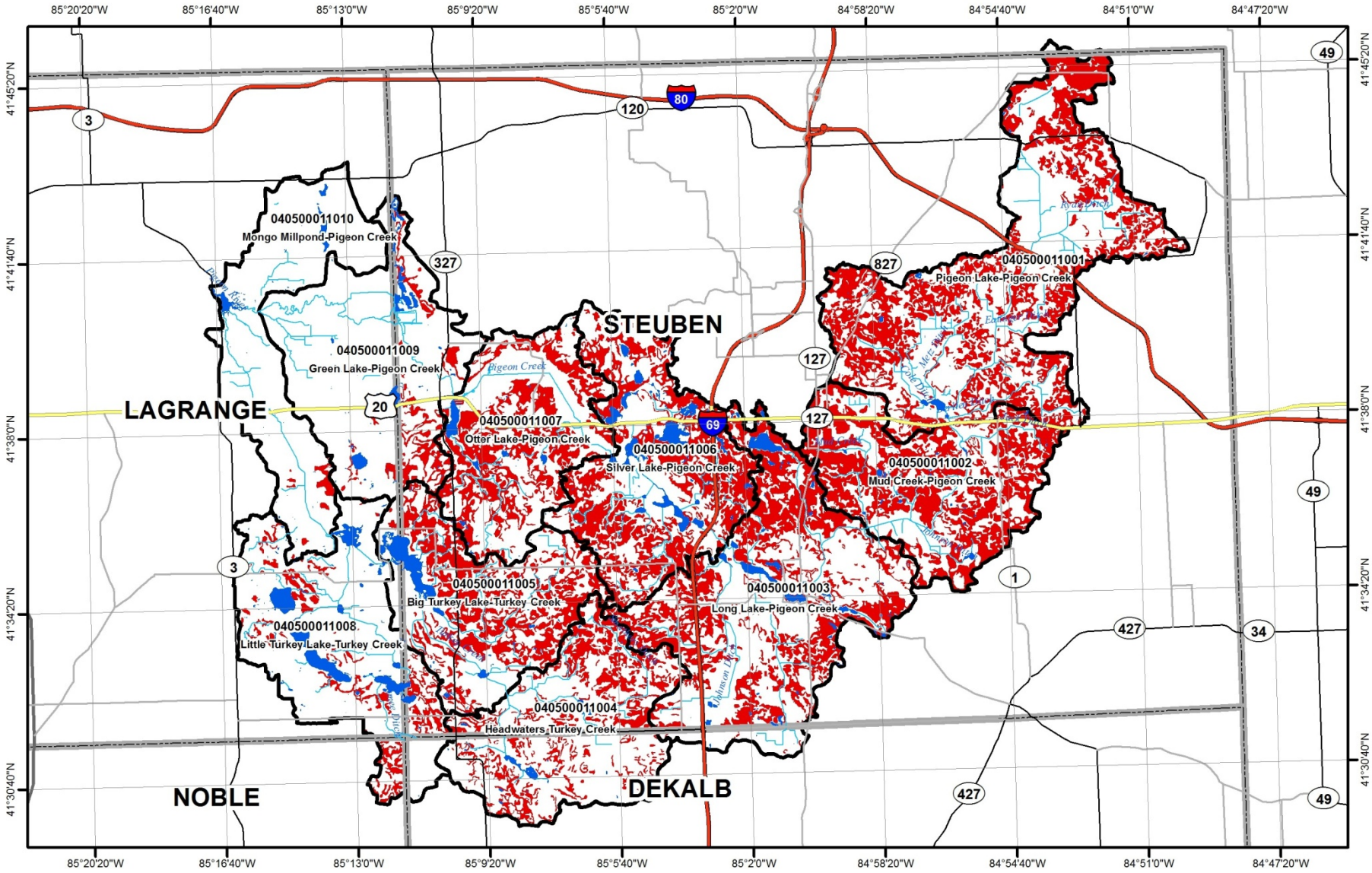
2013 Pigeon Creek
Hydrologic Soils Groupings
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University IN54
NRCS Natural Resources Conservation Service
Steuben County Government
S-C-L-C
STEUBEN COUNTY LAKES COUNCIL



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HEL Soils
Lakes/Reservoir
Subwatershed Boundary
Streams
County Boundary

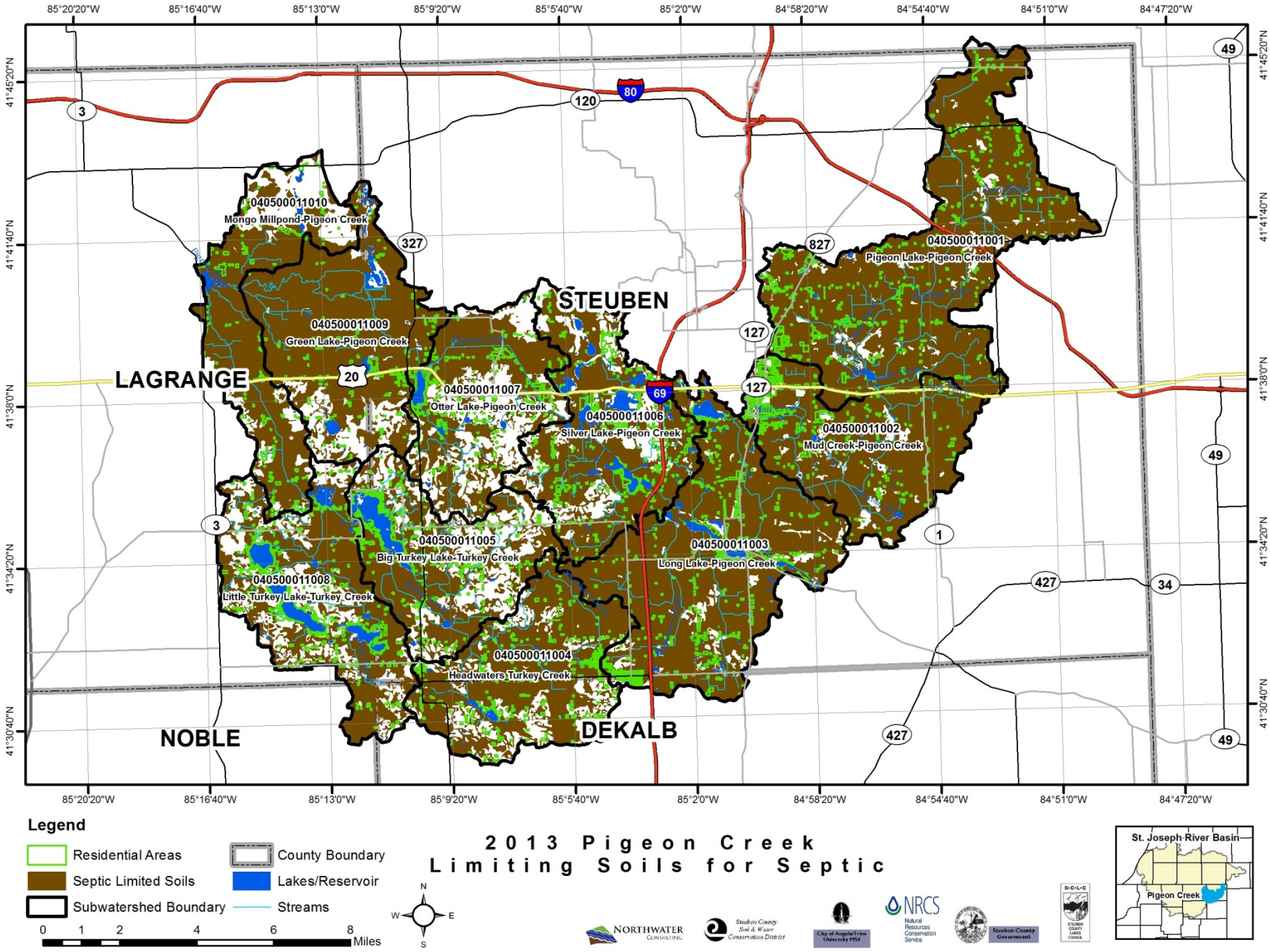
0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek HEL Soils

St. Joseph River Basin
Pigeon Creek

NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University IN54
NRCS Natural Resources Conservation Service
Steuben County Government
S·C·L·C Steuben County Lakes Council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Subwatershed Boundary
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Lakes/Reservoir
Streams
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2013 Pigeon Creek
Limiting Soils for Septic
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
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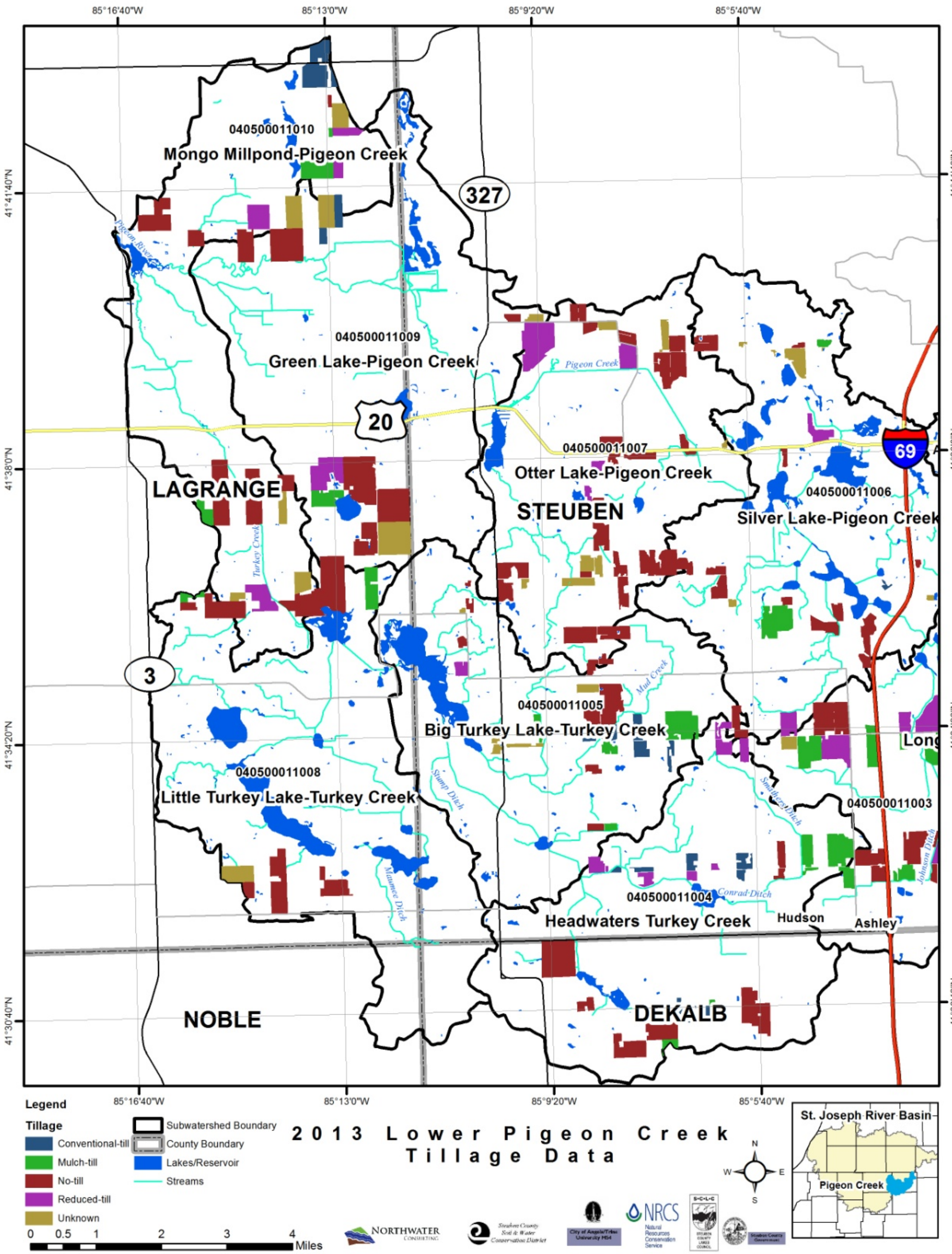
S·C·L·C
STEUBEN COUNTY LAKES COUNCIL



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Otter Lake-Pigeon Creek
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Silver Lake-Pigeon Creek
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Big Turkey Lake-Turkey Creek
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Little Turkey Lake-Turkey Creek
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Headwaters Turkey Creek
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DEKALB
Hudson
Ashley
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Pigeon Creek
Turkey Creek
Mud Creek
Stump Ditch
Maumee Ditch
Conrad Ditch
Johnson Ditch
85°16'40"W
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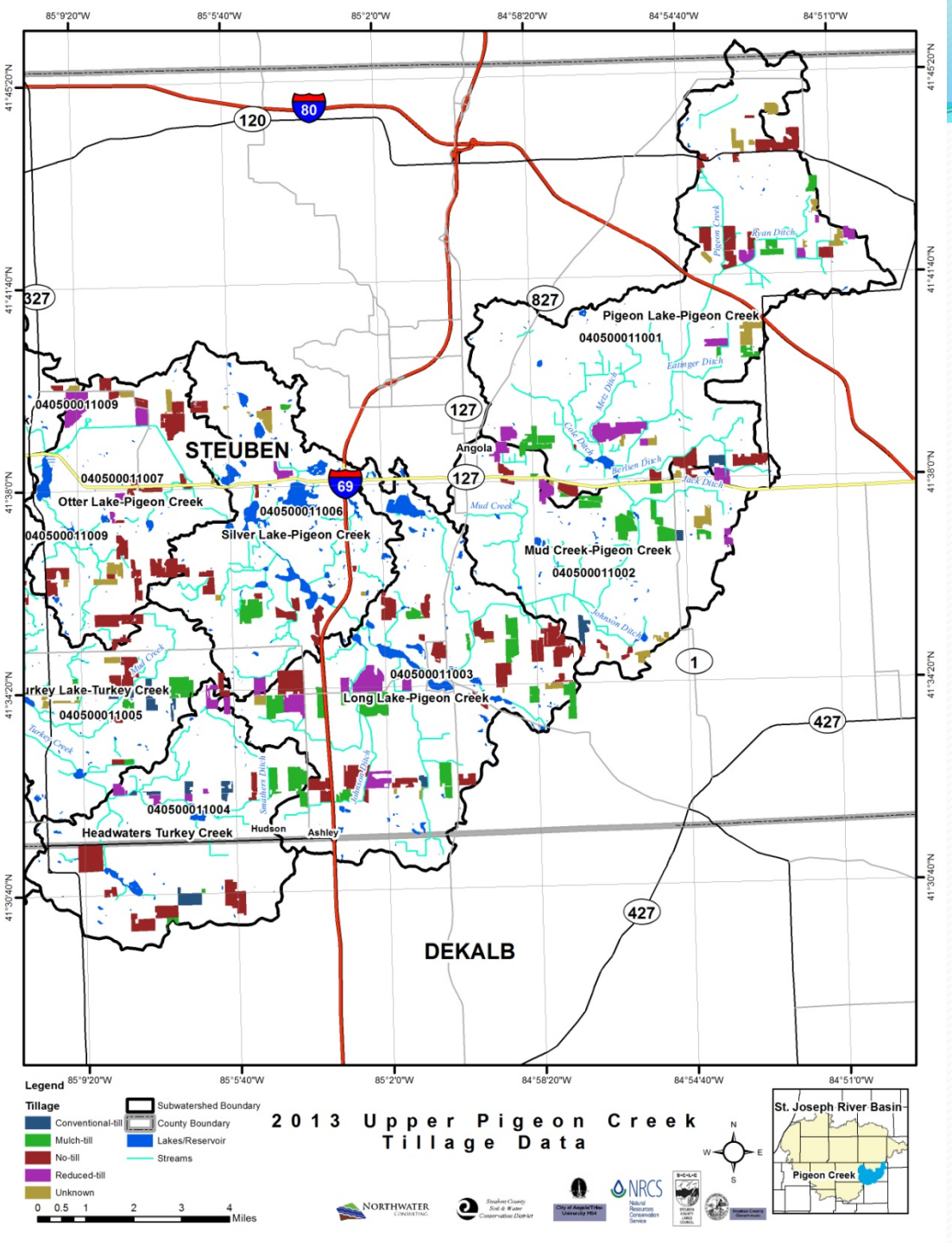
Legend
Tillage
Conventional-till
Mulch-till
No-till
Reduced-till
Unknown
Subwatershed Boundary
County Boundary
Lakes/Reservoir
Streams
0 0.5 1 2 3 4 Miles
St. Joseph River Basin
Pigeon Creek
NORTHWATER
NRCS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Subwatershed Boundary
County Boundary
Lakes/Reservoir
Streams
0 0.5 1 2 3 4 Miles
2013 Upper Pigeon Creek Tillage Data
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St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Tri-State University IN54
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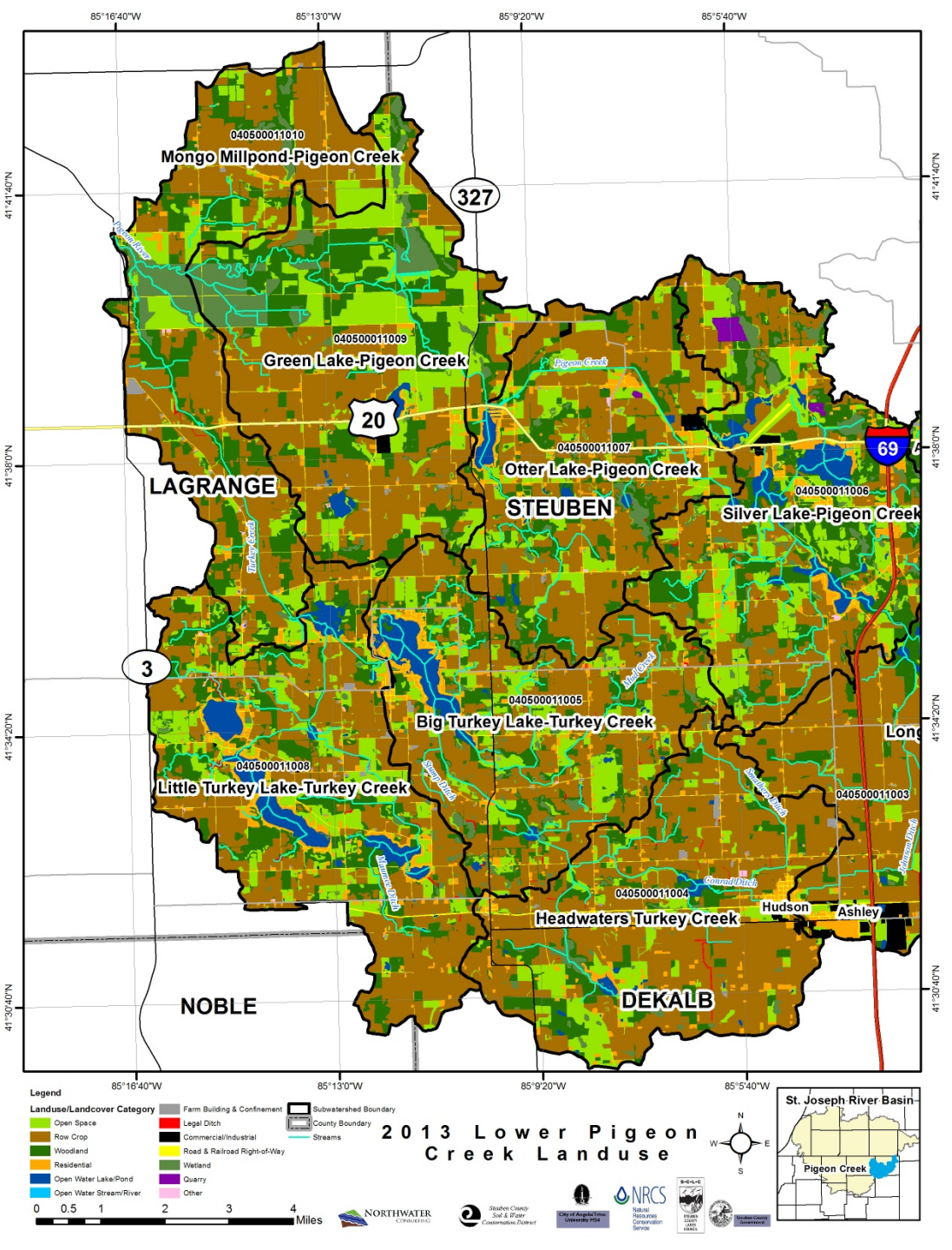
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Headwaters Turkey Creek
Hudson
Ashley
NOBLE
DEKALB
Legend
Landuse/Landcover Category
Open Space
Row Crop
Woodland
Residential
Open Water Lake/Pond
Open Water Stream/River
Farm Building & Confinement
Legal Ditch
Commercial/Industrial
Road & Railroad Right-of-Way
Wetland
Quarry
Other
Subwatershed Boundary
County Boundary
Streams
0 0.5 1 2 3 4 Miles
2013 Lower Pigeon Creek Landuse
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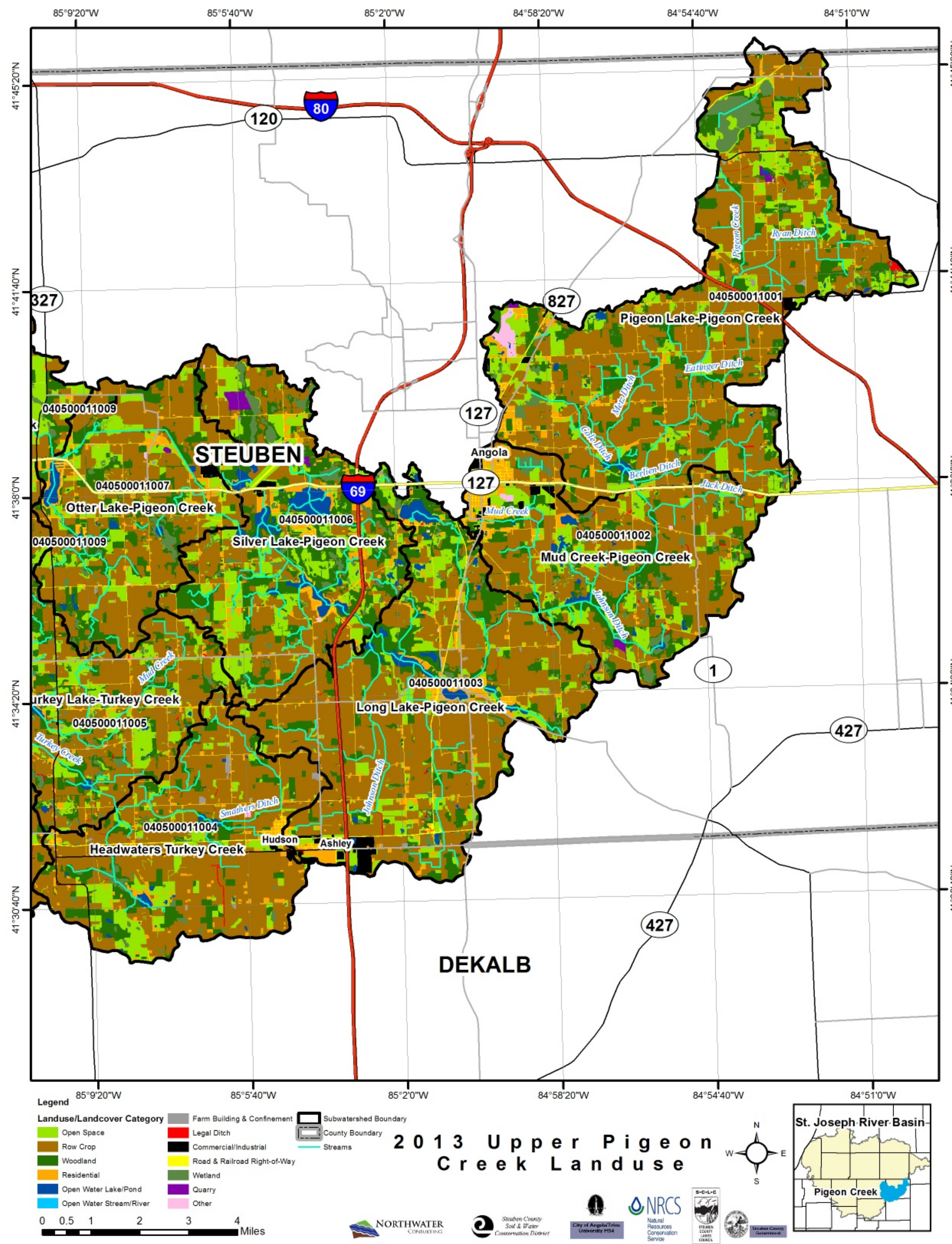
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
NRCS


2013 Upper Pigeon Creek Landuse
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Pigeon Lake-Pigeon Creek
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Mud Creek-Pigeon Creek
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Legend
Landuse/Landcover Category
Open Space
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Open Water Lake/Pond
Open Water Stream/River
Farm Building & Confinement
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Commercial/Industrial
Road & Railroad Right-of-Way
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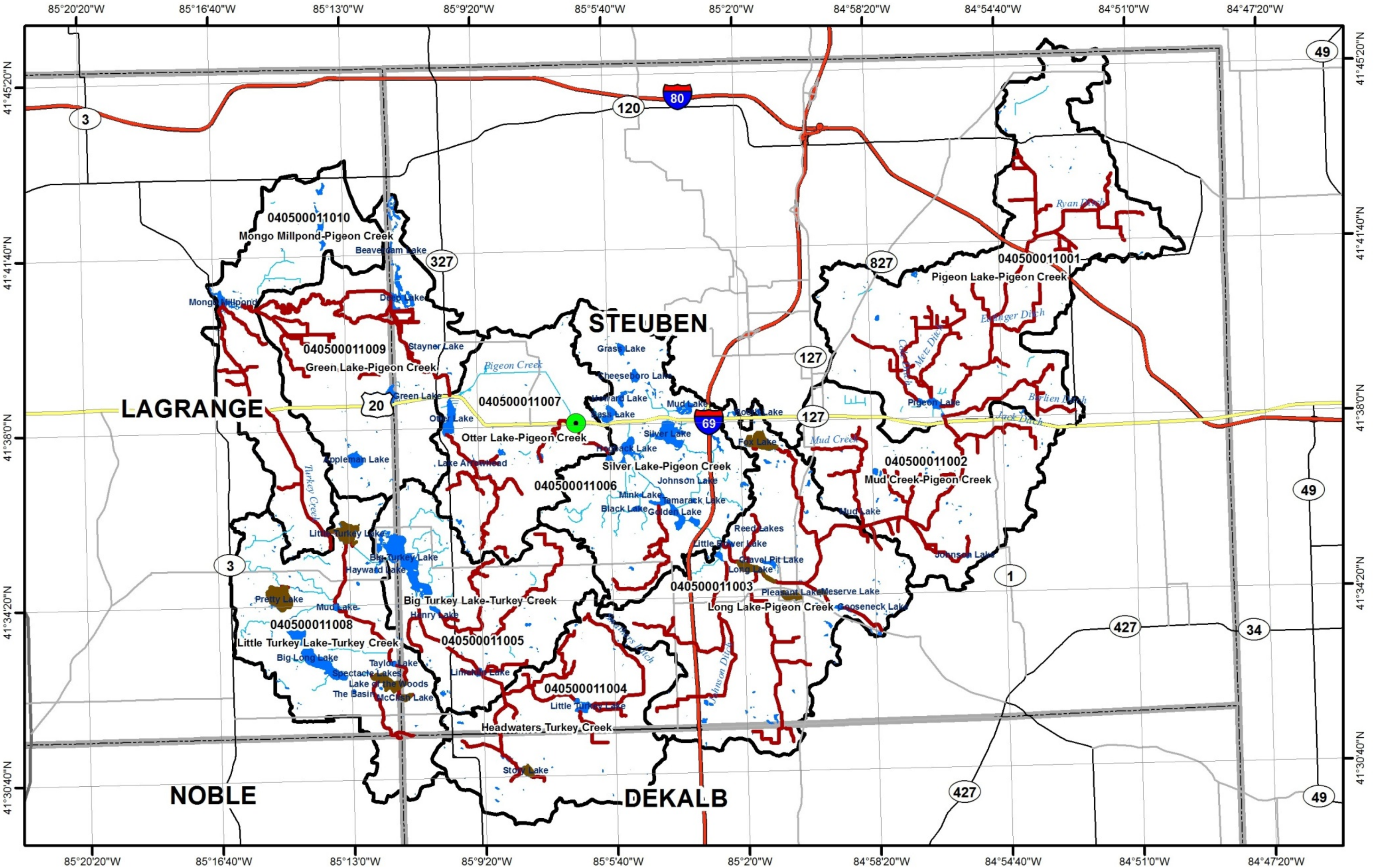
Subwatershed Boundary
County Boundary
Streams
0 0.5 1 2 3 4 Miles
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University MS4
NRCS Natural Resources Conservation Service
Steuben County Government

Problems

- 38 streams (179 miles) of category 4 and 5 impaired waterbodies
  - Low Dissolved Oxygen
  - High chloride
  - High bacteria
- Nine lakes (783) acres are listed as impaired
  - IBC
  - PCBs
  - Mercury
  - Phosphorus



2013 Pigeon Creek Impaired Lakes and Streams

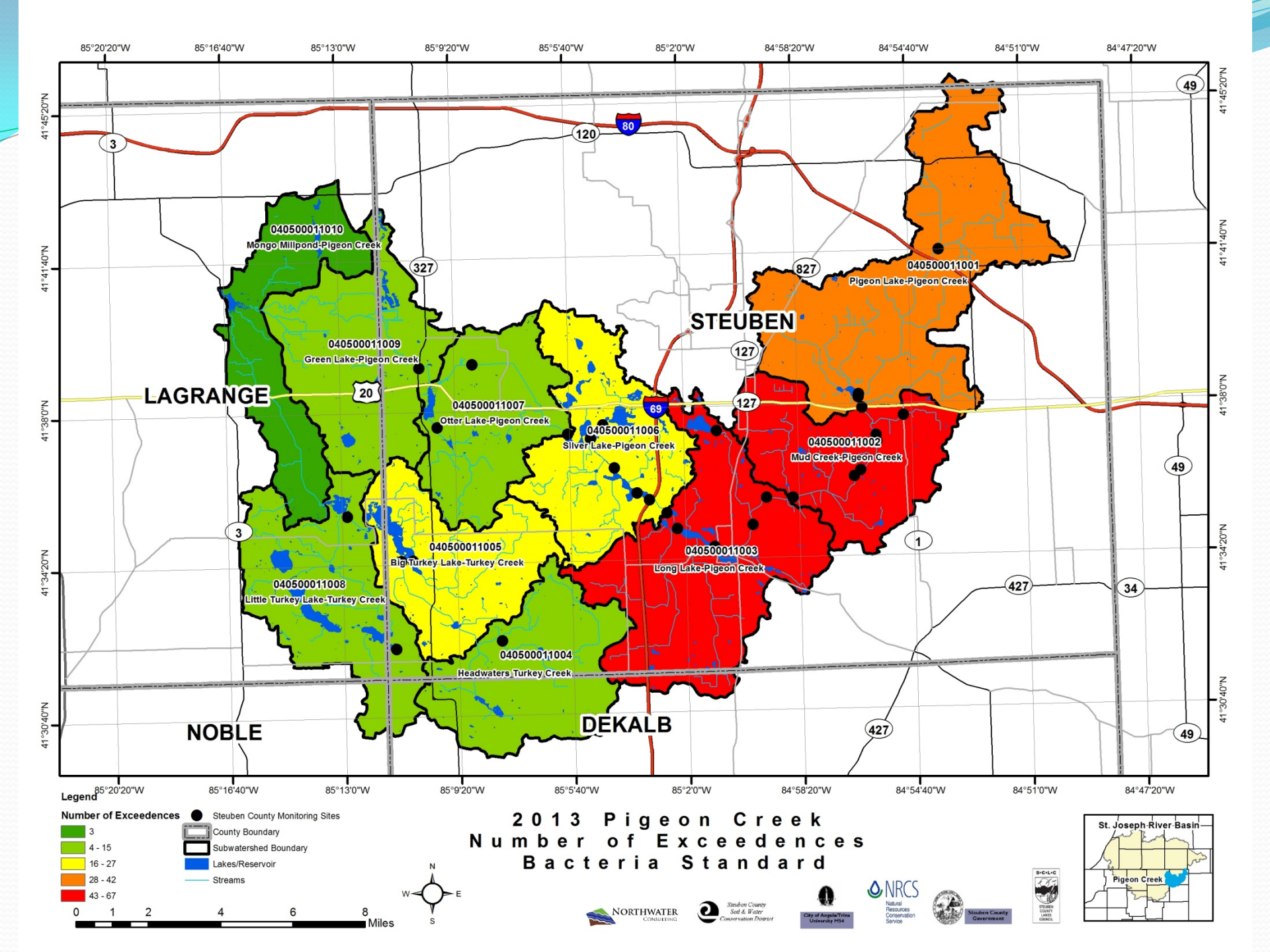
Legend

- USGS Gauge
- 2012 303(d) Impaired Lakes
- 2012 303(d) Impaired Streams
- Streams
- Lakes/Reservoir
- County Boundary
- Subwatershed Boundary

0 1 2 4 6 8 Miles

Problems

- 269 of 627 (43%) total samples that exceeded the reference limit of 235 CFU/100 mL for bacteria
- 40 of 577 (7%) total samples that exceeded of the reference limit of 0.30-mg/L for phosphorus
- 39 of 239 (16%) total samples that exceeded the reference limit of 10 mg/L for nitrogen
- 46 of 574 (8%) total samples that exceeded the reference limit of 30 mg/L limit for sediment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85°5'40"W
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84°58'20"W
84°54'40"W
84°51'0"W
84°47'20"W
41°45'20"N
41°41'40"N
41°38'0"N
41°34'20"N
41°30'40"N
040500011010
Mongo Millpond-Pigeon Creek
040500011009
Green Lake-Pigeon Creek
040500011007
Otter Lake-Pigeon Creek
040500011006
Silver Lake-Pigeon Creek
040500011005
Big Turkey Lake-Turkey Creek
040500011008
Little Turkey Lake-Turkey Creek
040500011004
Headwaters Turkey Creek
040500011001
Pigeon Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
040500011003
Long Lake-Pigeon Creek
LAGRANGE
STEUBEN
NOBLE
DEKALB
Legend
Number of Exceedences
3
4 - 15
16 - 27
28 - 42
43 - 67
Steuben County Monitoring Sites
County Boundary
Subwatershed Boundary
Lakes/Reservoir
Streams
0 1 2 4 6 8 Miles
N
W
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S
2013 Pigeon Creek
Number of Exceedences
Bacteria Standard
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University MS4
NRCS
Natural Resources Conservation Service
Steuben County Government
S-C-L-C
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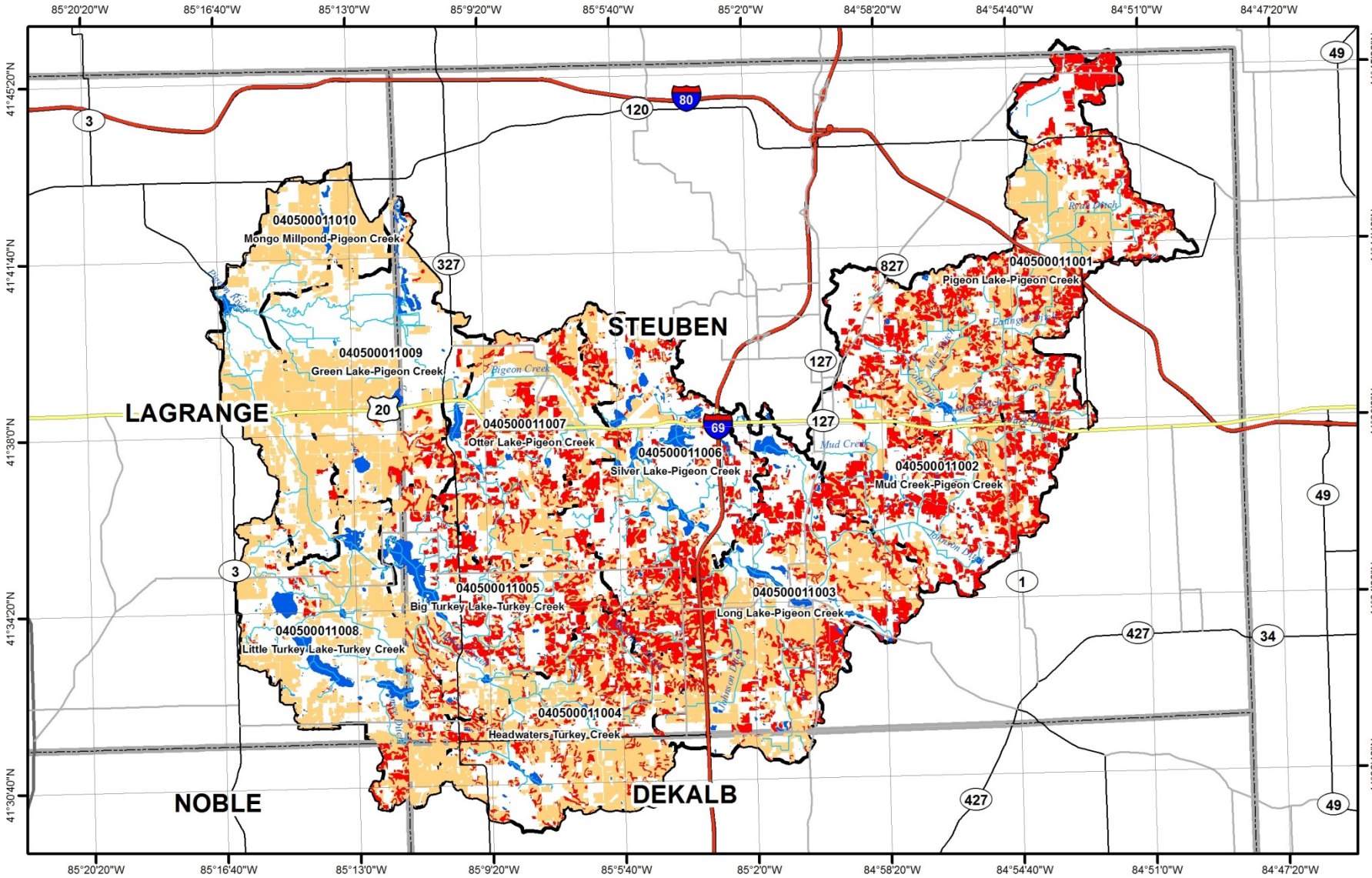
Problems & Causes/Sources

- Excessive bacteria
  - Runoff from agricultural sources
  - Septic systems
  - Urban runoff
- Excessive nutrients and sediment
  - Runoff from agricultural sources
  - Watershed modifications
  - Urban runoff
- Flooding
  - Lack of storage and capacity
  - Impervious surfaces



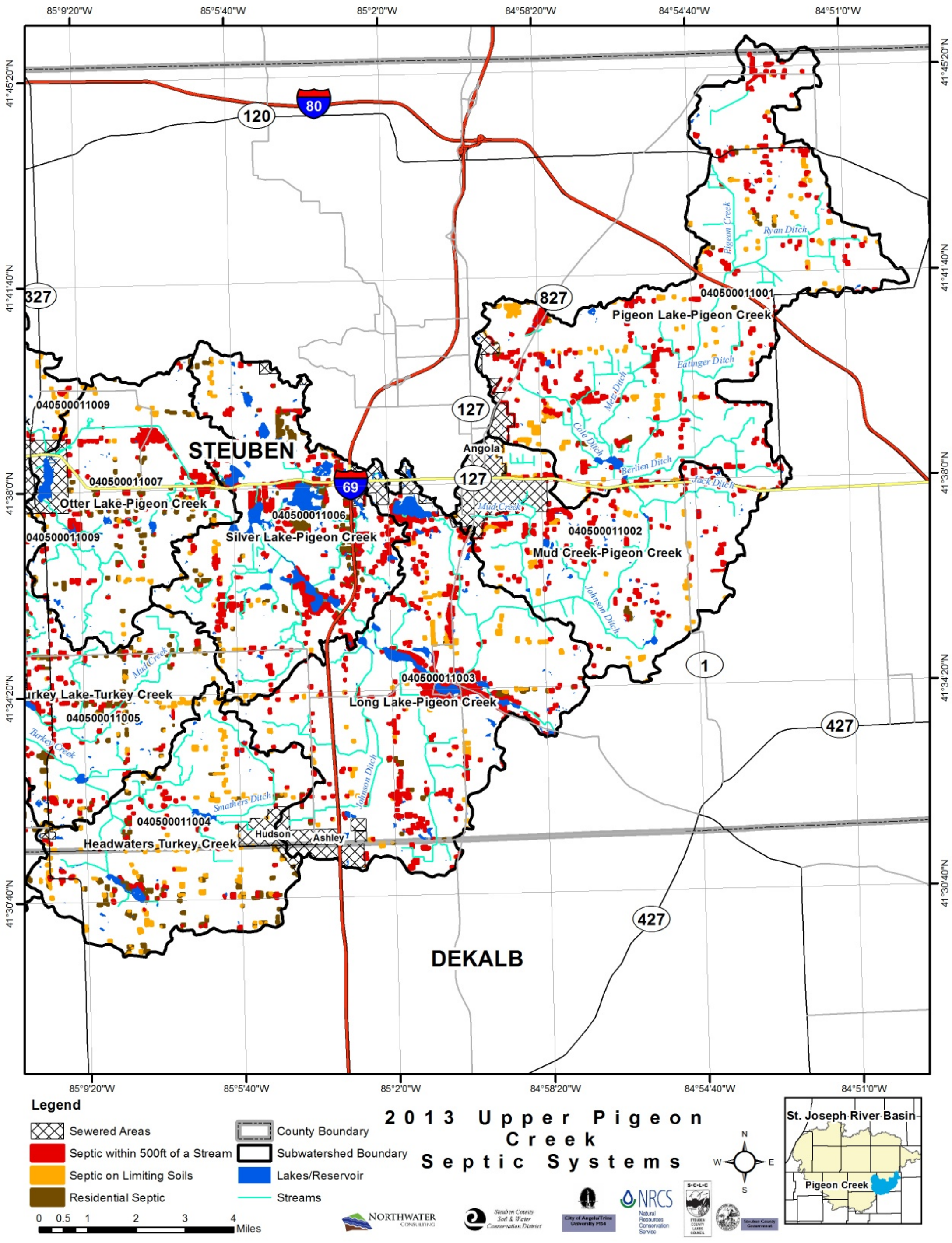
Legend

- HEL Row Crops
- Row Crops
- Lakes/Reservoir
- County Boundary
- Subwatershed Boundary
- Streams

0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek HEL Row Crop Soils


2013 Upper Pigeon Creek Septic Systems
Legend
Sewered Areas
Septic within 500ft of a Stream
Septic on Limiting Soils
Residential Septic
County Boundary
Subwatershed Boundary
Lakes/Reservoir
Streams
0 0.5 1 2 3 4 Miles
St. Joseph River Basin
Pigeon Creek
STEUBEN
DEKALB
040500011001
Pigeon Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
040500011003
Long Lake-Pigeon Creek
040500011004
Headwaters Turkey Creek
040500011005
urkey Lake-Turkey Creek
040500011006
Silver Lake-Pigeon Creek
040500011007
Otter Lake-Pigeon Creek
040500011009
Angola
Hudson
Ashley
Pigeon Creek
Ryan Ditch
Eatinger Ditch
Berlien Ditch
Jack Ditch
Johnson Ditch
Mud Creek
Turkey Creek
Smathers Ditch
80
120
69
127
827
327
1
427
85°9'20"W
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85°2'0"W
84°58'20"W
84°54'40"W
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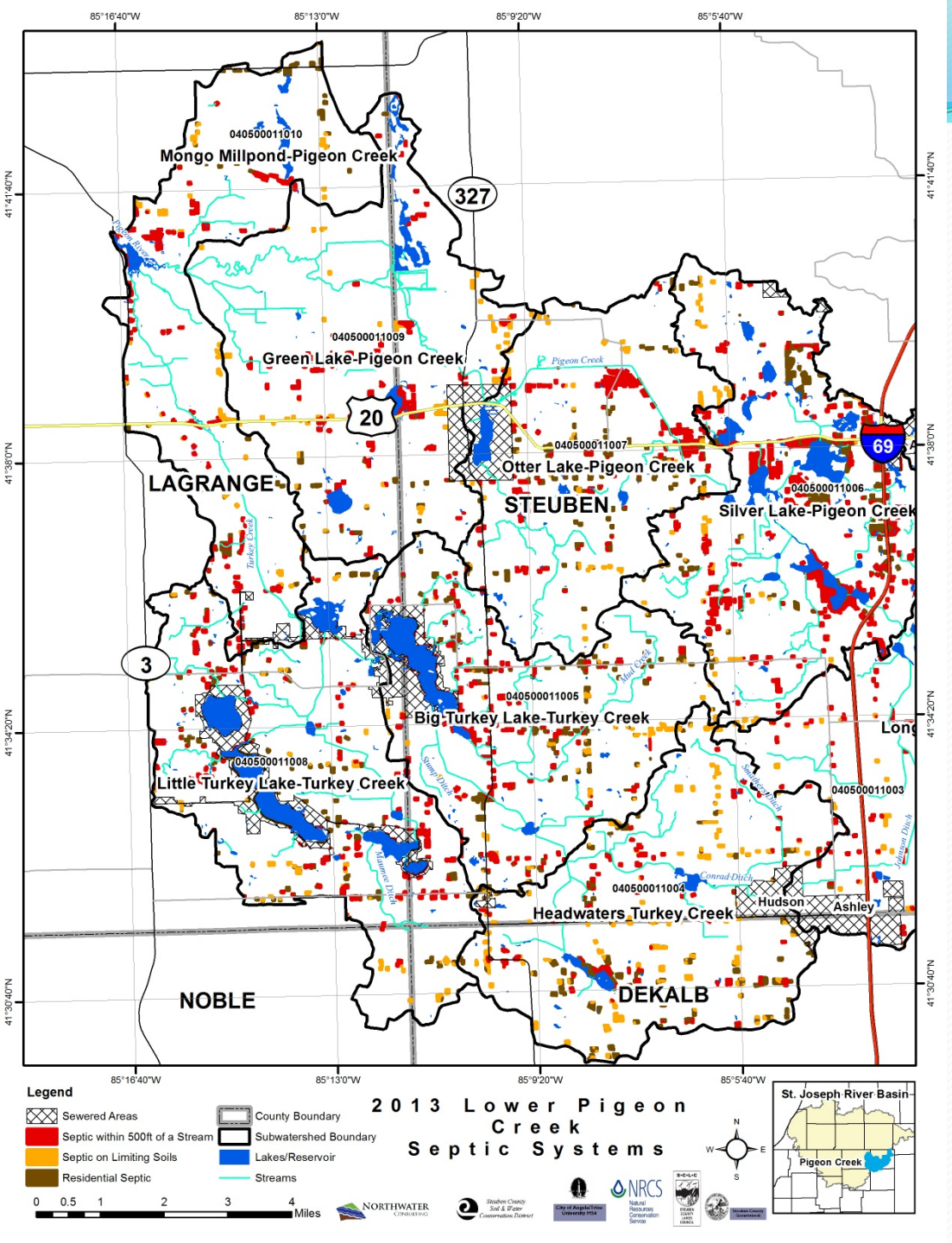
41°30'40"N
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
NRCS Natural Resources Conservation Service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41°30'40"N
040500011010
Mongo Millpond-Pigeon Creek
327
040500011009
Green Lake-Pigeon Creek
Pigeon Creek
20
040500011007
Otter Lake-Pigeon Creek
69
040500011006
Silver Lake-Pigeon Creek
LAGRANGE
STEUBEN
Turkey Creek
3
040500011005
Big Turkey Lake-Turkey Creek
Mud Creek
040500011008
Little Turkey Lake-Turkey Creek
Stump Ditch
Shephard Ditch
040500011003
Johnson Ditch
Conrad Ditch
040500011004
Headwaters Turkey Creek
Hudson
Ashley
NOBLE
DEKALB
Legend
Sewered Areas
Septic within 500ft of a Stream
Septic on Limiting Soils
Residential Septic
County Boundary
Subwatershed Boundary
Lakes/Reservoir
Streams
0 0.5 1 2 3 4 Miles
2013 Lower Pigeon Creek Septic Systems
N
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S
St. Joseph River Basin
Pigeon Creek
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Natural Resources Conservation Service

Model Overview

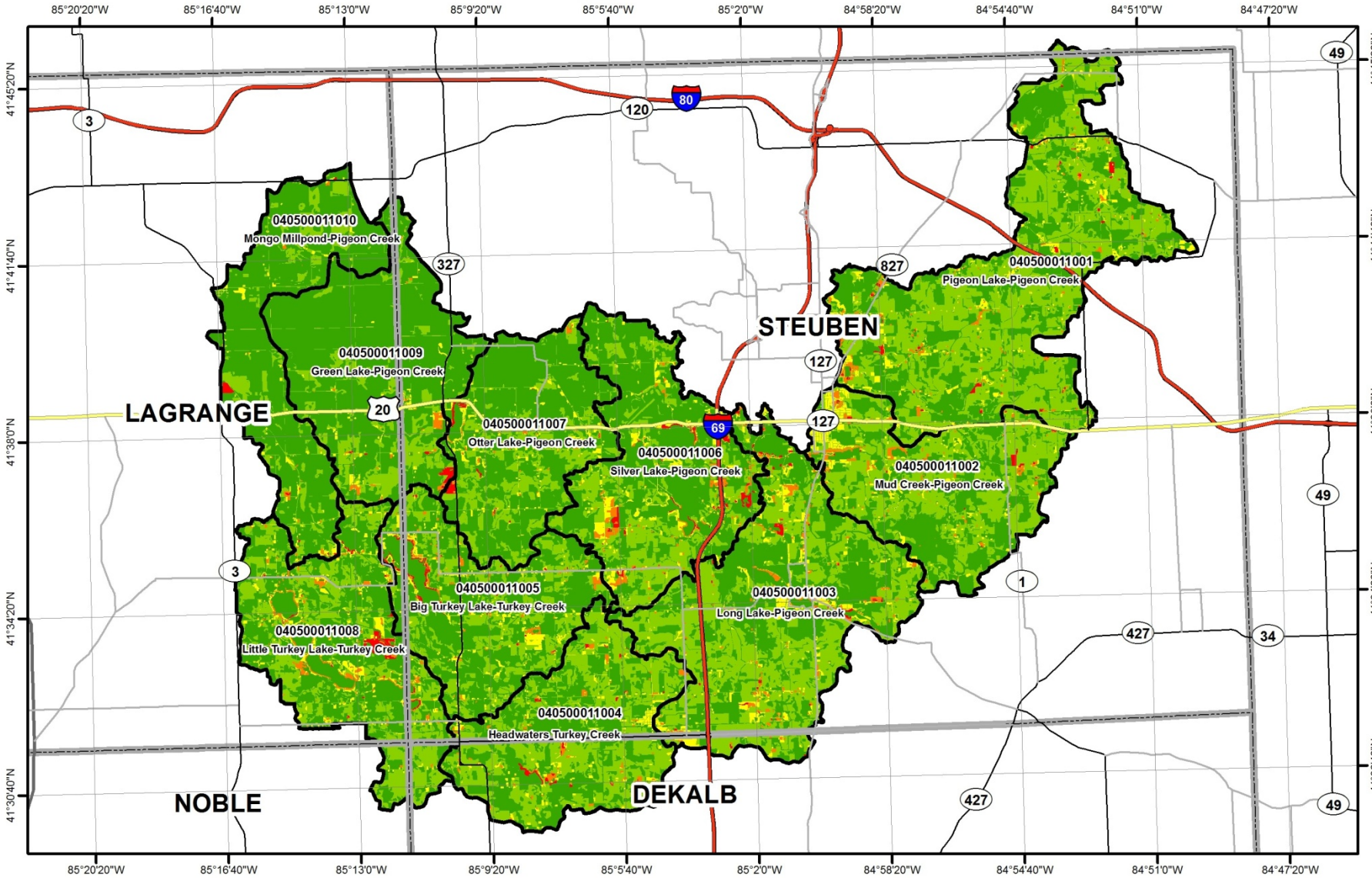
- SWAMM
  - Spatial Watershed Assessment and Management Model
  - GIS based pollution load model
- Purpose/use
  - Identify priority land parcels
  - Quantify upland pollutant loadings
  - Quantify load reductions from practice implementation
  - Link implementation with watershed plan targets and track plan success
- Major Model Components
  - Soils, landuse, precipitation

Pollution Loading from all Sources

Subwatershed Name	2012 HUC12 Subwatershed Codes	Watershed Acres	Phosphorus Load (lbs/yr)	Nitrogen Load (lbs/yr)	Sediment Load (tons/ yr)	Fecal Coliform (billion CFU/yr)
Pigeon Lake-Pigeon Creek	40500011001	22,036	28,745	190,871	23,581	53,337
Mud Creek-Pigeon Creek	40500011002	11,641	19,351	99,877	14,485	38,933
Long Lake-Pigeon Creek	40500011003	18,620	25,186	159,298	20,213	49,853
Headwaters Turkey Creek	40500011004	11,798	15,721	100,827	14,045	34,690
Big Turkey Lake-Turkey Creek	40500011005	11,015	11,296	73,206	9,685	32,204
Silver Lake-Pigeon Creek	40500011006	12,954	11,236	73,461	9,904	36,608
Otter Lake-Pigeon Creek	40500011007	10,491	12,896	63,731	8,920	30,109
Little Turkey Lake-Turkey Creek	40500011008	13,256	13,980	93,259	12,455	38,507
Green Lake-Pigeon Creek	40500011009	13,581	9,038	57,312	8,275	28,189
Mongo Millpond-Pigeon Creek	40500011010	10,520	11,107	57,500	6,448	27,053
Total		**135,911**	**158,556**	**969,341**	**128,012**	**369,481**

Pollution Loading

- Highest per acre nitrogen and phosphorus load = Pigeon Lake
  - 1.24 lbs/ac/yr P
  - 8.50 lbs/ac/yr N
- Highest per acre sediment load = Mud Creek
  - 1.22 tons/ac/yr
- Highest per acre bacteria load = Long Lake
  - 1.84 billion CFU/ac/yr



Legend

Bacteria billion CFU/ac/yr

- 0.05 - 1.34
- 1.34 - 3.2
- 3.2 - 5.62
- 5.62 - 9.05
- 9.05 - 54.5

County Boundary

Subwatershed Boundary

0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek Annual Bacteria Loading (Fecal Coliform)

St. Joseph River Basin

Pigeon Creek

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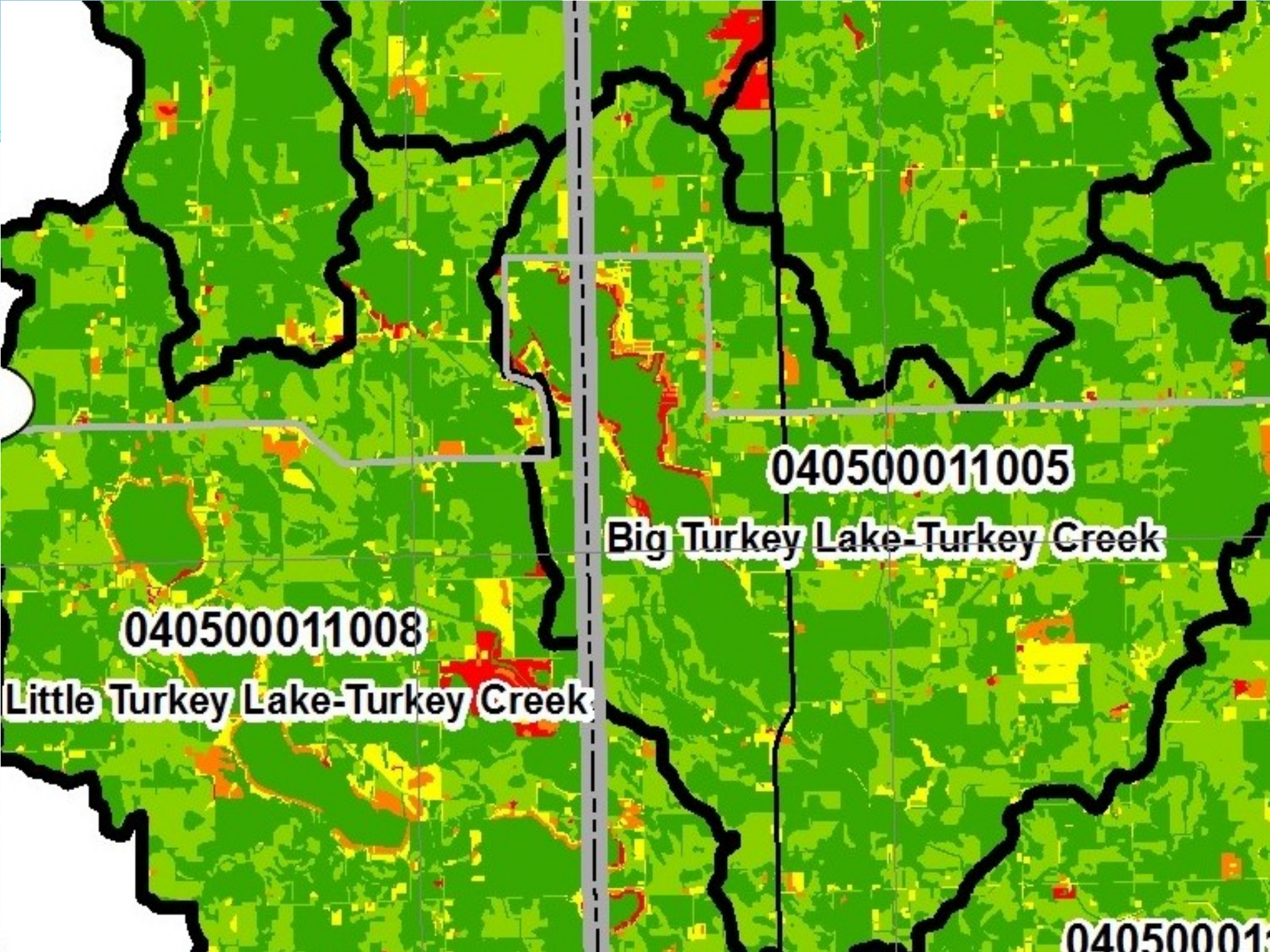
STEUBEN COUNTY LAKES COUNCIL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Big Turkey Lake-Turkey Creek
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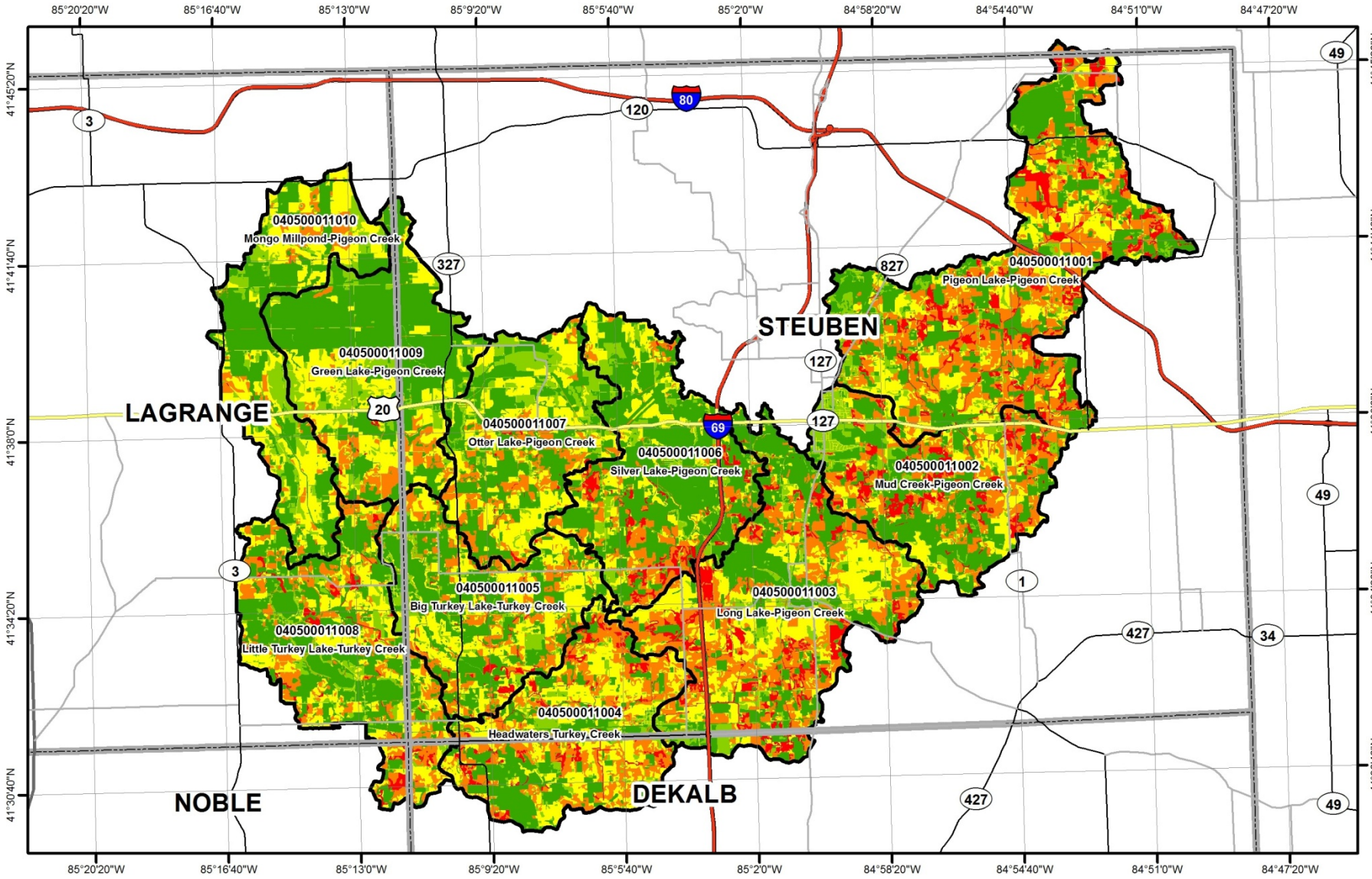
Little Turkey Lake-Turkey Creek



Legend

Phosphorus lbs/ac/yr

- 0.008 - 0.32
- 0.32 - 0.87
- 0.87 - 1.54
- 1.54 - 2.57
- 2.57- 6.25
- County Boundary
- Subwatershed Boundary

0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek Annual Phosphorus Loading

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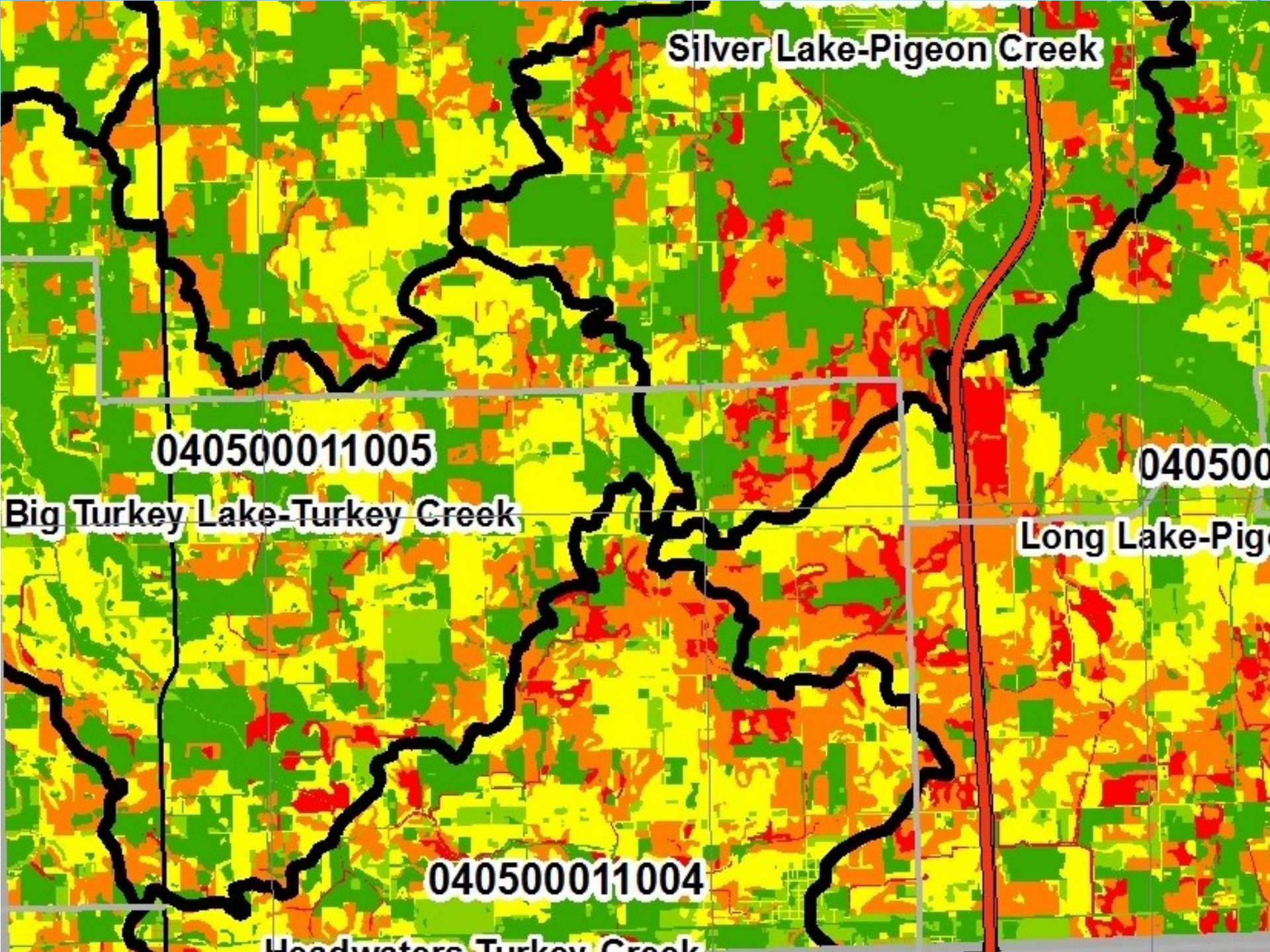
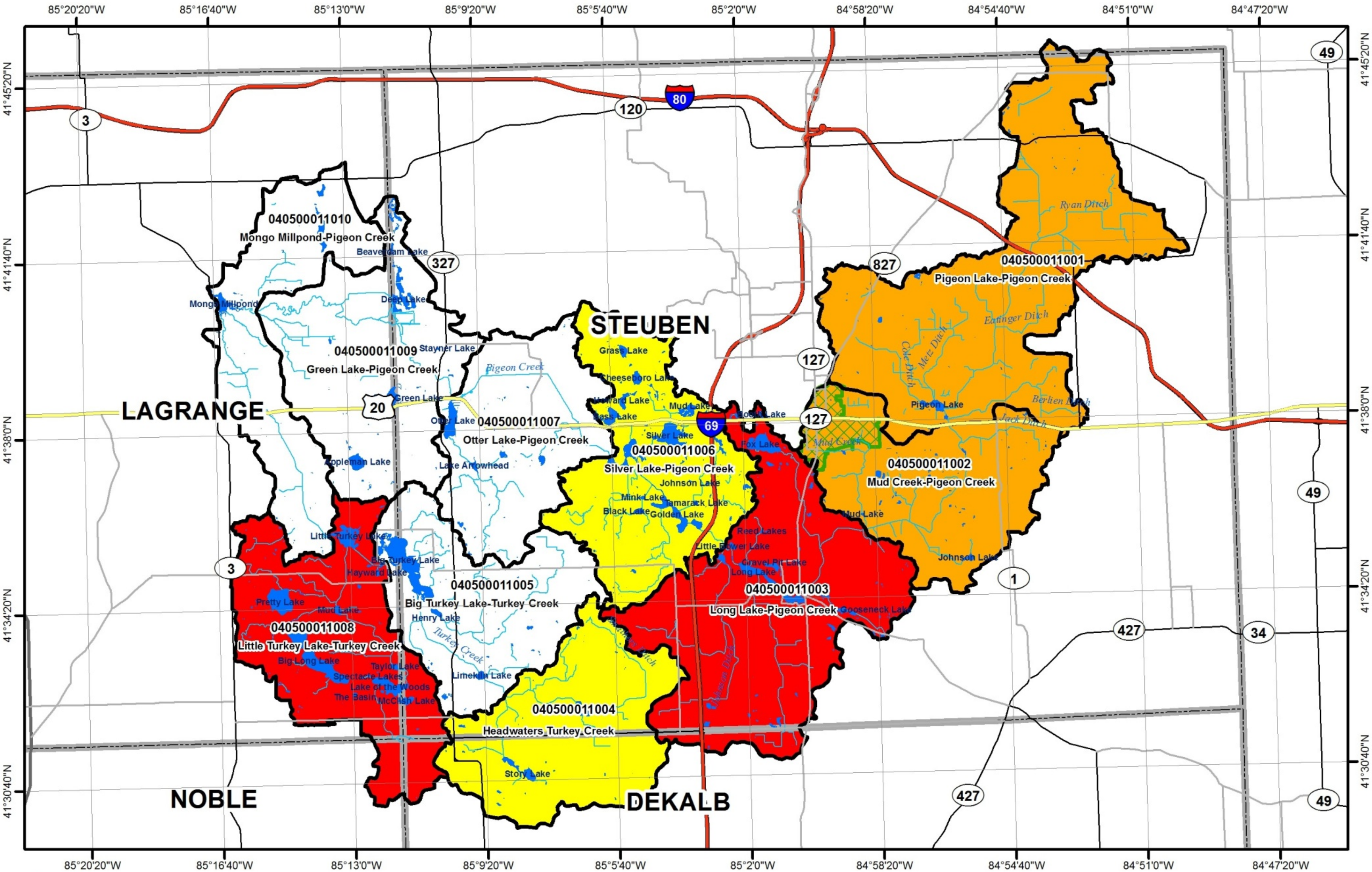

Silver Lake-Pigeon Creek
040500011005
Big Turkey Lake-Turkey Creek
040500
Long Lake-Pig
040500011004
Headwaters Turkey Creek

Critical Areas

- 3 types: reduce bacteria, reduce sediment and nutrients, and reduce flooding
- Reduce Bacteria
  - Little Turkey Lake, Silver lake, Long Lake
- Reduce nutrients and sediment
  - Long Lake, Pigeon Lake, Mud Creek
- Reduce Flooding
  - Long Lake, Mud Creek, Headwaters Turkey Creek



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41°34'20"N
41°30'40"N
LAGRANGE
STEUBEN
NOBLE
DEKALB
040500011010
Mongo Millpond-Pigeon Creek
040500011009
Green Lake-Pigeon Creek
040500011007
Otter Lake-Pigeon Creek
040500011006
Silver Lake-Pigeon Creek
040500011001
Pigeon Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
040500011003
Long Lake-Pigeon Creek
040500011005
Big Turkey Lake-Turkey Creek
040500011008
Little Turkey Lake-Turkey Creek
040500011004
Headwaters Turkey Creek
Beaver dam Lake
Deep Lake
Mongo Millpond
Stayner Lake
Green Lake
Otter Lake
Appleman Lake
Lake Arrowhead
Pigeon Creek
Grass Lake
Cheeseboro Lake
Howard Lake
Mud Lake
Bass Lake
Silver Lake
Johnson Lake
Mink Lake
Tamarack Lake
Black Lake
Golden Lake
Fox Lake
Reed Lakes
Little Bower Lake
Gravel Pit Lake
Long Lake
Gooseneck Lake
Pigeon Lake
Mud Creek
Johnson Lake
Ryan Ditch
Ettinger Ditch
Berlien Ditch
Jack Ditch
Little Turkey Lake
Big Turkey Lake
Hayward Lake
Pretty Lake
Mud Lake
Henry Lake
Turkey Creek
Big Long Lake
Taylor Lake
Spectacle Lakes
Lake of the Woods
The Basin
McClish Lake
Limekiln Lake
Story Lake
80
69
120
3
327
20
827
127
49
1
427
34

Legend

Critical Subwatershed

- Primary
- Secondary
- Tertiary
- Urban Critical Area
- Subwatershed Boundary
- Lakes/Reservoir
- County Boundary
- Streams

0 1 2 4 6 8 Miles

2013 Pigeon Creek Critical Areas (Subwatersheds)

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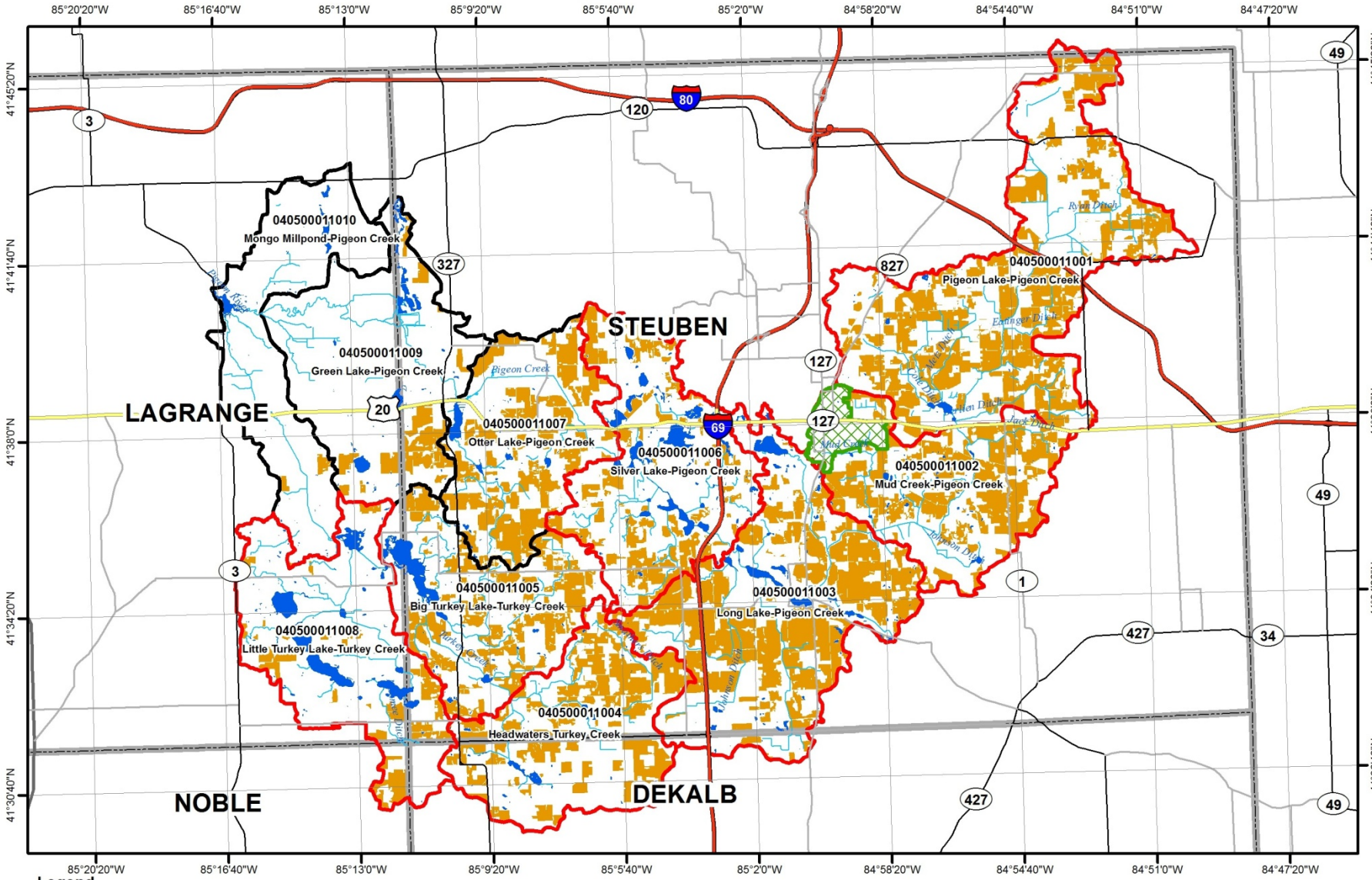
Recommendations & BMPs

- Basin-Wide Recommendations
  - Cover Crops are recommended on 39,186 acres (29%)
  - Terraces or Water and Sediment Control Basins are recommended to treat 25,916 acres (19%)
  - Blind Inlets are recommended for the treatment of 51,870 acres (38%)
  - Wetland restoration is recommended on 12,054 acres (9%)
  - septic systems through an inspection and maintenance program can be directed to 2,667 acres (2%).
    - 5,334 individual homes



Legend

- Cover Crop Areas
- Urban Critical Area
- Critical Area
- Lakes/Reservoir
- Subwatershed Boundary
- County Boundary
- Streams

0 1 2 4 6 8 Miles

N W E S

2013 Pigeon Creek Recommended Cover Crops

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City of Angola/Trine University IN54

NRCS Natural Resources Conservation Service

Steuben County Government

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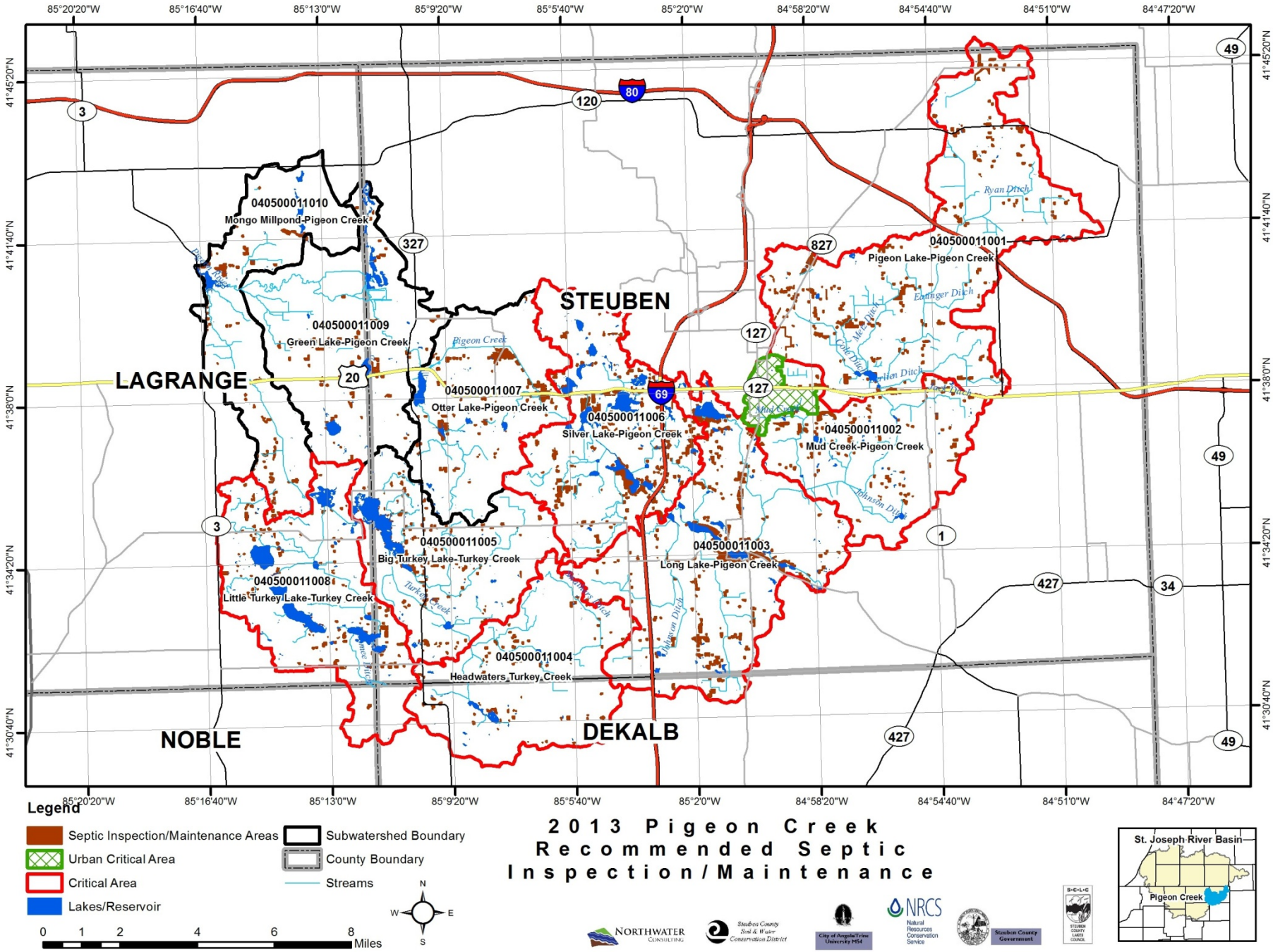
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41°38'0"N
41°34'20"N
41°30'40"N
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Mongo Millpond-Pigeon Creek
040500011009
Green Lake-Pigeon Creek
040500011007
Otter Lake-Pigeon Creek
040500011006
Silver Lake-Pigeon Creek
040500011001
Pigeon Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
040500011003
Long Lake-Pigeon Creek
040500011005
Big Turkey Lake-Turkey Creek
040500011008
Little Turkey Lake-Turkey Creek
040500011004
Headwaters Turkey Creek
STEUBEN
LAGRANGE
NOBLE
DEKALB
Pigeon Creek
Turkey Creek
Ryan Ditch
Ettinger Ditch
Johnson Ditch
Legend
Septic Inspection/Maintenance Areas
Urban Critical Area
Critical Area
Lakes/Reservoir
Subwatershed Boundary
County Boundary
Streams
0 1 2 4 6 8 Miles
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2013 Pigeon Creek
Recommended Septic
Inspection/Maintenance
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
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City of Angola/Trine University MS4
NRCS Natural Resources Conservation Service
Steuben County Government
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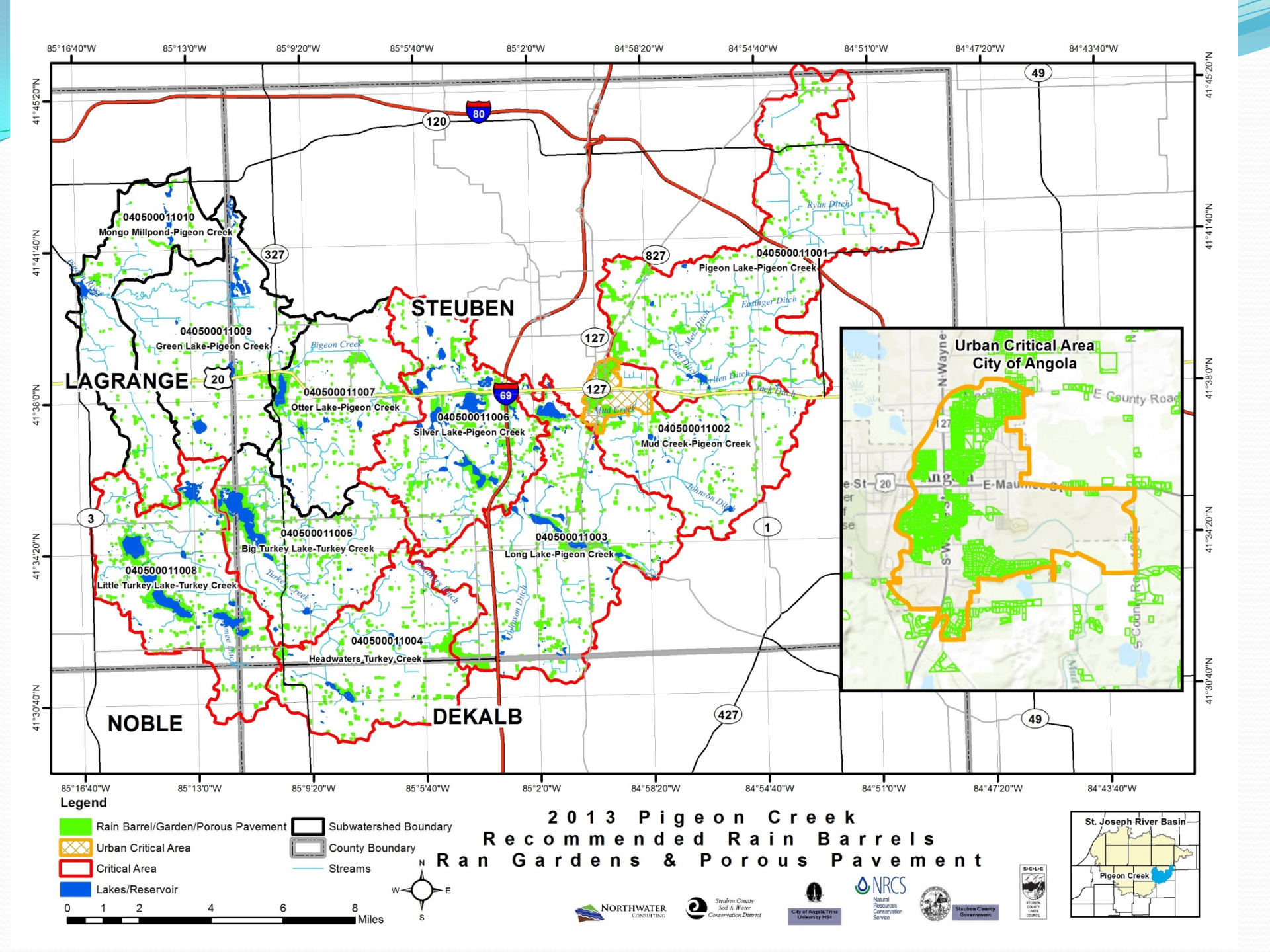
Recommendations & BMPs

- Basin-Wide
  - Denitrifying bioreactors are recommended for the treatment of 51,870 acres (38%)
  - Rain barrels, rain gardens, and porous pavement are recommended for 6,724 acres (5%)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41°34'20"N
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Mongo Millpond-Pigeon Creek
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Green Lake-Pigeon Creek
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Otter Lake-Pigeon Creek
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Silver Lake-Pigeon Creek
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Big Turkey Lake-Turkey Creek
040500011008
Little Turkey Lake-Turkey Creek
040500011004
Headwaters Turkey Creek
040500011003
Long Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
040500011001
Pigeon Lake-Pigeon Creek
LAGRANGE
STEUBEN
NOBLE
DEKALB
Pigeon Creek
Turkey Creek
Mud Creek
Ryan Ditch
Eminger Ditch
Johnson Ditch
Urban Critical Area
City of Angola
Legend
Rain Barrel/Garden/Porous Pavement
Urban Critical Area
Critical Area
Lakes/Reservoir
Subwatershed Boundary
County Boundary
Streams
0 1 2 4 6 8 Miles
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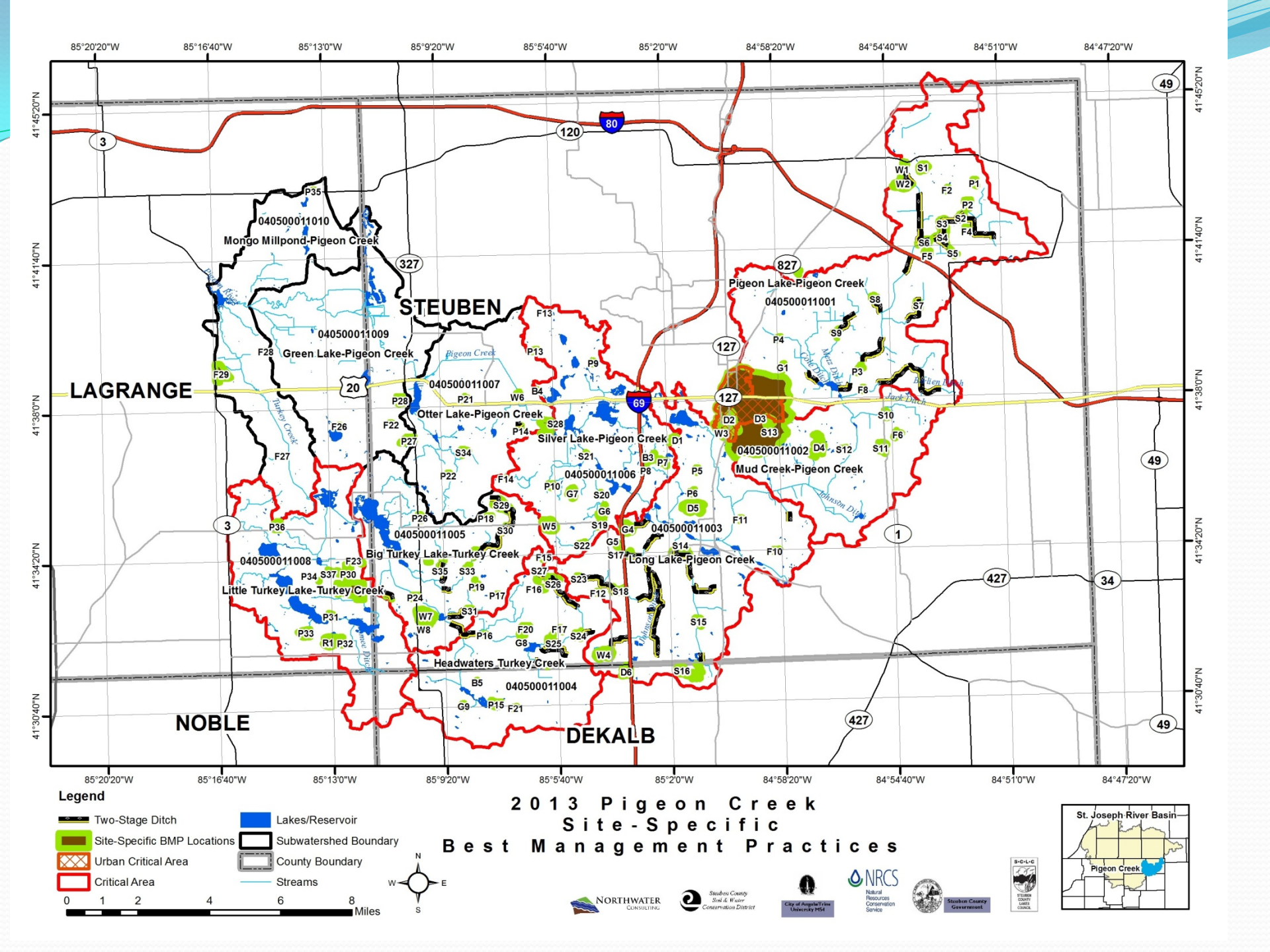
2013 Pigeon Creek
Recommended Rain Barrels
Ran Gardens & Porous Pavement
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University MS4
NRCS Natural Resources Conservation Service
Steuben County Government
St. Joseph River Basin
Pigeon Creek

Recommendations & BMPs

- Site-Specific
  - 9 grassed waterways
  - 5 terraces/sediment basins
  - 6 ponds
  - 29 small animal feed area waste treatment systems
  - 1 rock riffle
  - 8 wetlands
  - 60 two-stage ditches (176,485 feet)
  - 39 filter strips
  - 36 sites for pasture management
  - Other: streambank stabilization and detention for truck stop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Little Turkey Lake-Turkey Creek
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Long Lake-Pigeon Creek
040500011001
Pigeon Lake-Pigeon Creek
040500011002
Mud Creek-Pigeon Creek
Pigeon Creek
Turkey Creek
Johnson Ditch
Jack Ditch
Legend
Two-Stage Ditch
Site-Specific BMP Locations
Urban Critical Area
Critical Area
Lakes/Reservoir
Subwatershed Boundary
County Boundary
Streams
0 1 2 4 6 8 Miles
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2013 Pigeon Creek
Site-Specific
Best Management Practices
St. Joseph River Basin
Pigeon Creek
NORTHWATER CONSULTING
Steuben County Soil & Water Conservation District
City of Angola/Trine University MS4
NRCS
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Expected Load Reduction Percentages from Basin-Wide BMPs

Subwatershed Name	2012 HUC12 Subwatershed Codes	Load Reduction Phosphorus (lbs/yr)	Load Reduction Nitrogen (lbs/yr)	Load Reduction Sediment (tons/yr)	Load Reduction Bacteria (billion CFU/yr)
Pigeon Lake-Pigeon Creek	40500011001	82%	93%	100%	63%
Mud Creek-Pigeon Creek	40500011002	62%	87%	100%	62%
Long Lake-Pigeon Creek	40500011003	80%	95%	100%	63%
Headwaters Turkey Creek	40500011004	74%	87%	93%	68%
Big Turkey Lake-Turkey Creek	40500011005	75%	81%	100%	67%
Silver Lake-Pigeon Creek	40500011006	67%	69%	90%	59%
Otter Lake-Pigeon Creek	40500011007	58%	80%	100%	68%
Little Turkey Lake-Turkey Creek	40500011008	54%	64%	70%	54%
Green Lake-Pigeon Creek	40500011009	48%	52%	51%	62%
Mongo Millpond-Pigeon Creek	40500011010	35%	49%	40%	64%
Total		**67%**	**81%**	**96%**	**63%**

Expected Load Reduction Percentages from Site-Specific BMPs

Subwatershed Name	2012 HUC12 Subwatershed Codes	Load Reduction Phosphorus (lbs/yr)	Load Reduction Nitrogen (lbs/yr)	Load Reduction Sediment (tons/yr)	Load Reduction Bacteria (billion CFU/yr)
Pigeon Lake-Pigeon Creek	40500011001	5%	5%	1%	2%
Mud Creek-Pigeon Creek	40500011002	5%	5%	9%	6%
Long Lake-Pigeon Creek	40500011003	5%	5%	4%	2%
Headwaters Turkey Creek	40500011004	3%	4%	2%	2%
Big Turkey Lake-Turkey Creek	40500011005	5%	6%	2%	1%
Silver Lake-Pigeon Creek	40500011006	3%	2%	4%	1%
Otter Lake-Pigeon Creek	40500011007	1%	1%	1%	0.4%
Little Turkey Lake-Turkey Creek	40500011008	2%	3%	1%	5%
Green Lake-Pigeon Creek	40500011009	0.5%	1%	0.1%	1%
Mongo Millpond-Pigeon Creek	40500011010	1%	1%	1%	2%
Total		**4%**	**4%**	**3%**	**2%**

Cost Estimates

- Basin-wide BMPs
  - *$1,362,177,180.*
  - **Note: This includes 1 billion $$ just for porous pavement or 6,724 acres @ 164,000/ac**
- Site-specific BMPs
  - *$31,867,495*
- Grand total
  - ***$1,394,044,674.***

Responsible Parties & Resources

- Responsible Parties
  - SWCD
  - NRCS
  - Private Landowners (agricultural and residential)
  - Health Department
  - County Assessor
  - Municipalities
- Resources
  - Grant funds
  - USDA programs
  - Private funds

Monitoring

- Track implementation of plan recommendations
  - Set milestones/targets – Described in the plan
- Monitor water quality and track changes in watershed conditions
  - Number of water quality samples exceeding standards
  - Feet or number of impaired lakes and streams


Any Questions?