Hey and Associates, Inc.

Nippersink Creek Watershed Plan 2018

Chapter 3: Existing Pollutant Loading Analysis

McHenry and Lake Counties, Illinois
Walworth and Kenosha Counties, Wisconsin

Project No. 16-0424

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Appendices

3.1 Pollutants of Concern

As discussed in Chapter 2 of the 2008 *Nippersink Creek Watershed Plan* (2008 Plan), the primary pollutants of concern in the Nippersink Creek watershed continue to include fecal coliform, nutrients and sediment. The main channel segment of Nippersink Creek (IEPA AUID IL_DTK-04), downstream of Wonder Lake is included on the IEPA 303(d) list for fecal coliform impairment. As reported in the 2008 Plan, there are also indications that low-streamflow conditions could result in seasonal dissolved oxygen (DO) problems, stressing aquatic organisms. The main sources of these pollutants are believed to be non-point sources. Modeling included in this chapter indicates that since the watershed is primarily rural agricultural land, the main sources of non-point pollutant loads are nutrients and sediment from agricultural runoff. Streambank and shoreline erosion from within channelized and heavily shaded and poorly vegetated stream segments are additional sources of sediment and nutrient loading in the watershed.

Urban runoff from the developed areas around Woodstock, Richmond, Spring Grove, Hebron and Wonder Lake also contribute significant amounts of pollutants associated with urban runoff, such as oils and grease, heavy metals, and increased water temperature. Since the creation of the 2008 Plan, McHenry County has amended the Stormwater Management Ordinance (4/2008, 10/2010, 3/2011, 4/2014, 12/2014, 4/2016) to better address development concerns included in the 2008 Plan and to protect against pollution due to development. Although the pressure of urbanization has lessened on the watershed in the last decade, and protection ordinances are in place, regional development may still contribute pollutants to the waterbodies.

3.1.1 Pollutant Loading Analysis Approach

A pollutant loading analysis was performed to identify and quantify the sources of pollutants in the Nippersink Watershed. Current watershed conditions were assessed to estimate existing pollutant loading. Results can be used to identify management strategies for addressing existing and future water quality concerns.

The United States Environmental Protection Agency's (EPA) Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to estimate the pollutant loads for the subwatersheds, as it is a ubiquitous tool used and accepted throughout the country and is consistent with the approach to pollutant loading analysis being used by the Wisconsin Department of Natural Resources

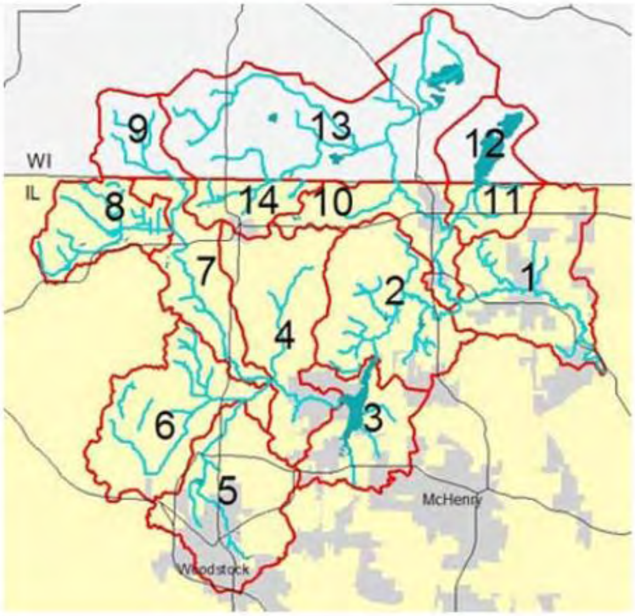
(WDNR) and Walworth County in Wisconsin. This Microsoft Excel spreadsheet model calculates nutrient and sediment loads, and the load reductions associated with various best management practices (BMPs), both existing and proposed. Additional information about STEPL can be found at http://it.tetratech-ffx.com/steplweb/. This model requires basic input data, including location, land use distribution, presence of agricultural animals, and septic system service, and also allows for optional input data, such as dominant soil type and water sampling data, to better estimate loadings.

Much like the Generalized Watershed Loading Function (GWLF) model used in the 2008 pollutant loading analysis, STEPL can also be used to determine the effectiveness of Best Management Practices (BMPs) in reducing pollutant loads. In this analysis, the BMP capabilities in STEPL were used to calculate how existing BMPs in the watershed were reducing pollutant loads. Neither an estimate of future pollutant loads, nor an estimate of future implementation of additional BMPs were completed as part of this Chapter. Additionally, like the GWLF model, to determine the pollutant load reduction for a particular BMP, STEPL aggregates similar BMPs within the subject subwatershed to calculate the total pollutant load reduction. For example, the pollutant load reduction resulting from applying nutrient management is calculated by the total number of acres included, and not by the number of individual farm units.

Subwatersheds

The subwatersheds identified in Section 1.6, Figure 1.3, of the *Nippersink Creek Watershed Plan*, dated February 2008 were modified for modeling purposes based upon more current topographic data and a desire to further refine the analysis, specifically in the Wisconsin portion of the watershed and at the border. The graphic from the 2008 plan has been included below as Figure 3.1.

Figure 3.1 2008 Subwatershed Location Map



Subwatershed #	Subwatershed Name
1	Lower Nippersink Creek
2	Glacial Park / Tamarack Farms
3	Wonder Lake
4	Vander Karr Creek
5	Silver Creek
6	Slough Creek
7	Bailey Woods
8	Nippersink Creek Headwaters
9	Zenda Headwaters
10	North Branch Nippersink Creek
11	Lower Elizabeth Lake Drain
12	Elizabeth Lake
13	Upper North Branch Nippersink Creek
14	Hebron Peatlands

The WDNR was responsible for modeling the Wisconsin portion of the Nippersink Creek Watershed, comprising of approximately 66,050 acres. They utilized the Unites States Geological Survey's (USGS) Hydrologic Units Codes (HUCs), cataloging unit level (HUC12) watershed boundaries for modeling. The parameters included in the WDNR provided models either 1) only reflected known conditions on the Wisconsin side (ex. agricultural animals were only estimated for the Wisconsin side) or 2) calculated or extrapolated for the entire HUC12 (ex. land use areas included the Illinois portions of the HUC12 where a subwatershed straddled the border).

Following receipt of the initial WDNR data, the modeling underwent minor revisions to better represent the subwatersheds included in the NWA 2008 report. Additionally, some of the subwatersheds included in the 2008 report would be further broken down to better represent stream confluences. The HUC12 boundaries were used as a base, and then further divided along NWA 2008 boundaries. The WDNR's catchments spatial layer, available on the WDNR Surface Water Data Viewer (SWDV) and McHenry County 2-ft LiDAR topography were used to further subdivide based on stream confluences. Values calculated for subwatersheds 12, 13A, and 13B are included in Appendix 21.5. Table 3.1 and Exhibit 3.1 shows how 2008 subwatersheds were modified for this effort.

TABLE 3.1: SUBWATERSHEDS						
State	**2008 No.**	**2008 Sub-watershed**	**2018 No.**	**2018 Sub-watershed**	**2018 Modeled No.**	**2018 Modeled Sub-watershed**
IL	1	Lower Nippersink Creek	1	Lower Nippersink Creek	1	Lower Nippersink Creek
IL	2	Glacial Park/ Tamarack Farms	2	Glacial Park/ Tamarack Farms	2	Glacial Park/ Tamarack Farms
IL	3	Wonder Lake	3	Wonder Lake	3	Wonder Lake
IL	4	Vander Karr Creek	4	Vander Karr Creek	4	Vander Karr Creek
IL	5	Silver Creek	5	Silver Creek	5	Silver Creek
IL	6	Slough Creek	6	Slough Creek	6	Slough Creek
IL	7	Bailey Woods	7A	Bailey Woods: Upper Bailey Woods Carver Creek	7A	Bailey Woods: Upper Bailey Woods Carver Creek
			7B	Bailey Woods: Lower Bailey Woods	7B	Bailey Woods: Lower Bailey Woods
IL	8	Nippersink Creek Headwaters	8	Nippersink Creek Headwaters	8	Nippersink Creek Headwaters
WI	9	Zenda Headwaters	9	Zenda Headwaters	9	Zenda Headwaters
IL	10	North Branch Nippersink Creek	10	North Branch Nippersink Creek	10	North Branch Nippersink Creek
IL	11	Lower Elizabeth Lake Drain	11	Lower Elizabeth Lake Drain	11	Lower Elizabeth Lake Drain
WI	12	Elizabeth Lake	12	Elizabeth Lake	12/13A/ 13B	Upper North Branch Nippersink Creek
WI	13	Upper North Branch Nippersink Creek	13A	Upper North Branch: Genoa City		
			13B	Upper North Branch: Powers, Bennedict, and Tombeau Lakes		
			13C	Upper North Branch: West Branch	13C	Upper North Branch Nippersink Creek: West Branch
IL	14	Hebron Peatlands	14	Hebron Peatlands	14	Hebron Peatlands

3.1.2 Pollutant Loading Analysis Methodology

STEPL is designed to model nitrogen (N), phosphorus (P), biochemical oxygen demand (BOD), sediment, and E. coli loading in each subwatershed. STEPL includes capabilities to assess existing loading due to watershed characteristics and proposed loading following the implementation of BMPs. In this assessment, since significant BMPs are already in place, existing BMPs were estimated to assess the true current conditions. In the results table, the loading results section that includes BMPs reflects true current conditions at the time of this analysis (2018).

An analysis was performed using the United States Department of Agriculture (USDA), National Agricultural Statistics Service's (NASS) Cropland Data Layer (CDL) to determine if it was necessary to create Soil Nutrient Application Planner (SnapPlus) representative field conditions to better refine regional BMP nutrient load reduction efficiencies. Methods included in the Wisconsin Department of Natural Resources' (WDNR) Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) and CDL data for years 2012-2016 were used to determine and estimate crop rotations for both Illinois and Wisconsin agricultural lands.

Ultimately, WDNR decided that the STEPL default reduction efficiencies for the existing agricultural practices in the watershed were sufficient, so WDNR's SnapPlus data was not used. This process resulted in a comparison of the agricultural land use in Illinois and Wisconsin. Exhibit 3.2 shows the CDL analysis results and Table 3.2 shows the comparison between Wisconsin and Illinois. The CDL dataset can be accessed here: https://agcensus.usda.gov/.

TABLE 3.2: CDL ANALYSIS RESULTS

State	Crop Rotation (%)				
	Cash Grain	Continuous Corn	Dairy	Potato/ Vegetable	Pasture/Hay/ Grass
WI	53%	9%	3%	3%	32%
IL	45%	20%	18%	0%	17%
Difference	**8%**	**11%**	**15%**	**3%**	**15%**

For each of the input variables, methods detailing data collection are included in the following sections. Walworth County Land Use and Resource Management Department (LURM) and WDNR provided Wisconsin-specific information for modeling purposes. Illinois-specific information was provided by McHenry County Planning and Development Stormwater staff, McHenry County Soil and Water Conservation District (SWCD), McHenry County Conservation

District (MCCD), McHenry County Farm Bureau, and McHenry County Natural Resources Conservation Service (NRCS).

Watershed land use area and precipitation

A land use layer for the watershed was created using WiscLand2 (2016), the McHenry County GIS land use layer (updated 11/2015), the Lake County GIS land use layer (2010), and aerial imagery. These sources were chosen to best reflect land use conditions because they are relatively current and regionally specific. Land use categories were reclassified into the categories necessary for STEPL input, as shown on Exhibit 3.3. Acreages were calculated using Geographic Information System (GIS) spatial analysis. Feedlot acreage in Illinois was estimated using aerial review of sites noted as having agricultural animals present by McHenry County SWCD. Feedlot acreage in Wisconsin was estimated by Walworth County LURM. State, county, and corresponding county average weather stations that best reflect the subwatershed location were chosen to select the appropriate STEPL-provided rainfall data.

Agricultural animals

Numbers of agricultural animals in Illinois were estimated using McHenry County's 2012 Agricultural census data. Estimates were manually adjusted by McHenry County SWCD. County averages were applied to the land area in each Illinois subwatershed. Manure application practices in Illinois were estimated by McHenry County SWCD. Numbers of agricultural animals and manure application practices in Wisconsin were estimated by Walworth County LURM.

Septic system and illegal direct wastewater discharge data

The number of septic systems in Illinois was estimated by McHenry County. It was estimated that most (assumed all) of unincorporated areas are not served by municipal sewer systems, 10% of incorporated areas are not served by municipal sewer systems, and both Spring Grove and Johnsburg are not served by municipal sewer systems. GIS calculated number of parcels was used as a surrogate for the number of septic systems in areas not served by municipal sewer systems. Default values were used for all other inputs. The number of septic systems in Wisconsin was estimated by Walworth County LURM; default values were used for all other inputs.

Universal Soil Loss Equation (USLE) parameters

WDNR provided a spreadsheet entitled "USLEbyLU" that included county-wide averages for USLE parameters for each land use. McHenry county averages were used for the primarily Illinois subwatersheds. Values were refined and confirmed by McHenry County SWCD. WDNR and Walworth County LURM further refined the C factors to reflect average cropland and pastureland tillage/soil disturbance levels and very little level of soil disturbance on pastures and other grass/wetland areas and confirmed other "USLEbyLU" inputs. Default values were used for all other inputs.

Average soil hydrologic group (SHG)

The United Stated Department of Agriculture (USDA) NRCS Soil Survey was used to determine the predominant soil hydrologic group. Default values were used for all other inputs.

Reference runoff curve number (RCN)

WDNR adjusted User Defined RCN to represent a "catch-all" for land uses that are known to not largely contribute to pollutant loading, such as wetlands, shrub, and meadow. For this effort, the same strategy was used for the Illinois subwatersheds.

Nutrient concentration in runoff and E. coli

Default values were used for these inputs.

Urban land use distribution

The land use layer for the watershed, mentioned in the watershed land use area and precipitation section, was created using WiscLand2 (2016), McHenry County GIS land use layer (updated 11/2015), the Lake County GIS land use layer (2010), and aerial imagery. These sources were chosen to best reflect land use conditions because they are relatively current and regionally specific. Urban land use categories were reclassified into the categories provided in STEPL. Acreages were calculated using GIS analysis.

Irrigation area and irrigation amount

Default values were used for these inputs.

Pastureland Nutrient concentration in runoff and E. coli

Default values were used for these inputs.

Gulley

WDNR did not include gulleys in their initial analysis, as the input data to complete their typical analysis was not available (shapefile symbolizing flowpaths connectivity through culverts). Additionally, prior WDNR modeling experience suggested that gulleys are not generally a large contributor to pollutant loading in a watershed in this region.

For the Illinois subwatersheds, a sensitivity analysis was performed to estimate what level of pollutant loading gulleys may contribute. Areas of relatively steep slope on agricultural lands were selected and predominantly preside in areas far upstream in the watershed, not directly adjacent to major channel segments. This initial investigation indicated that most pollutants created by presence of gulleys, where gulley formation is anticipated in the upper watershed, have ample time to settle along flowpaths through shallower slopes and may not enter surface water to the extent expected from a typical gulley. Additionally, representative approximate dimensions of regional gulleys were included in working versions to estimate pollutant contribution. Relative increases to subwatershed loading was insignificant.

Due to these two analyses and the WDNR approach to modeling, it was determined that gulleys would not be included in this effort for the Illinois subwatersheds. To better refine these inputs, a comprehensive gulley inventory could be completed to better reflect current conditions.

Streambank

For the streambank analysis, NWA's 2008 stream assessment was used to estimate current conditions of the stream segments in both the IL and WI watersheds. Sections listed as channelized and not recovering were recorded as impaired streambanks. Sections listed as not channelized or channelized and recovering were assumed to not be currently impaired streambanks. Representative bank height, soil textural class, and a moderate rate of lateral recession were chosen for the analysis. A BMP efficiency of zero was included to represent the existing condition.

Eroding lake and impoundment shorelines were not included in this analysis due to limited data. A sensitivity analysis was performed to assess the relative contribution of pollutants from streambank erosion. For the watersheds included in this analysis, other land use characteristics produce a significantly higher load compared to streambanks, so a detailed analysis was not performed as part of this study. To better refine these inputs, a comprehensive stream and shoreline inventory could be completed to better reflect current conditions.

BMPs

McHenry County SWCD provided anecdotal information to aid in estimating what BMPs are implemented in the watershed, to what extent they're consistently implemented, and on what type of lands they're being practiced on the Illinois subwatersheds.

- 2-3% of agricultural lands implement grass buffers and consistently implement a Nutrient Management Plan NMP
- 40% of agricultural lands practice conservation tillage 1 (30-59% residue) and consistently implement an NMP
- 30% of agricultural lands practice conservation tillage 2 (equal to or more than 60% residue) and consistently implement an NMP
- 5% of agricultural lands use cover crop 1 (group A commodity) and consistently implement an NMP
- 1% of agricultural lands use cover crop 2 (group A traditional normal planting time) and consistently implement an NMP
- 95% of agricultural lands have and consistently implement an NMP

Walworth County LURM provided similar information for the Wisconsin subwatersheds.

- 80% of NMPs are implemented consistently
- 20% of dairy land acres use cover crop 2 (group A traditional normal planting time) and an NMP

- 20% of non-dairy cropland practices conservation tillage 1 (30-59% residue)
- 50% of non-dairy cropland practices conservation tillage 2 (equal to or more than 60% residue)

All combined practices were assumed to be operating in series.

The CDL analysis described in Section 3.1.1 was used to separate dairy and non-dairy agricultural lands to apply the Wisconsin BMPs. Since the total cropland area calculated by the CDL analysis does not exactly match the total cropland area calculated by the GIS land use investigation, an analysis was performed to 1) estimate the total cropland acres and 2) estimate the crop rotations. Although not necessary for the application of Illinois BMPs, the analysis detailed below was also calculated for the Illinois subwatersheds. This data is recorded in Appendix 21.5 and could be used in future modeling efforts.

In this analysis, it was assumed that the total cropland area calculated by the GIS analysis is more accurate than the total cropland area calculated by the CDL analysis. This assumption was made based on three main data characteristics. The first, is that the McHenry and Lake County land use layers are more likely to better represent total cropland compared to the CDL data because of the detailed knowledge of the area needed to produce a land use layer. Similarly, the WiscLand2 remote sensing methods are better capable at distinguishing land uses, while the CDL remote sensing methods are narrowly focused on sensing specific agricultural practices within the broader agricultural land use category. The second, is that the County land use layers and WiscLand2 have been derived and created more recently than the CDL data. The CDL data relies on a historic series of data, while WiscLand2, McHenry County land use, Lake County land use, and aerial imagery are more recent “snapshots” of the land use conditions. The third, is that McHenry and Lake County polygon vector data has the potential to more accurately reflect on-ground conditions, compared to the remotely-sensed, relatively coarse (30M pixel) CDL raster layer. WiscLand2 is also relatively coarse (30M pixel), so this characteristic was not a factor in selecting WiscLand2 over CDL data.

To transfer the crop rotations from the CDL analysis to the GIS estimate of total cropland area, the CDL distribution of each rotation was scaled to the GIS derived total cropland area.

The following STEPL default BMP efficiencies were used in the model to estimate the effectiveness of BMPs to reduce pollutant loads. Not all reduction efficiencies, listed below in Table 3.3-3.7, were included in this modeling effort; they were included for reference of relative effectiveness. An efficiency of 1 denotes 100% removal efficiency, an efficiency of 0 denotes no removal, and "ND" denotes no data. However, removal efficiencies of each pollutant are dependent on the removal efficiencies for other pollutants. For example, a nitrogen removal efficiency of 1 does not produce a 100% nitrogen load reduction unless sediment removal efficiency is also substantial. Similarly, a sediment removal efficiency of 1 produces a 100% sediment load reduction and a measurable reduction in nitrogen, phosphorus, and BOD load reductions. The STEPL model also allows for calculation of combined BMPs using the BMP Calculator tool. This tool allows for the estimation of combined removal efficiencies, whether working in series or parallel, as removal efficiencies are not simply additive.

TABLE 3.3: STEPL DEFAULT BMP EFFICIENCIES FOR CROPLAND

BMP	Reduction Efficiency			
	N	P	BOD	Sediment
Bioreactor	0.453	ND	ND	ND
Buffer - Forest (100ft wide)	0.478	0.465	ND	0.586
Buffer - Grass (35ft wide)	0.338	0.435	ND	0.533
Conservation Tillage 1 (30-59% Residue)	0.15	0.356	ND	0.403
Conservation Tillage 2 (equal or more than 60% Residue)	0.25	0.687	ND	0.77
Contour Farming	0.279	0.398	ND	0.341
Controlled Drainage	0.388	0.35	ND	ND
Cover Crop 1 (Group A Commodity) (High Till only for Sediment)	0.008	ND	ND	ND
Cover Crop 2 (Group A Traditional Normal Planting Time) (High Till only for TP and Sediment)	0.196	0.07	ND	0.1
Cover Crop 3 (Group A Traditional Early Planting Time) (High Till only for TP and Sediment)	0.204	0.15	ND	0.2
Land Retirement	0.898	0.808	ND	0.95
Nutrient Management 1 (Determined Rate)	0.154	0.45	ND	ND
Nutrient Management 2 (Determined Rate Plus Additional Considerations)	0.247	0.56	ND	ND
Streambank Stabilization and Fencing	0.75	0.75	ND	0.75
Terrace	0.253	0.308	ND	0.4
Two-Stage Ditch	0.12	0.28	ND	ND

TABLE 3.4: STEPL DEFAULT BMP EFFICIENCIES FOR PASTURELAND				
BMP	REDUCTION EFFICIENCY			
	N	P	BOD	SEDIMENT
30m Buffer with Optimal Grazing	0.364	0.653	ND	ND
Alternative Water Supply	0.133	0.115	ND	0.187
Critical Area Planting	0.175	0.2	ND	0.42
Forest Buffer (minimum 35 feet wide)	0.452	0.4	ND	0.533
Grass Buffer (minimum 35 feet wide)	0.868	0.766	ND	0.648
Grazing Land Management (rotational grazing with fenced areas)	0.43	0.263	ND	ND
Heavy Use Area Protection	0.183	0.193	ND	0.333
Litter Storage and Management	0.14	0.14	ND	0
Livestock Exclusion Fencing	0.203	0.304	ND	0.62
Pasture and Hayland Planting (also called Forage Planting)	0.181	0.15	ND	ND
Prescribed Grazing	0.408	0.227	ND	0.333
Streambank Protection without Fencing	0.15	0.22	ND	0.575
Streambank Stabilization and Fencing	0.75	0.75	ND	0.75
Use Exclusion	0.39	0.04	ND	0.589
Winter Feeding Facility	0.35	0.4	ND	0.4

TABLE 3.5: STEPL DEFAULT BMP EFFICIENCIES FOR FORESTLAND				
BMP	REDUCTION EFFICIENCY			
	N	P	BOD	SEDIMENT
Road dry seeding	ND	ND	ND	0.41
Road grass and legume seeding	ND	ND	ND	0.71
Road hydro mulch	ND	ND	ND	0.41
Road straw mulch	ND	ND	ND	0.41
Road tree planting	ND	ND	ND	0.5
Site preparation/hydro mulch/seed/fertilizer	ND	ND	ND	0.71
Site preparation/hydro mulch/seed/fertilizer/transplants	ND	ND	ND	0.69
Site preparation/steep slope seeder/transplant	ND	ND	ND	0.81
Site preparation/straw/crimp seed/fertilizer/transplant	ND	ND	ND	0.95
Site preparation/straw/crimp/net	ND	ND	ND	0.93
Site preparation/straw/net/seed/fertilizer/transplant	ND	ND	ND	0.83
Site preparation/straw/polymer/seed/fertilizer/transplant	ND	ND	ND	0.86

TABLE 3.6: STEPL DEFAULT BMP EFFICIENCIES FOR FEEDLOTS				
BMP	**Reduction Efficiency**			
	N	**P**	**BOD**	**Sediment**
Diversion	0.45	0.7	ND	ND
Filter strip	ND	0.85	ND	ND
Runoff Management System	ND	0.825	ND	ND
Solids Separation Basin	0.35	0.31	ND	ND
Solids Separation Basin w/Infiltration Bed	ND	0.8	0.85	ND
Terrace	0.55	0.85	ND	ND
Waste Management System	0.8	0.9	ND	ND
Waste Storage Facility	0.65	0.6	ND	ND

TABLE 3.7: STEPL DEFAULT BMP EFFICIENCIES FOR URBAN LAND				
BMP	REDUCTION EFFICIENCY			
	N	P	BOD	SEDIMENT
Alum Treatment	0.6	0.9	0.6	0.95
Bioretention facility	0.63	0.8	ND	ND
Concrete Grid Pavement	0.9	0.9	ND	0.9
Dry Detention	0.3	0.26	0.27	0.575
Extended Wet Detention	0.55	0.685	0.72	0.86
Filter Strip-Agricultural	0.5325	0.6125	ND	0.65
Grass Swales	0.1	0.25	0.3	0.65
Infiltration Basin	0.6	0.65	ND	0.75
Infiltration Devices	ND	0.83	0.83	0.94
Infiltration Trench	0.55	0.6	ND	0.75
Low Impact Development (LID)/Cistern	0	0	0	0
LID/Cistern + Rain Barrel	0	0	0	0
LID/Rain Barrel	0	0	0	0
LID/Bioretention	0.43	0.81	ND	ND
LID/Dry Well	0.5	0.5	0.7	0.9
LID/Filter/Buffer Strip	0.3	0.3	0.4	0.6
LID/Infiltration Swale	0.5	0.65	ND	0.9
LID/Infiltration Trench	0.5	0.5	0.7	0.9
LID/Vegetated Swale	0.075	0.175	ND	0.475
LID/Wet Swale	0.4	0.2	ND	0.8
Oil/Grit Separator	0.05	0.05	ND	0.15
Porous Pavement	0.85	0.65	ND	0.9
Sand Filter/Infiltration Basin	0.35	0.5	ND	0.8
Sand Filters	ND	0.375	0.4	0.825
Settling Basin	ND	0.515	0.56	0.815
Vegetated Filter Strips	0.4	0.4525	0.505	0.73
Weekly Street Sweeping	ND	0.06	0.06	0.16
Wet Pond	0.35	0.45	ND	0.6
Wetland Detention	0.2	0.44	0.63	0.775
Water Quality Inlet w/Sand Filter	0.35	ND	ND	0.8
Water Quality Inlets	0.2	0.09	0.13	0.37

Point Sources

Although not included in the STEPL model, point sources of pollution were compiled to record other sources of pollution to the Nippersink Creek. Table 3.8 shows point sources related to Municipal Separate Storm Sewer Systems (MS4s), Wastewater Treatment Plants (WWTPs), Concentrated Animal Feeding Operations (CAFOs), National Pollutant Discharge Elimination System (NPDES) Permits, and other discharges. Effective Clean Water Act permit information was found using the Environmental Protection Agency's (EPA) Watershed Assessment, Tracking & Environmental Results System (WATERS) spatial mapping service located at: https://www.epa.gov/waterdata/waters-watershed-assessment-tracking-environmental-results-system

TABLE 3.8: POINT SOURCES OF POLLUTION (EFFECTIVE PERMITS)

Permittee	Location	Subwatershed	Permit Number(s)
Nunda Township (MS4)	3518 Bay Rd, Crystal Lake, IL 60012	Bailey Woods: Lower Bailey Woods	ILR400100
McHenry County Conservation District	6720 Keystone Road, Richmond, IL 60071	Glacial Park/Tamarack Farms	ILG870538
Village of Hebron Wastewater Treatment Plant (WWTP)	North Freeman Road, Hebron, IL 60034	Hebron Peatlands	IL0026433
Intermatic, Inc.	7777 Winn Rd, Spring Grove, IL 60081	Lower Nippersink Creek	IL0059145
Scot Forge Co.	8001 Winn Road, Spring Grove, IL 60081	Lower Nippersink Creek	IL0077909
Village of Spring Grove (MS4)	7401 Meyer Road, Spring Grove, IL 60081	Lower Nippersink Creek	ILR400520, ILG870407
Keystone Hatcheries, LLC	11409 Keystone Road, Richmond, IL 60071	North Branch Nippersink Creek	ILG870198
Leica Biosystems Richmond, Inc.	5205 Route 12, Richmond, IL 60071	North Branch Nippersink Creek	IL0070645
Richmond Sewage Treatment Plant (WWTP)	East Street, Richmond, IL 60071	North Branch Nippersink Creek	IL0026093
Village of Genoa City Wastewater Treatment Facility (WWTP)	517 First Street, Genoa City, WI 53128	North Branch Nippersink Creek	WI0021083
Landkeepers, LLC	700 McHenry Ave, Woodstock, IL 60098	Silver Creek	ILG870559
McHenry County Department of Health Division of Environmental Health	2200 N Seminary Ave, Woodstock, IL 60098	Silver Creek	ILG870274

TABLE 3.8 CONTINUED: POINT SOURCES OF POLLUTION (EFFECTIVE PERMITS)			
Permittee	**Location**	**Subwatershed**	**Permit Number(s)**
Surface Discharging System 80	11315 Country Club Rd, Woodstock, IL 60098	Silver Creek	ILG620080
City of Woodstock (MS4)	21 W Calhoun, Woodstock, IL 60098	Silver Creek	ILR400499
McHenry County Division of Transportation	16111 Nelson Rd, Woodstock, IL 60098	Slough Creek	ILG870174, ILR400264
Village of Bloomfield (MS4)	N 1143 Highway U, Genoa City, WI 53128	Upper North Branch Nippersink Creek: Powers, Bennedict, and Tombeau Lakes	WI0049794
Merry Water Farms, Inc.	N1240 Hillside Rd, Lake Geneva WI, 53147	Upper North Branch Nippersink Creek: West Branch	WI0061883
Snudden Farms, LLC	N815 Zenda Rd, Lake Geneva, WI 53147	Upper North Branch Nippersink Creek: West Branch	WI0064971

These locations, as well as other locational anecdotal information provided by McHenry County SMC, McHenry County SWCD, and MCCD are included on Exhibit 3.4.

3.2 Pollutant Loading Results and Pollutant Reduction Strategies

3.2.1 Runoff Volume

Arguably, runoff is the most critical component of any watershed process. Changes in watershed conditions, particularly land use and level of development, signal subsequent changes in runoff. Likewise, changes in runoff amount, timing, and water quality may cause profound changes in the dynamics of pollutant processes. Urbanization of a watershed, or portion of a watershed, will generally cause a significant increase of watershed runoff volume, due to creation of impermeable or less-permeable surfaces. Although total runoff volume is not calculated by the STEPL model, it's important to keep in mind that this is a factor when planning for future watershed needs.

Since the 2008 Plan was created, the majority of the watershed has remined rural and unurbanized.

Planning for future increases in impervious area, due to development mostly centered around existing urban areas, such as the Wonder Lake subwatershed and The Lower Elizabeth Lake Drain subwatershed should be considered. Various regulations, specifically municipal ordinances, in the watershed have been developed or amended to more thoroughly address site development and stormwater impacts through regulation of runoff volume and water quality.

3.2.2 Best Management Practices for Runoff Reduction

Runoff reduction strategies must target developing areas in the watershed, as well as existing and dated areas lacking extensive stormwater infrastructure. Some of the practices listed in Tables 3.3-3.7 will not only reduce the pollutant loads, but will also reduce flow velocities, promote infiltration, and provide some level of detention. Mitigation for increased runoff within the watershed can be achieved by preserving and restoring the floodplain and developing responsibly. Watershed wide BMPs for reducing runoff volumes include:

- Rain gardens to promote infiltration
- Preserving open lands to promote infiltration and groundwater recharge
- Practicing Low Impact Development (Reduction of imperviousness)
- Wetland conversion/restoration to encourage retention and infiltration
- Modification of tile systems
- Infiltration trenches and basins to retain water and promote infiltration
- Implementing buffers to developing, idle, and agricultural lands
- Improved conservation tillage and cover practices

3.2.3 Nippersink Creek Pollutant Loading Results

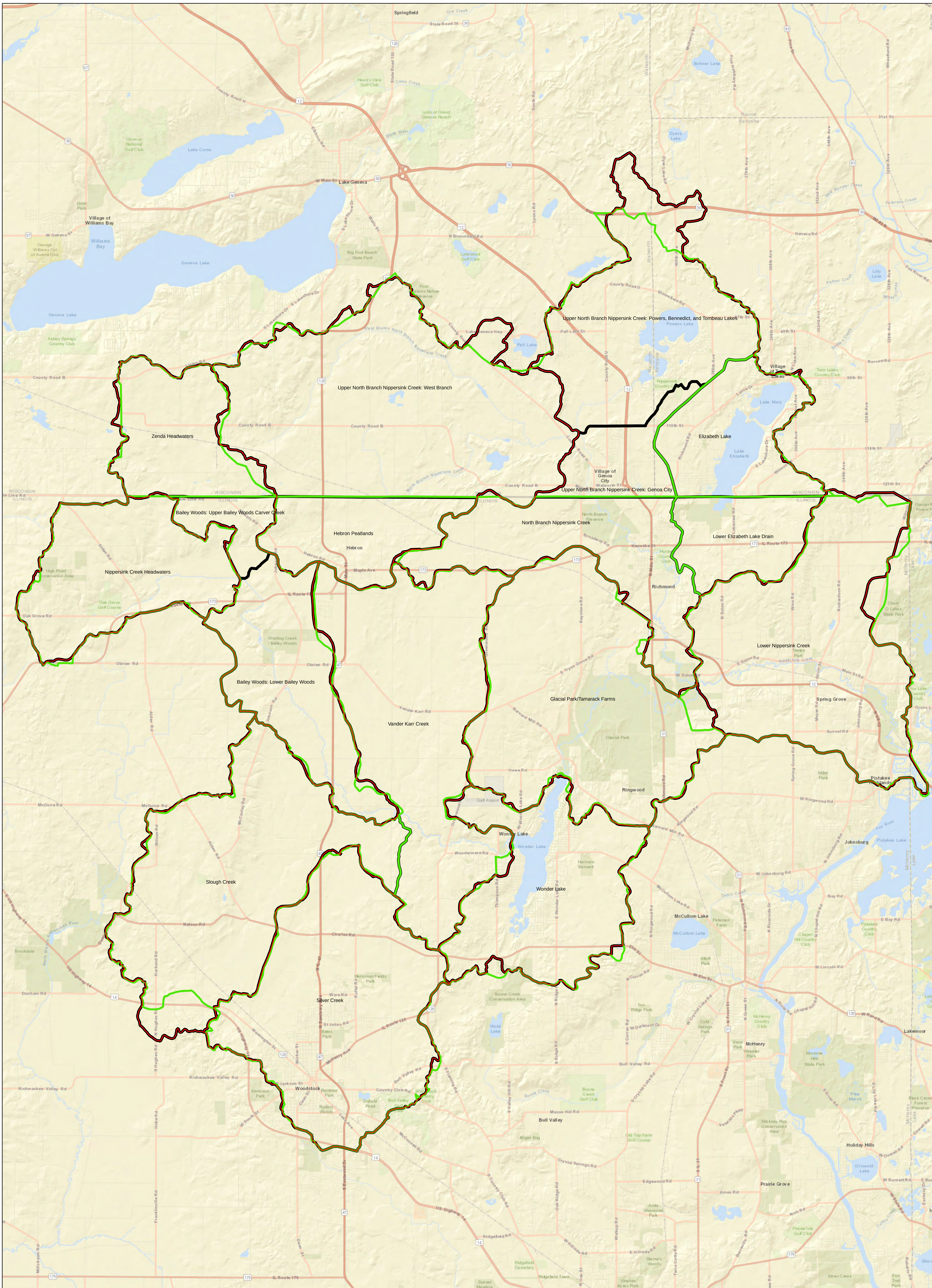
STEPL is designed to model N, P, BOD, sediment, and E. coli loading in each subwatershed. Since no E. coli data was available for input, all subwatersheds produced no detectable E. coli loads, and subsequently are not included in the results tables. Future studies could refine input data to better estimate E. coli loading.

The following tables include 2018 existing conditions pollutant loading analysis results for each subwatershed. Detailed loading results, by land use and for each subwatershed, are included in Appendix 2.

TABLE 3.9: ANNUAL POLLUTANT LOAD BY SUBWATERSHED						
No.	**Subwatershed**	**Area (Ac)**	**N Load (lbs/ year)**	**P Load (lbs/ Year)**	**BOD Load (lbs/ year)**	**Sediment Load (tons/ year)**
1	Lower Nippersink Creek	12,031.2	75,783.5	16,426.7	211,843.9	3,103.5
2	Glacial Park/Tamarack Farms	12,979.2	74,269.0	16,736.0	179,837.4	3,399.8
3	Wonder Lake	7,669.2	46,312.1	10,315.6	127,835.9	2,266.7
4	Vander Karr Creek	12,305.9	90,187.8	21,376.3	206,414.9	4,500.6
5	Silver Creek	12,028.6	119,804.0	22,973.0	326,952.7	3,987.8
6	Slough Creek	12,581.0	144,996.7	29,335.9	338,488.6	5,341.6
7A	Bailey Woods: Upper Bailey Woods Carver Creek	1,318.5	9,835.2	3,122.3	21,528.2	888.6
7B	Bailey Woods: Lower Bailey Woods	5,992.3	39,518.2	10,496.7	87,317.9	2,400.5
8	Nippersink Creek Headwaters	6,599.4	40,226.2	10,957.9	92,660.6	3,008.6
9	Zenda Headwaters	4,421.1	18,926.4	6,732.1	42,234.4	2,247.8
10	North Branch Nippersink Creek	6,666.8	37,253.2	9,172.4	93,720.1	2,129.4
11	Lower Elizabeth Lake Drain	3,048.9	28,085.3	6,441.9	69,338.4	1,496.5
12/13A/13B	Upper North Branch Nippersink Creek: West Branch	15,789.4	35,324.0	11,239.4	10,2130.8	3,976.8
13C	Upper North Branch Nippersink Creek	15,667.5	53,607.5	17,640.3	119,608.5	5,145.9
14	Hebron Peatlands	3,707.8	38,132.9	8,569.9	90,568.9	1,856.3
Total		132,806.8	852,262.1	201,536.2	2,110,481.1	45,750.3

TABLE 3.10: POLLUTANT CONTRIBUTION INDEX						
No.	Subwatershed	Area (Ac)	Contribution Index*			
			N	P	BOD	Sediment
1	Lower Nippersink Creek	12031.2	98	90	**111**	75
2	Glacial Park/Tamarack Farms	12979.2	89	85	87	76
3	Wonder Lake	7669.2	94	89	**105**	86
4	Vander Karr Creek	12305.9	**114**	**114**	**106**	**106**
5	Silver Creek	12028.6	**155**	**126**	**171**	96
6	Slough Creek	12581.0	**180**	**154**	**169**	**123**
7A	Bailey Woods: Upper Bailey Woods Carver Creek	1318.5	**116**	**156**	**103**	**196**
7B	Bailey Woods: Lower Bailey Woods	5992.3	**103**	**115**	92	**116**
8	Nippersink Creek Headwaters	6599.4	95	**109**	88	**132**
9	Zenda Headwaters	4421.1	67	**100**	60	**148**
10	North Branch Nippersink Creek	6666.8	87	91	88	93
11	Lower Elizabeth Lake Drain	3048.9	**144**	**139**	**143**	**142**
12/13A/13B	Upper North Branch Nippersink Creek: West Branch	15789.4	35	47	41	73
13C	Upper North Branch Nippersink Creek	15667.5	53	74	48	95
14	Hebron Peatlands	3707.8	**160**	**152**	**154**	**145**

* Contribution index = (Percent of total watershed load coming from subwatershed ÷ Percent of watershed area that subwatershed comprises) × 100. Index above 100 indicates subwatershed produces disproportionately large pollutant load. (This metric was adopted from Poplar Creek Watershed Action Plan, CMAP, 2006)



Scale:

0 5,000 10,000 Feet

Orientation:

Legend:

USGS HUC12 Watersheds

2008 NWA Subwatersheds

2018 Modeled Subwatersheds

Project Number: 16-0424

Date: 10/8/2018

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Creek Watershed
Pollutant Loading Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

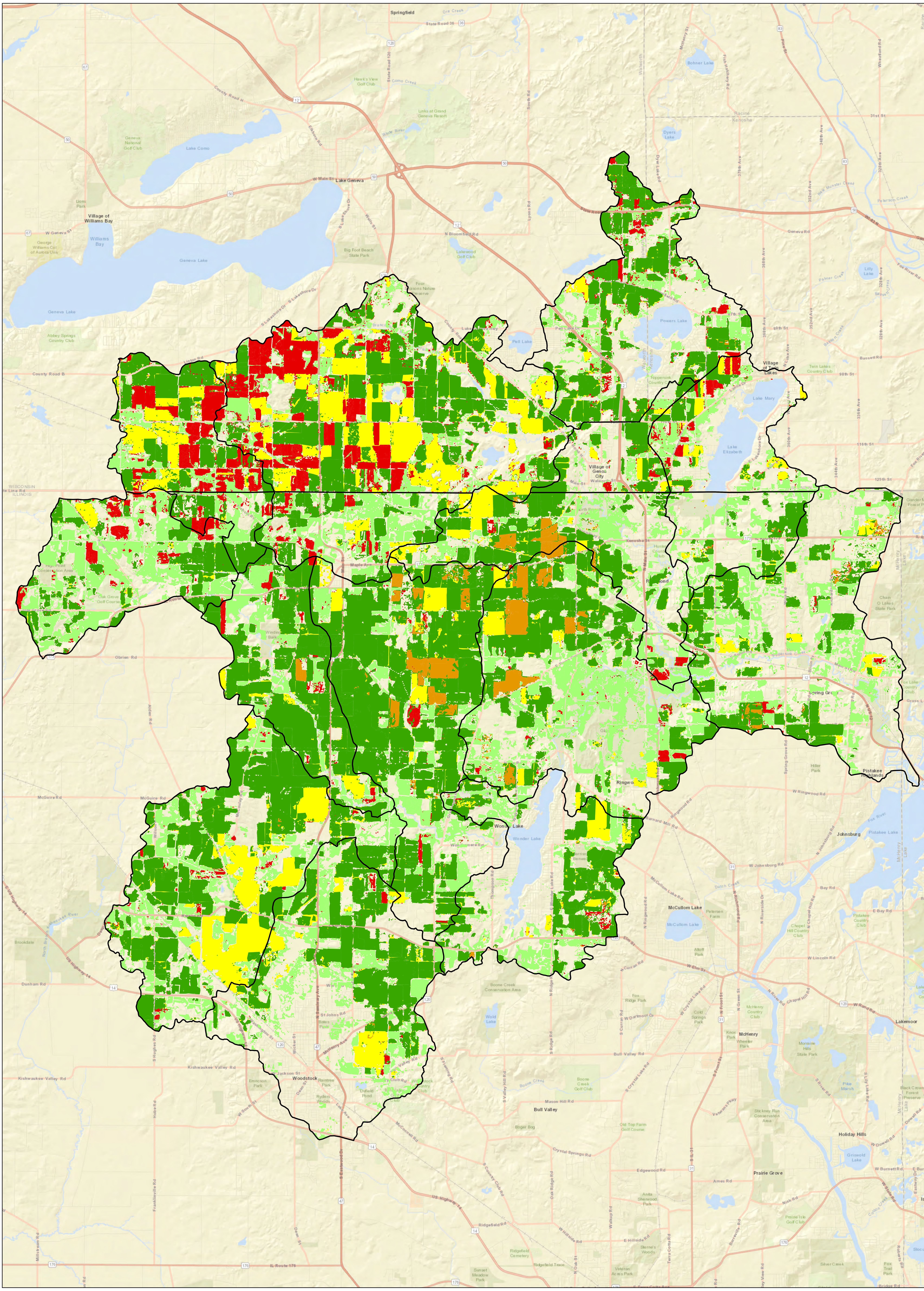
Derivation of 2018 subwatersheds for modeling

Exhibit Title:

Subwatersheds

Exhibit:

3.1



Scale:

0 5,000 10,000 Feet

Orientation:

Legend:

- 2018 Modeled Subwatersheds
- Dairy
- Cash Grain
- Continuous Corn
- Pasture/Hay/Grass
- Potato/Vegetable

Project Number: 16-0424

Date: 11/7/2018

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Creek Watershed
Pollutant Loading Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

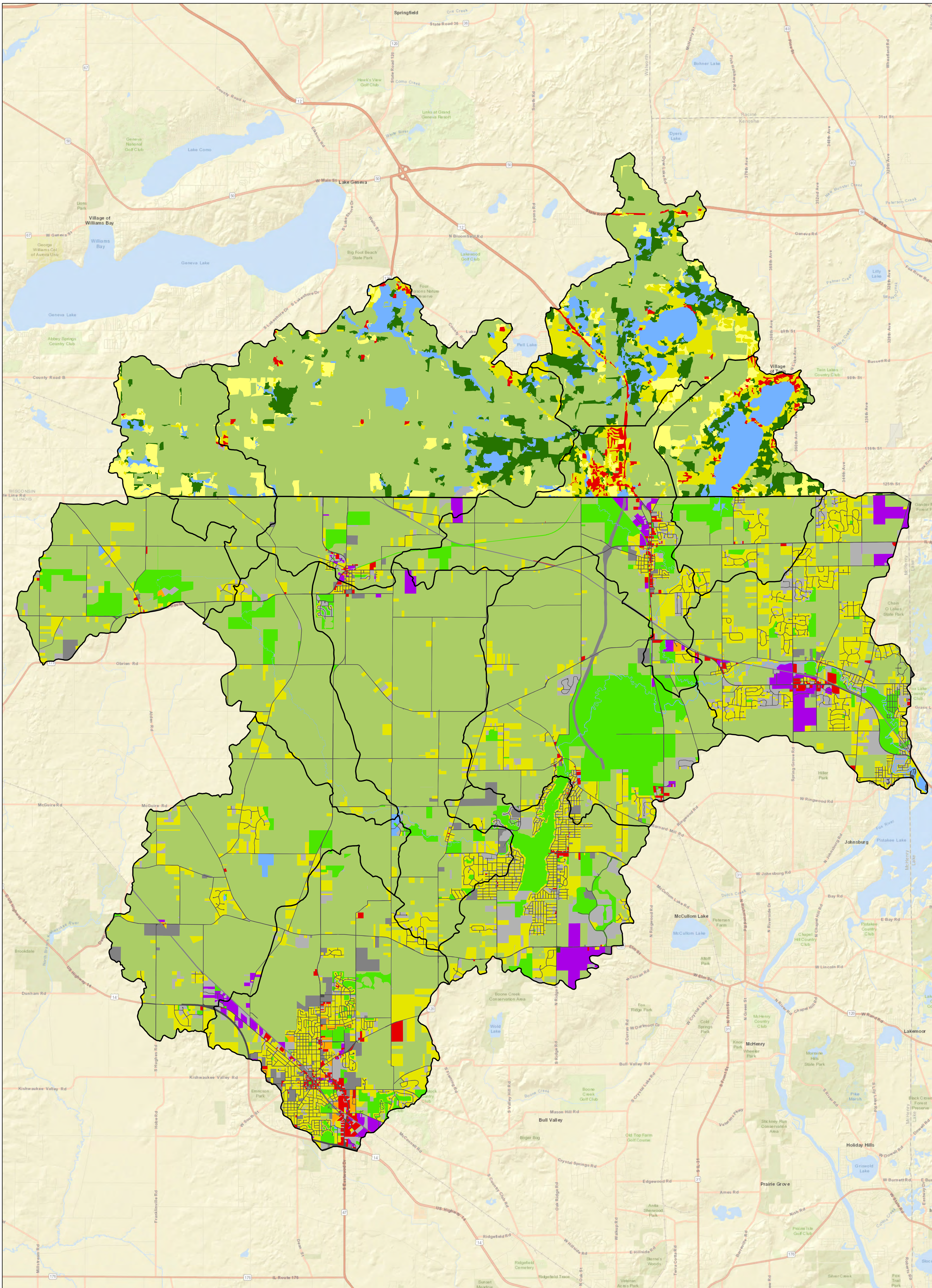
Data from USDA CDL 2012-2016

Exhibit Title:

Agricultural Analysis

Exhibit:

3.2



Scale:

0 5,000 10,000 Feet

Orientation:

Legend:

2018 Modeled Subwatersheds

Cropland	Urban, Commercial	Urban, Institutional
Pastureland	Urban, Industrial	Urban, Vacant
Forest	Urban, Multi-Family	Urban, Transportational
User Defined (Non-Contributing)	Urban, Single Family	Urban, Open Space

Project Number: 16-0424

Date: 11/7/2018

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Creek Watershed
Pollutant Loading Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

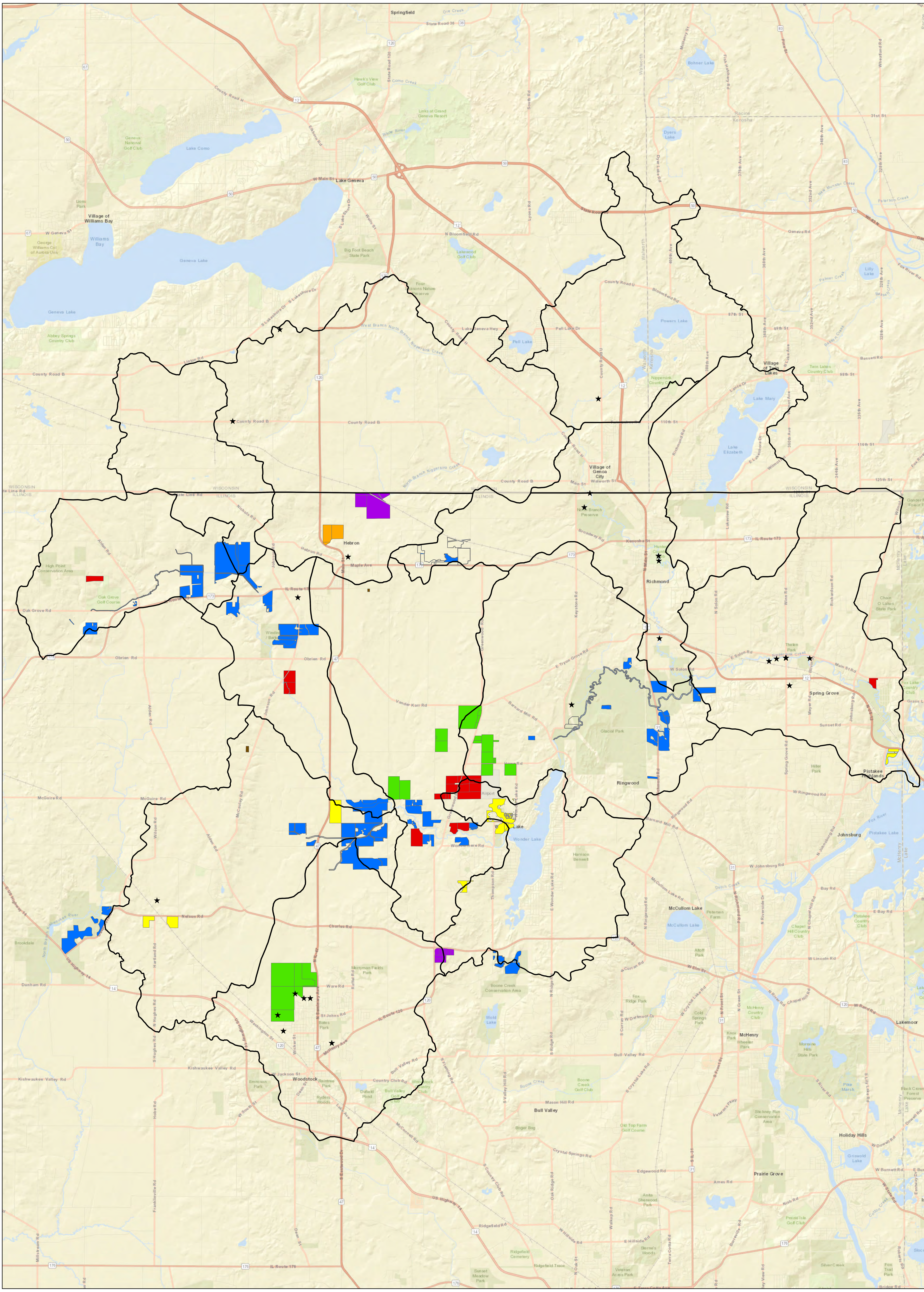
Data from McHenry Co, Lake Co, 2017
Aerial Imagery & WiscLand 2016

Exhibit Title:

Modeled Land Uses

Exhibit:

3.3



Scale:

0 5,000 10,000 Feet

Orientation:

Legend:

- 2018 Modeled Subwatersheds
- ★ WATERS Data: Any Effective Permits
- MCCD Leased Lands
- Presence of Cows
- Known Dairy Operation
- Presence of Horses
- Land Applicaiton of Nutrients
- Nursery/Orchard
- Known Other Large Agricultural Operations

Project Number: 16-0424

Date: 11/13/2018

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Creek Watershed
Pollutant Loading Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

Data from 8/28/2018 Meeting, MCCD, and EPA's WATERS Mapper

Exhibit Title:

Points of Interest

Exhibit:

3.4

Appendix 21.2

Detailed Pollutant Loads

Appendix 21.2 Detailed Pollutant Loads

THE LOWER NIPPERSINK CREEK SUBWATERSHED (1)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	32566.75	5169.14	114650.76	775.03
Cropland	37090.05	9025.88	79782.10	1847.26
Pastureland	73.46	7.90	234.77	0.99
Forest	2.83	1.71	6.63	0.29
Feedlots	2246.00	449.20	2994.67	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	3151.75	1234.44	12869.66	0.00
Streambank	652.65	538.43	1305.30	479.89
Total	75783.50	16426.70	211843.88	3103.46

THE GLACIAL PARK/TAMARACK FARMS SUBWATERSHED (2)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	15539.30	2260.87	52005.20	363.12
Cropland	57657.62	13931.42	124049.57	2826.65
Pastureland	0.00	0.00	0.00	0.00
Forest	0.00	0.00	0.00	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	786.47	308.03	3211.42	0.00
Streambank	285.62	235.64	571.25	210.02
Total	74269.01	16735.96	179837.44	3399.79

THE WONDER LAKE SUBWATERSHED (3)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	21202.79	3235.57	72172.15	502.98
Cropland	19073.41	4840.09	40976.05	1039.63
Pastureland	0.00	0.00	0.00	0.00
Forest	1.04	0.64	2.43	0.11
Feedlots	2874.88	574.98	3833.17	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	2175.40	852.03	8882.88	0.00
Streambank	984.61	812.30	1969.22	723.98
Total	46312.12	10315.61	127835.89	2266.69

THE VANDER KARR CREEK SUBWATERSHED (4)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	10743.19	1744.84	37056.72	257.82
Cropland	75548.05	18345.71	162516.81	3745.07
Pastureland	0.00	0.00	0.00	0.00
Forest	0.30	0.18	0.71	0.03
Feedlots	2785.04	557.01	3713.38	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	434.33	170.11	1773.53	0.00
Streambank	676.87	558.42	1353.75	497.70
Total	90187.79	21376.28	206414.89	4500.62

THE SILVER CREEK SUBWATERSHED (5)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	42034.69	6673.44	158230.24	965.76
Cropland	74350.09	14718.23	160806.22	2178.76
Pastureland	0.00	0.00	0.00	0.00
Forest	0.00	0.00	0.00	0.00
Feedlots	1329.63	265.93	1772.84	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	942.78	369.26	3849.69	0.00
Streambank	1146.84	946.14	2293.67	843.26
Total	119804.03	22972.98	326952.67	3987.79

THE SLOUGH CREEK SUBWATERSHED (6)				
Land Use Source	**N Load (lbs/year)**	**P Load (lbs/year)**	**BOD Load (lbs/year)**	**Sediment Load (tons/year)**
Urban	14986.28	2475.75	56490.86	349.00
Cropland	127701.00	25196.65	276216.39	3704.74
Pastureland	0.00	0.00	0.00	0.00
Forest	0.00	0.00	0.00	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	557.97	218.54	2278.38	0.00
Streambank	1751.47	1444.97	3502.95	1287.85
Total	144996.73	29335.90	338488.59	5341.59

THE BAILEY WOODS: UPPER BAILEY WOODS CARVER CREEK SUBWATERSHED (7A)				
LAND USE SOURCE	**N LOAD (LBS/YEAR)**	**P LOAD (LBS/YEAR)**	**BOD LOAD (LBS/YEAR)**	**SEDIMENT LOAD (TONS/YEAR)**
Urban	423.84	71.63	1425.77	10.36
Cropland	9218.87	2904.38	19658.50	757.66
Pastureland	0.57	0.08	1.81	0.01
Forest	0.00	0.00	0.00	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	27.98	10.96	114.25	0.00
Streambank	163.93	135.24	327.86	120.54
Total	9835.19	3122.29	21528.19	888.57

THE BALEY WOODS: LOWER BAILEY WOODS SUBWATERSHED (7B)				
LAND USE SOURCE	**N LOAD (LBS/YEAR)**	**P LOAD (LBS/YEAR)**	**BOD LOAD (LBS/YEAR)**	**SEDIMENT LOAD (TONS/YEAR)**
Urban	2972.01	465.30	9777.10	72.05
Cropland	34957.53	9606.54	74909.43	2237.68
Pastureland	0.00	0.00	0.00	0.00
Forest	0.00	0.00	0.00	0.00
Feedlots	1308.62	261.72	1744.82	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	156.68	61.37	639.80	0.00
Streambank	123.38	101.79	246.77	90.72
Total	39518.22	10496.73	87317.92	2400.46

THE NIPPERSINK CREEK HEADWATERS SUBWATERSHED (8)				
LAND USE SOURCE	**N LOAD (LBS/YEAR)**	**P LOAD (LBS/YEAR)**	**BOD LOAD (LBS/YEAR)**	**SEDIMENT LOAD (TONS/YEAR)**
Urban	4938.82	751.32	16600.07	116.93
Cropland	33953.12	9246.05	72779.04	2135.24
Pastureland	27.68	3.26	88.00	0.49
Forest	0.00	0.00	0.00	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	278.55	109.10	1137.41	0.00
Streambank	1028.06	848.15	2056.11	755.92
Total	40226.22	10957.87	92660.63	3008.59

THE ZENDA HEADWATERS SUBWATERSHED (9)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	155.48	24.47	678.15	3.43
Cropland	13075.74	5244.11	28803.92	1610.30
Pastureland	2259.09	223.53	7251.89	22.54
Forest	20.96	12.40	49.45	1.84
Feedlots	2457.57	491.51	3276.76	0.00
User Defined	6.90	5.69	13.80	2.16
Septic	124.35	48.70	507.77	0.00
Streambank	826.32	681.71	1652.63	607.59
Total	18926.41	6732.13	42234.37	2247.85

THE NORTH BRANCH NIPPERSINK CREEK SUBWATERSHED (10)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	9743.11	1491.68	34131.17	227.03
Cropland	26861.20	7307.77	57579.23	1686.07
Pastureland	30.82	3.63	97.98	0.55
Forest	0.40	0.22	0.96	0.02
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	324.22	126.99	1323.89	0.00
Streambank	293.42	242.07	586.83	215.75
Total	37253.16	9172.35	93720.07	2129.41

THE LOWER ELIZABETH LAKE DRAIN SUBWATERSHED (11)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	5513.07	867.38	20131.68	129.84
Cropland	21648.23	4962.53	46645.50	940.18
Pastureland	4.22	0.42	13.52	0.05
Forest	0.07	0.04	0.16	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	339.86	133.11	1387.75	0.00
Streambank	579.89	478.41	1159.78	426.39
Total	28085.33	6441.88	69338.39	1496.45

THE UPPER NORTH BRANCH NIPPERSINK CREEK SUBWATERSHED (12/13A/13B)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	8084.71	1205.08	37074.47	170.90
Cropland	19898.53	7524.29	44052.44	2202.36
Pastureland	4544.51	421.94	14634.50	33.79
Forest	333.54	191.13	796.38	23.42
Feedlots	0.00	0.00	0.00	0.00
User Defined	84.76	69.92	169.51	26.49
Septic	310.88	121.76	1269.44	0.00
Streambank	2067.04	1705.31	4134.08	1519.88
Total	35323.97	11239.43	102130.82	3976.85

THE UPPER NORTH BRANCH NIPPERSINK CREEK: WEST BRANCH SUBWATERSHED (13C)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	1601.97	241.86	7177.62	34.39
Cropland	47738.89	15817.08	100503.60	4035.32
Pastureland	2506.67	232.82	8071.98	18.68
Forest	196.88	112.84	470.06	13.85
Feedlots	0.00	0.00	0.00	0.00
User Defined	33.74	27.83	67.47	10.54
Septic	124.35	48.70	507.77	0.00
Streambank	1404.99	1159.12	2809.99	1033.08
Total	53607.49	17640.26	119608.49	5145.87

THE HEBRON PEATLANDS SUBWATERSHED (14)				
LAND USE SOURCE	N LOAD (LBS/YEAR)	P LOAD (LBS/YEAR)	BOD LOAD (LBS/YEAR)	SEDIMENT LOAD (TONS/YEAR)
Urban	5626.71	882.46	20252.01	131.41
Cropland	31798.61	7178.81	68545.26	1331.08
Pastureland	2.09	0.21	6.71	0.02
Forest	0.00	0.00	0.00	0.00
Feedlots	0.00	0.00	0.00	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	169.90	66.54	693.75	0.00
Streambank	535.58	441.85	1071.15	393.81
Total	38132.88	8569.87	90568.87	1856.32

Appendix 21.5

Digital STEPL Spreadsheets

Appendix 21.6

Digital Geodatabase

Appendix 21.7

Meeting Minutes

TOPIC:	Nippersink Watershed Pollutant Loading Analysis Approach	☐	**PHONE CALL**
DATE:	June 22, 2017	☐	**SITE VISIT**
STAFF:	Kirsten James, Dave Kraft	☒	**MEETING**
WITH:	Andrew Craig (WDNR), Brian Smetana (Walworth County)	☐	**OTHER**

Hey lead with reintroduction of project goals and summary of meeting specific goals, which included:

- Summarizing and understanding the WDNR approach to STEPL modeling utilizing available cropland data and SnapPlus
- Discussing the state line watersheds and how best to break them down
- Discussing available Illinois data and congruency with Wisconsin approach
- Discussing watershed based practices for use in STEPL modeling and overall report

The following items were discussed in detail:

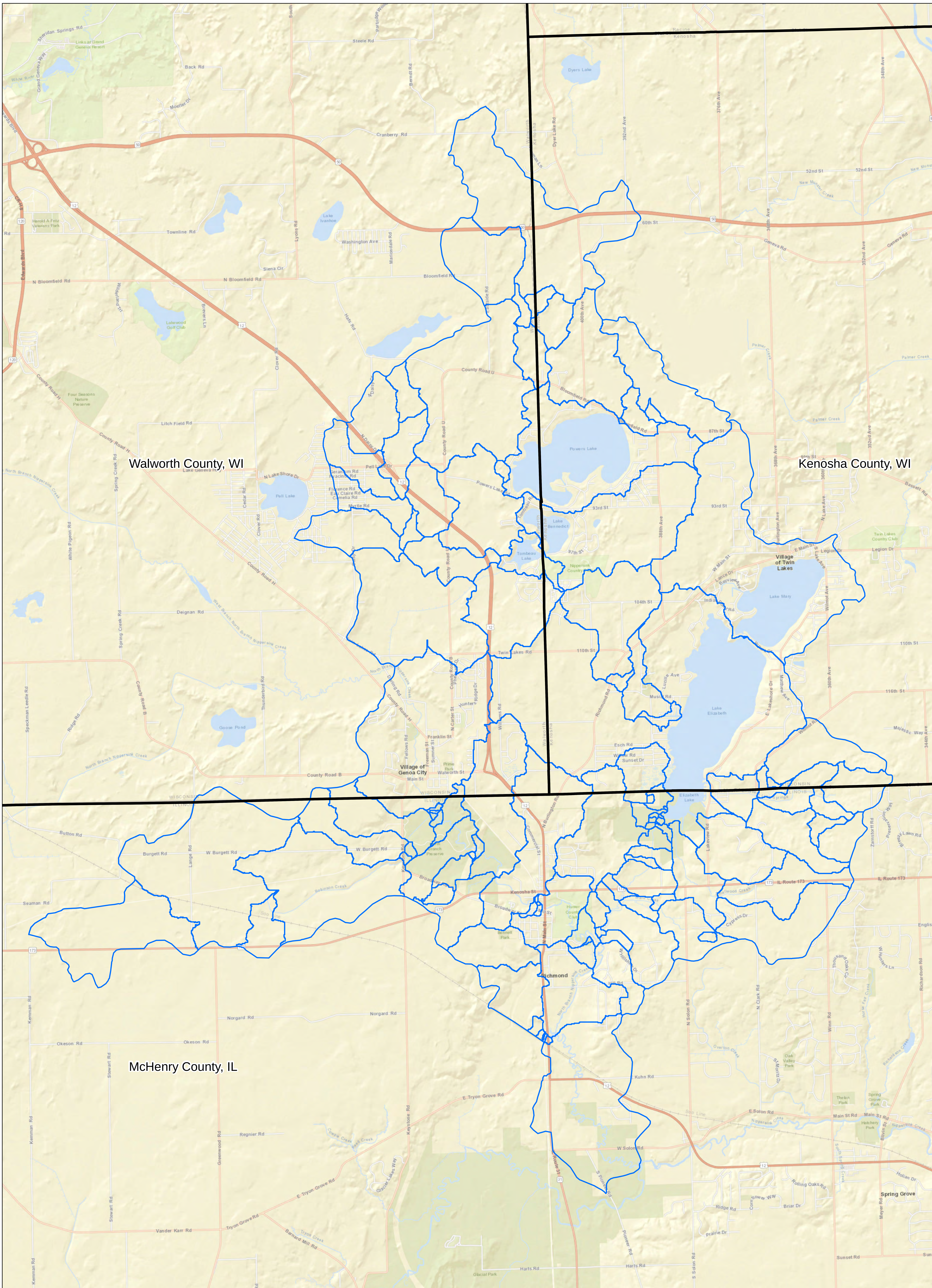
- Subwatershed boundaries discussion
  - Use HUC12s or 2008 Nippersink study boundaries (loosely based on HUC12 boundaries)?
    - Generally stay with HUC12, Illinois subwatersheds can be further divided based on NWA preferences
  - How do we split up the three HUC12s that straddle state boundaries?
    - Potentially split western straddling watershed (HUC 071200060903) due to differences in agricultural land use distribution, roughly along state boundary
    - Potentially combine central straddling watershed (HUC 071200060801) due to similarities in agricultural land use distribution
    - Look into topography, MS4, municipal, and HUC16 boundaries (see attached exhibit) for eastern straddling watershed (HUC 071200060802)

- SnapPlus integration into STEPL
  - Input of representative combinations of soil/agricultural practices in SnapPlus to generate targeted efficiencies to further refine baseline efficiencies in STEPL
  - Create baseline existing conditions analysis using available information on practices being employed. Create proposed analysis by including targeted practices based upon watershed assessment, including practicality of implementation
  - Assume some percent of practices are being implemented for existing NMPs
  - Site specific soil test information is not critical to produce estimated efficiencies in SnapPlus
    - Choose common field and soil combinations, input a sample soil test, extrapolate to other like field/soil combinations
  - Not all sites with NMPs are implementing all the practices, some practices are more likely to be used than others
    - No till, cover crops, buffers (most likely for implementation)
  - Gulley and streambank erosion estimation
    - Field/aerial analysis
    - Categorize into approximate small, medium, and large size categories

        - Use LiDAR based EVAAL to estimate locations of gulleys (culvert location input is necessary)
        - Look into grassed waterway and streambank stabilization projects
    - 2 CAFOs in Walworth County in the watershed; pull their NMPs
    - 3-4 500+ animal unit operations in Walworth County in the watershed
- Data refining
    - Further discuss the division of HUC12 state border watersheds
    - Hey has acquired 2012-2016 (5 years) of the Cropland Data Layer to use in the creation of a generalized Crop Rotation layer

- Research
    - Fenwood Creek Watershed Management Plan
    - Land Trusts
        - Wisconsin Wetland Conservation Trust
        - McHenry County
        - Gathering Waters
        - Kettle Moraine – Jackson Creek
        - Great Lakes Conservancy
    - In lieu fee program: potential funds available for in-watershed projects
    - Walworth County: will send a Shapefile of NMP Parcels (only includes parcels where NMPs are most likely being implemented, per review by Brian)
    - Reduction Targets
        - IL Draft TMDL Public Notice December 2017 – all loading decreases are assumed in IL
        - WI TP Reductions: 100µg major rivers, 75µg streams, 20-40µg lakes
        - Define realistically achievable reduction goals
    - NRCS Code 590: Nutrient Management Standards
    - 9 Element Plan

- WDNR confirmed they will perform pollutant loading analysis for WI watersheds.



Scale:

0 2,500 5,000 Feet

Orientation:

Legend:

USGS NHD HUC16 Watersheds

Conunty Boundaries

Project Number: 16-0424

Date: 6/27/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Watershed Pollutant Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

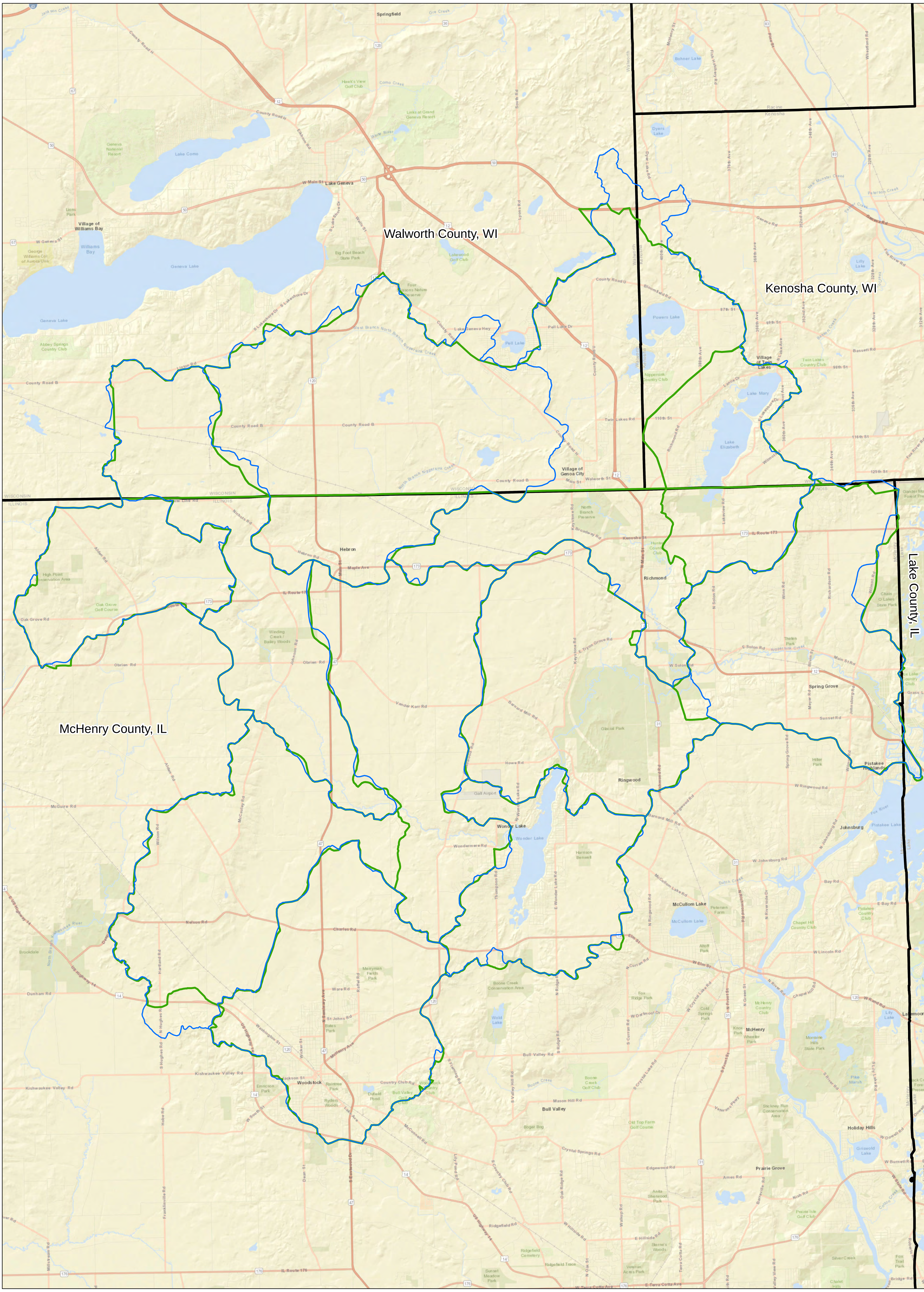
HUC 071200060802

Exhibit Title:

North Branch Nippersink Watershed

Exhibit:

3



Scale:

0 8,000 16,000
Feet

Orientation:

Legend:

USGS NHD HUC12 Watersheds

Nippersink Watershed Association Subwatersheds

Conunty Boundaries

Project Number: 16-0424

Date: 6/22/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Nippersink Watershed Association

Project Name:

Nippersink Watershed Pollutant Analysis

Prepared for:

Nippersink Watershed Association

Information about exhibit:

Comparison of HUC12 and NWA Subwatershed Boundaries

Exhibit Title:

Subwatershed Comparison

Exhibit:

2

APPENDIX B

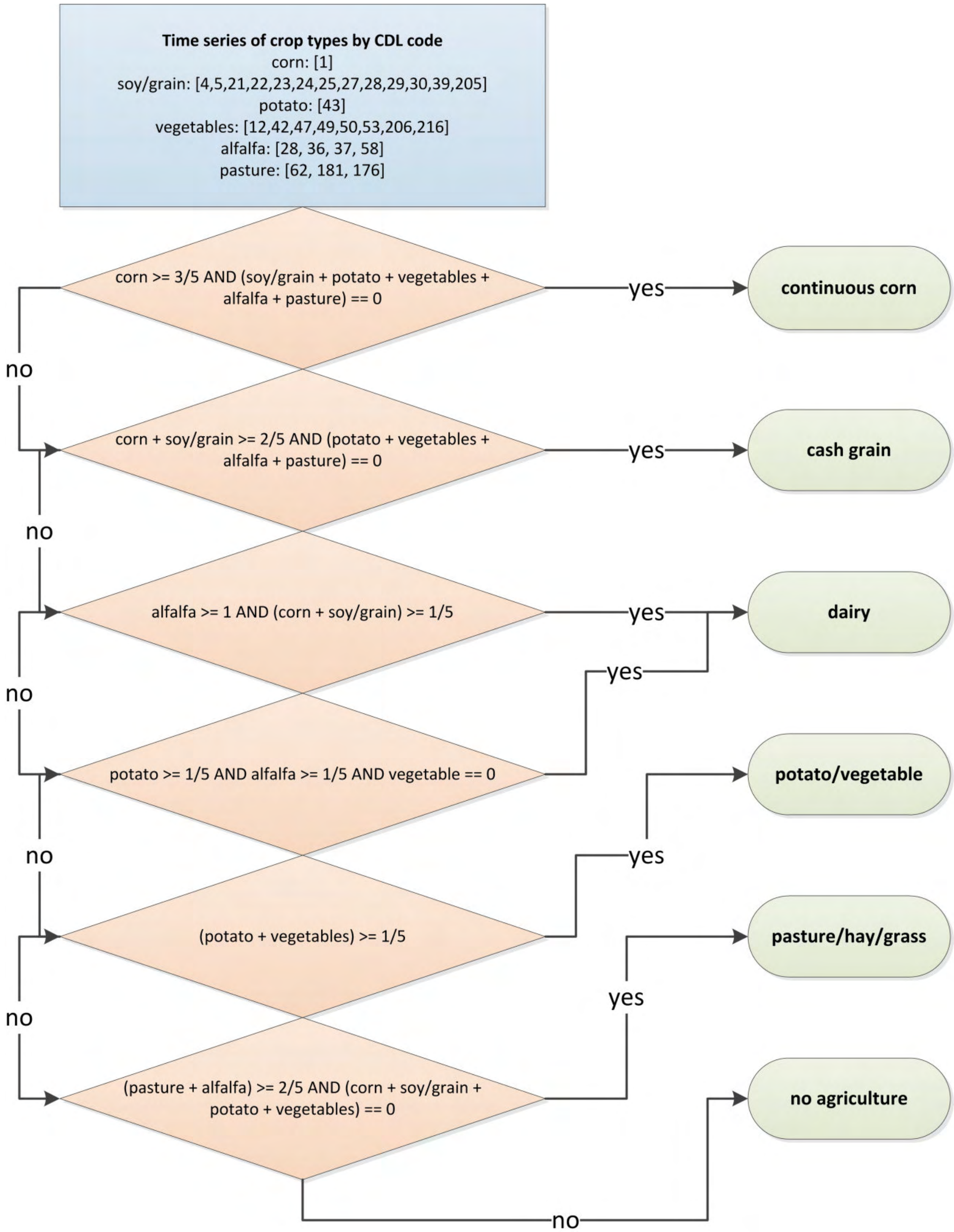


Figure B1. Decision rules for binning sequences of crops into generalized crop rotations. The input dataset are a series of raster maps called the Cropland Data Layer (CDL) that represents what crop is grown annually. Each crop was first aggregated into a crop type defined by the sets of codes in the input dataset (descriptions of CDL codes can be found in Table B2). Then, the numbers of each crop type are counted across the time series (5 years was used in the calibration dataset). Finally, the sequence of crops was binned into a generalized rotation by testing the numbers of crop types using the conditional statements above. For example, the first test, if the number of years of corn exceeded 3 out of 5 years, and there were no instances of soybeans, grain, potato, vegetable, alfalfa, or pasture, then the sequence would be binned into the "continuous corn" generalized rotation.

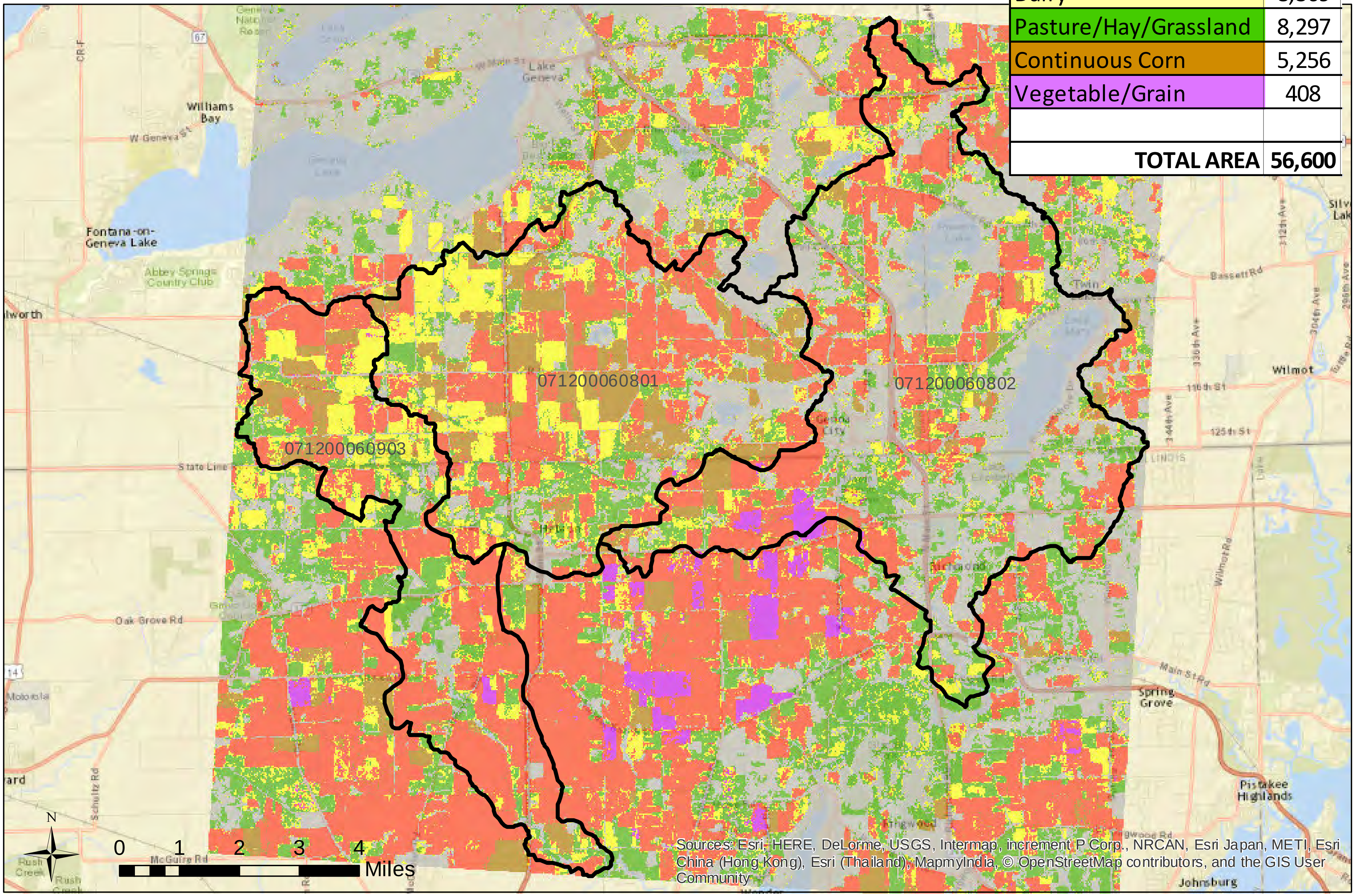
Table B1. Descriptions of codes used in the Cropland Data Layer (CDL).

CDL Code	Description
1	Corn
4	Sorghum
5	Soybeans
12	Sweet corn
21	Barley
22	Durum wheat
23	Spring wheat
24	Winter wheat
25	Other small grains
27	Rye
28	Oats
29	Millet
30	Speltz
36	Alfalfa
37	Other hay/non-alfalfa
38	Camelina
39	Buckwheat
42	Dry beans
43	Potatoes
47	Miscellaneous vegetables and fruit
49	Onions
50	Cucumbers
53	Peas
58	Clover/wildflowers
62	Pasture/grass
176	Grassland/pasture
181	Pasture/hay (deprecated in favor of class 176 for any CDL dataset downloaded after the year 2013)
205	Triticale
206	Carrots
216	Peppers

Nippersink Creek
Crop Rotation Analysis
2012 - 2016

DRAFT

ROTATION	ACRES
Cash Grain	17,714
No Agriculture	16,556
Dairy	8,369
Pasture/Hay/Grassland	8,297
Continuous Corn	5,256
Vegetable/Grain	408
TOTAL AREA	56,600



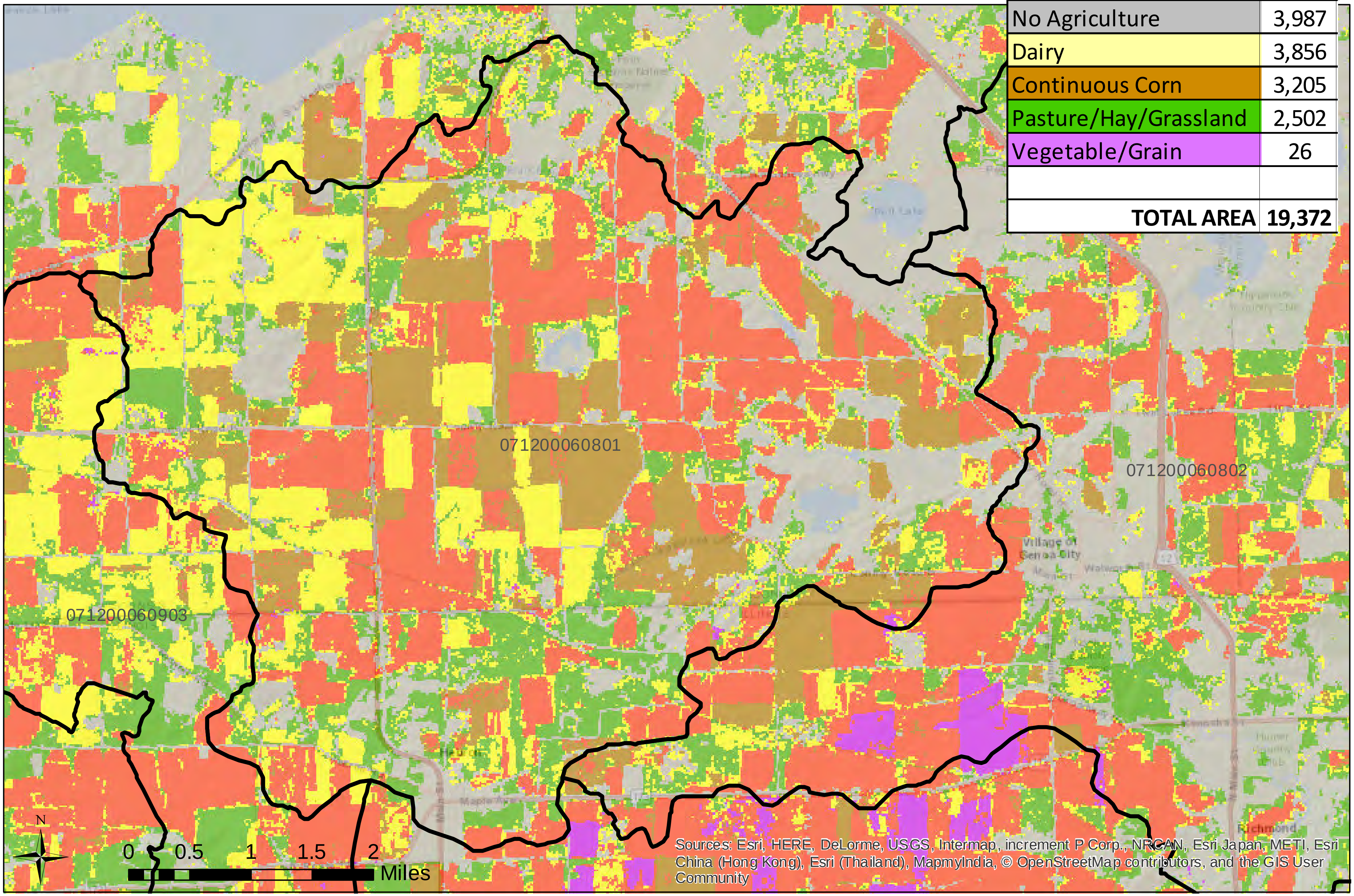
THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 06/07/2017

West Branch North Branch Nippersink Creek - HUC 071200060801
Crop Rotation Analysis
2012 - 2016

DRAFT

ROTATION	ACRES
Cash Grain	5,795
No Agriculture	3,987
Dairy	3,856
Continuous Corn	3,205
Pasture/Hay/Grassland	2,502
Vegetable/Grain	26
TOTAL AREA	19,372

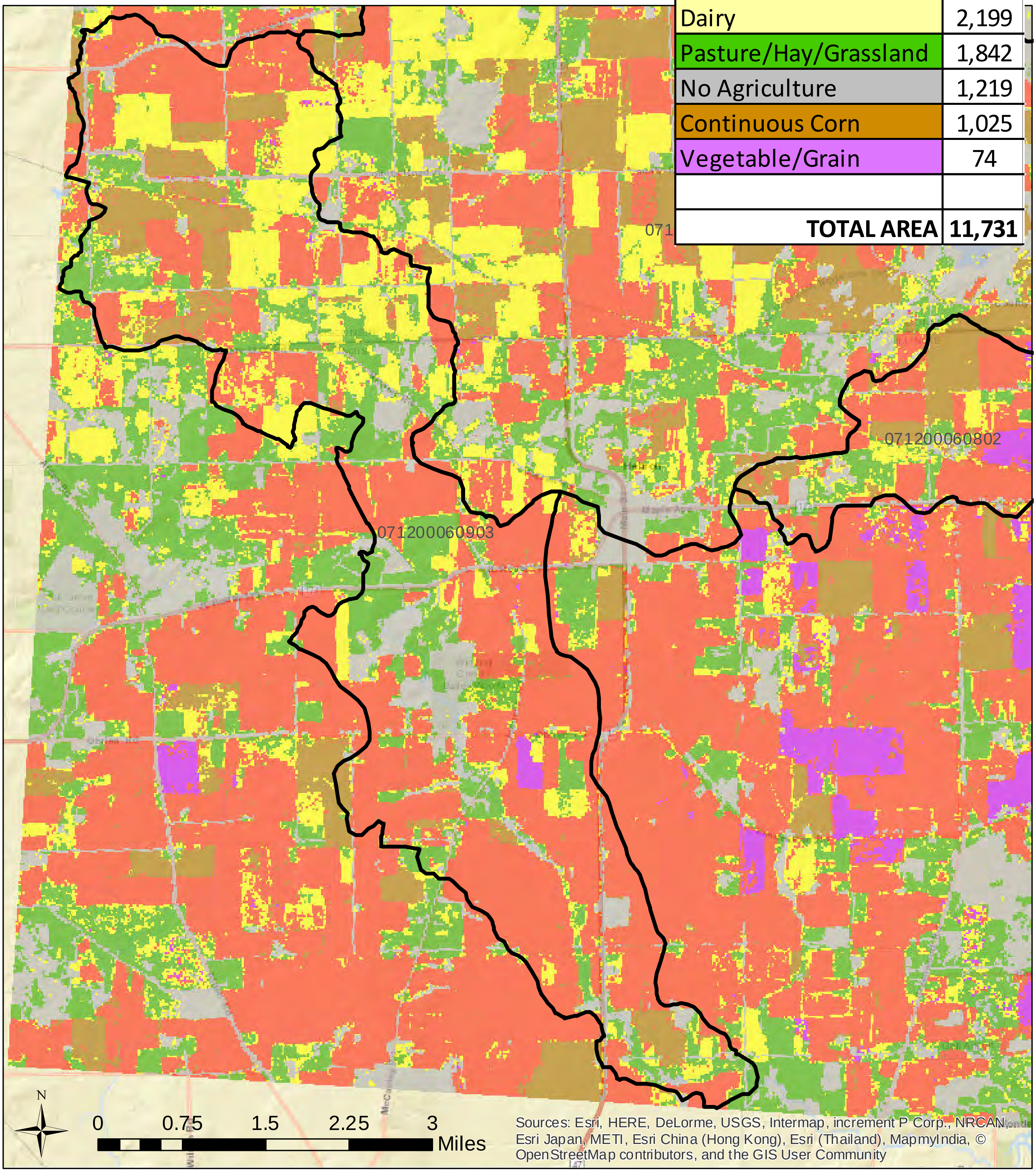


THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED. WDNR 06/07/2017

Headwaters Nippersink Creek - HUC 071200060903
Crop Rotation Analysis
2012 - 2016

DRAFT

ROTATION	ACRES
Cash Grain	5,373
Dairy	2,199
Pasture/Hay/Grassland	1,842
No Agriculture	1,219
Continuous Corn	1,025
Vegetable/Grain	74
TOTAL AREA	11,731



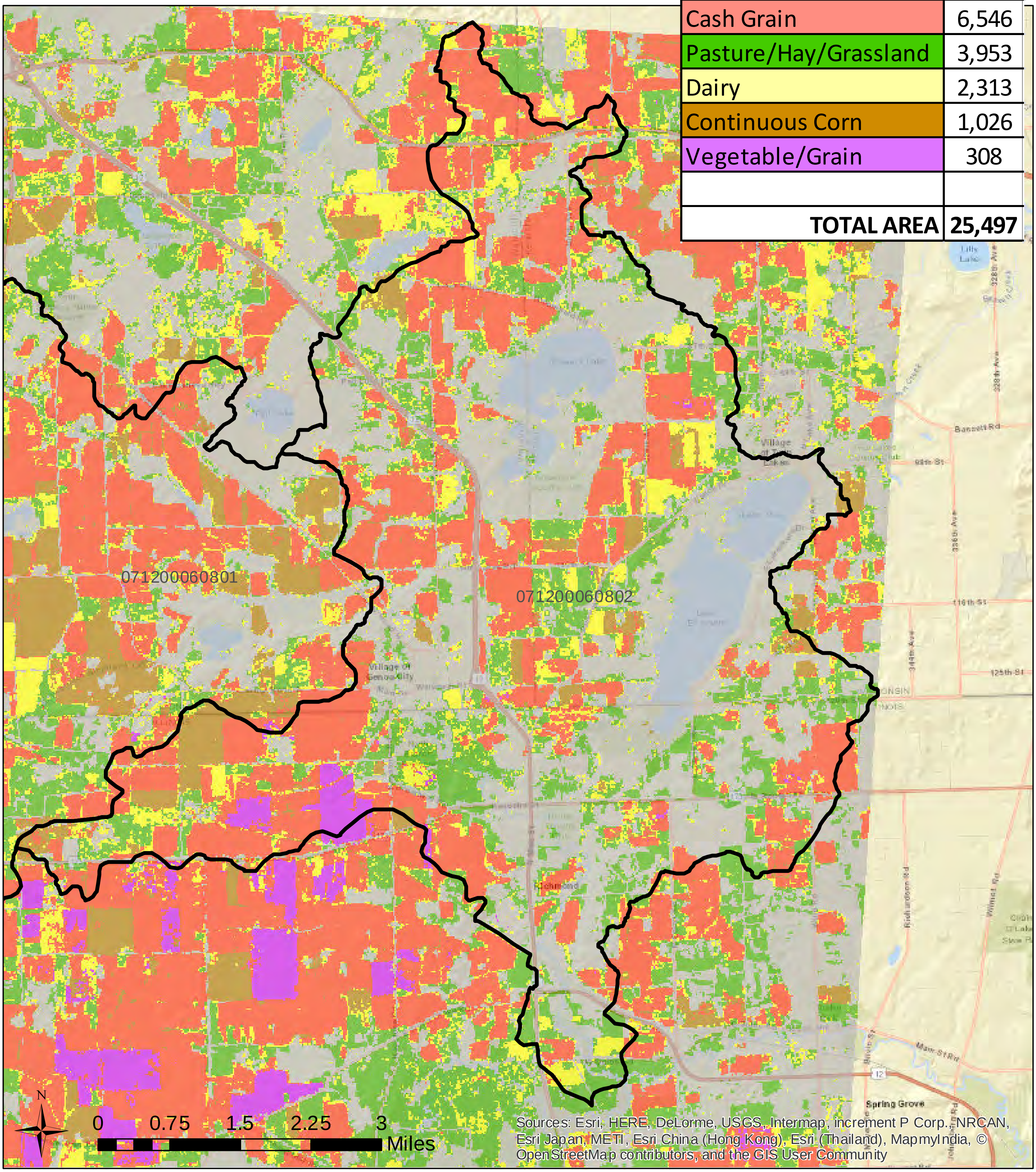
THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 06/07/2017

North Branch Nippersink Creek - HUC 071200060802
Crop Rotation Analysis
2012 - 2016

DRAFT

ROTATION	ACRES
No Agriculture	11,350
Cash Grain	6,546
Pasture/Hay/Grassland	3,953
Dairy	2,313
Continuous Corn	1,026
Vegetable/Grain	308
TOTAL AREA	25,497



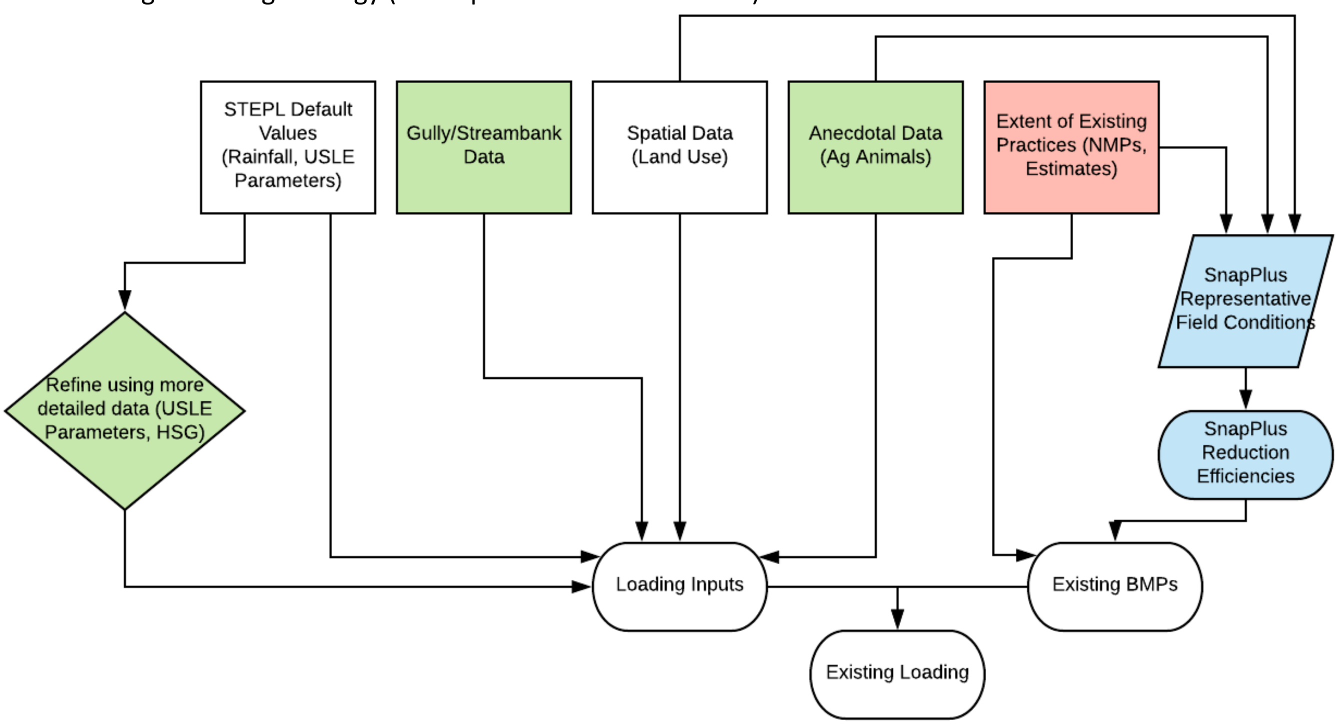
THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 06/07/2017

TOPIC:	Nippersink Watershed Pollutant Loading Analysis Approach	☐	**PHONE CALL**
DATE:	June 21, 2018	☐	**SITE VISIT**
STAFF:	Kirsten James, Dave Kraft	☒	**MEETING**
WITH:	Andrew Craig (WDNR), Brian Smetana (Walworth Co LURM), Fay Amerson (Walworth Co LURM), Shannon Haydin (Walworth Co LURM)	☐	**OTHER**

Hey led with a reintroduction of project goals, specific meeting goals, and a review of the conceptual modeling framework, which included:

- Create an existing conditions pollutant loading model of the Nippersink Creek Watershed spanning both WI and IL. Hey intends to strategize IL modeling to best reflect the WI modeling efforts. Modeling strategy for IL will vary from WI methods where available data deems necessary.
- Update
- Finalizing Modeling Strategy (Conceptual model framework)



  - Discuss/confirm some of the variables used in STEPL (Green)
  - Discuss watershed based practices for use in STEPL modeling and overall report (Red)
    - Estimate extent of current practices in watersheds (cropland, pasture, urban)
  - Adjust STEPL pollutant reduction efficiencies for cropland and pastureland using SnapPlus representative field conditions runs (Blue)

The following items were discussed in detail:

Update

- State line breakdown of watersheds (see attachment)
  - Watersheds are derived from the HUC12s, the NWA basins, the state line, and WDNR catchments.

- Hey has confirmed with the NWA that these are the intended subwatersheds to be used in the Nippersink Creek Watershed report update.
- WDNR will be providing modeling for:
  - Zenda Headwaters (WI portion of HUC 903)
  - Upper North Branch Nippersink Creek: West Branch (WI portion of HUC 801)
  - Upper North Branch Nippersink Creek: Powers, Benedict, and Tombeau Lakes, Upper North Branch Nippersink Creek: Genoa City, and Elizabeth Lake (WI portion of HUC 802)
    - These three subwatersheds may be grouped together for modeling. Input data has been and will be calculated for the three individual subwatersheds where possible to provide for future efforts.

Finalizing Modeling Strategy

- WI Land Use Inputs – relatively complete, refining as necessary (Green)
  - User Defined Land Use
    - This is a "catch-all" for land uses that we know aren't largely contributing to pollutant loading. Select appropriate RCNs that represent an average for the land uses encompassed by this category (wetlands, shrub, meadow, etc.).
  - Feedlots
    - Acreage should be estimated based upon anecdotal information
      - Estimate total number of feedlots, calculate acreage for each, use anecdotal evidence to determine problem areas
    - Brian: There are 2 CAFOS that don't have feedlots, 6-12 feedlots in the WI watershed, +/- 2 of these feedlots are problem areas. Generally, there are no major feedlot issues.
    - Andrew: This isn't a relatively large contributing factor to the overall pollutant load in the STEPL model. Effort to estimate watershed conditions should not be in excess.
  - Ag Animals/AFOs
    - Brian has already provided some estimates in his 1/12/2018 email
      - 903: 1700 dairy cattle in AU. No beef or hogs. Use 1.4 AU per cow.
      - 801: 6000 dairy cattle in AU, 1400 hogs in AU, and 400 goats in number of goats. No beef. Use 0.4 AU per hog.
      - 802: Brian not aware of any animals
      - It appears that there may be a couple of horse operations in the watershed based upon google maps, but no record.
    - Manure spread
      - Ensure we don't over represent/double count this. Quantify acres with and without manure application.
      - Brian: 6 farms with 500AU, 10,000gal/acre annually
  - Septic System/Illegal Wastewater
    - What data is available? Health Department? Parcel Data?
    - Agree that using default population per septic system and failure rate is probably sufficient for this application.
    - Andrew: This isn't a relatively large contributing factor to the overall pollutant load in the STEPL model. Effort to estimate watershed conditions should not be in excess.
  - Refine USLE
    - Values discussed in December 2017/January 2018 are relatively refined already.
    - Andrew: The county average C value for cropland is 0.25. Brian estimates the value is probably more around 0.20 for this portion of the county.
  - Refine HSG

        - User defined RCN should be adjusted to represent appropriate values for "catch-all" land use category.
    - Urban Area w/ Storm Sewers? A percentage of total? All?
        - See MS4 discussion
    - Any other optional data?
        - Review soil P concentration 0.066%
        - Refine as data is available
    - Locational points of interest (ie. Large farms, agricultural animals, non-compliant polluters) (can complete last with Brian)
- WI Gully and Streambank Erosion Estimation Inputs (Green)
    - On a large scale – gullys and streambanks are a small "slice of the pie" in this model
    - EVAAL has not been completed for the Nippersink watersheds
    - Potential GIS investigation using elevation and slope data, fields, and slope length
        - Using EVAAL-like methods?
        - Aerial review, Representative fields, field verification, extrapolate
    - NWA has a good feel of problem streambanks in McHenry Co.
- WI Current BMP Evaluation (Cropland/pastureland/urban)
    - Create baseline existing conditions analysis using available information
        - Proposed BMP analysis is not part of current Hey scope
        - No TMDL has been completed for the Nippersink Creek watershed
        - Use similar Rock River basins in their TMDL to approximate water quality goals
    - Discuss watershed based practices for use in STEPL modeling and overall report (see table below)
        - Urban
            - Hey will further research how this was handled in the previous Nippersink Watershed Plan, how some 9-Element plans are incorporating this data, and discuss with NWA as to how they would like to approach this. Further coordination and investigation into the existing MS4 permits is needed.
                - Potentially eliminate MS4 areas from the STEPL model and include the specific MS4 modeling and loads outside of the STEPL model.
        - Pastureland
            - Pastureland not prevalent in the WI areas of the watershed. BMPs will not be looked at in detail.
            - IL may have more pastureland areas that may need more detailed analysis of existing practices. Hey will meet with the McHenry County farm experts and decide what may be the logical next steps.
        - Cropland
            - Steps: 1) What practices are in the watershed? Largely anecdotal estimations by Brian and McHenry farm staff/ NWA 2) Estimate acres implementing specific BMPs or combined BMPs (don't double count). 3) Calculate composited efficiencies for combined BMPs for a few combined BMP options
            - We must estimate what's practically happening in the watershed. Brian – 15% of NMPs are not implemented consistently. Brian – assume 80 implementation/20 non-implementation.
            - Brian: 20-25% of dairy uses a cover crop + NMP combination. 20% of the total non-dairy cropland uses tillage 1, 50% of the total non-dairy cropland uses tillage 2.
            - Review STEPL list of BMPs and reduction efficiencies
                - STEPL default values are national averages
                - Andrew will send an example SnapPlus analysis for review

- Use SnapPlus to refine percent reduction values for representative fields
  - Finalize more existing data prior to creating SnapPlus runs.
- Potentially use NDTI (Landsat data) to estimate cropping patterns/residue – WI Land and Water webinar

Landuse	BMP & Efficiency	N	P	BOD	Sediment	E. coli
Cropland	Bioreactor	0.453	ND	ND	ND	ND
Cropland	Buffer - Forest (100ft wide)	0.478	0.465	ND	0.586	ND
Cropland	Buffer - Grass (35ft wide)	0.338	0.435	ND	0.533	ND
Cropland	Combined BMPs-Calculated	0	0	0	0	0
Cropland	Conservation Tillage 1 (30-59% Residue)	0.15	0.356	ND	0.403	ND
Cropland	Conservation Tillage 2 (equal or more than 60% Residue)	0.25	0.687	ND	0.77	ND
Cropland	Contour Farming	0.279	0.398	ND	0.341	ND
Cropland	Controlled Drainage	0.388	0.35	ND	ND	ND
Cropland	Cover Crop 1 (Group A Commodity) (High Till only for Sediment)	0.008	ND	ND	ND	ND
Cropland	Cover Crop 2 (Group A Traditional Normal Planting Time) (High Till only for TP and Sediment)	0.196	0.07	ND	0.1	ND
Cropland	Cover Crop 3 (Group A Traditional Early Planting Time) (High Till only for TP and Sediment)	0.204	0.15	ND	0.2	ND
Cropland	Land Retirement	0.898	0.808	ND	0.95	ND
Cropland	Nutrient Management 1 (Determined Rate)	0.154	0.45	ND	ND	ND
Cropland	Nutrient Management 2 (Determined Rate Plus Additional Considerations)	0.247	0.56	ND	ND	ND
Cropland	Streambank Stabilization and Fencing	0.75	0.75	ND	0.75	ND
Cropland	Terrace	0.253	0.308	ND	0.4	ND
Cropland	Two-Stage Ditch	0.12	0.28	ND	ND	ND

Attachments:

Nippersink Creek Watershed, HUCs -801, -802, -903 refinement exhibit
HUCs -801, -802, -903 Crop Rotation Analysis
Andrew's Follow-Up Email 06-21-2018

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Scale:

0 5,000 10,000 Feet

Project Number: 16-0424

Orientation:

Date: 6/6/2018

Legend:

- Wisconsin HUC12 derived watershed units
- Other watershed units
- Conunty Boundaries

Note: These watershed units are intended to be individual analysis basins for the STEPL modeling. These units were derived from the NWA basins, HUC12 basins, county and state boundaries, waterway confluences, and SWDV catchments.

Project Name:

Nippersink Watershed Pollutant Loading Analysis

Prepared For:

Nippersink Watershed Association

Information about exhibit:

Nippersink Creek Subwatersheds

Exhibit Title:

Subwatershed Boundaries

Exhibit:

1

Nippersink Creek
Crop Rotation Analysis
2012 - 2016

DRAFT

ROTATION	ACRES
Cash Grain	17,714
No Agriculture	16,556
Dairy	8,369
Pasture/Hay/Grassland	8,297
Continuous Corn	5,256
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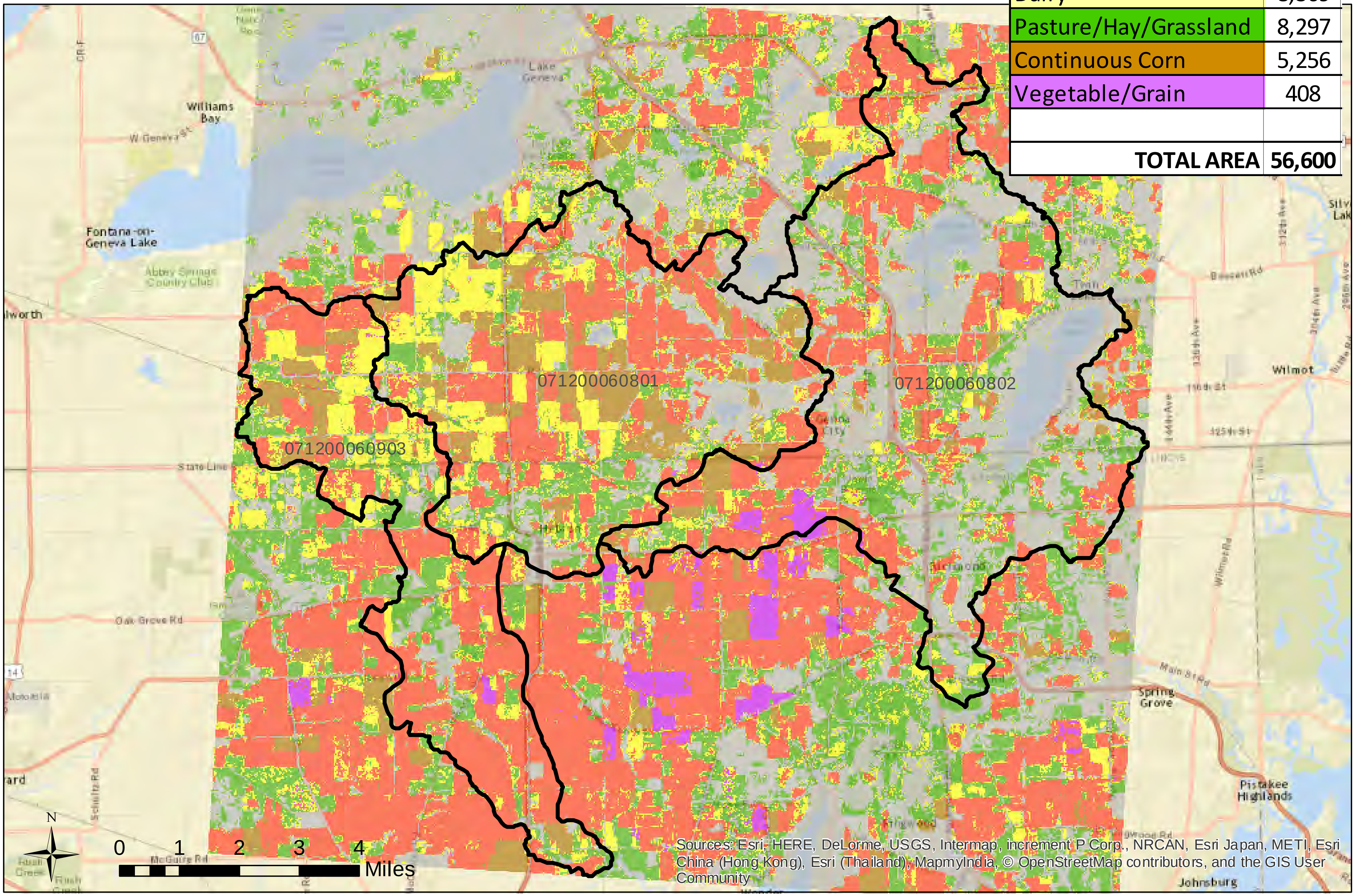
TOTAL AREA	56,600



THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 06/07/2017

Follow up to Nippersink Watershed Modeling meeting - June 21st

Craig, Andrew D - DNR <Andrew.Craig@wisconsin.gov>

Thu 6/21/2018 2:48 PM

To: Kirsten James <kjames@heyassoc.com>; Smetana, Brian <bsmetana@co.walworth.wi.us>;

Cc: Dave Kraft <dkraft@heyassoc.com>; Creegan, Lisa J - DNR <Lisa.Creegan@wisconsin.gov>; rjstowe@gmail.com <rjstowe@gmail.com>;

1 attachments (4 MB)

Nippersink_Crop_Rotations.zip;

Kirsten, Dave and others:

Thanks for attending the Nippersink Creek 9E plan meeting this AM. We were able to clarify methods and STEPL data inputs to define current/baseline conditions for multiple HUC 12 watersheds in Wisconsin and, with additional inputs, Illinois.

Summary of STEPL practices discussion:

- Andrew will work with Brian Smetana to update STEPL file to define current/baseline conditions
- Brian will provide estimate, by HUC 12, total number of feedlots, average feedlot size (acres) and number of feedlots contributing/causing discharges to surface waters.
- Andrew will use the attached watershed/crop rotation maps to populate STEPL landuse inputs and also for setting BMP baseline inputs
- Cropland practices – for each HUC 12
  - Appx 80% of cropland acres with documented NMP are consistently implemented.
    - HUC 801 = 4,200 total acres * 80% = 3,360 acres NMP1 (rate only)
    - HUC 802 = ?? Brian, please provide estimate, your prior emails (below) only describe animal numbers
    - HUC 903 = 2,400 total acres * 80% = 1,920 acres NMP 1 (rate only)
  - 20% of total dairy acres have combo of NMP1 (rate only)/NMP2 + cover crop 2
  - 20% of non-dairy acres implement Conservation Tillage 2 (> 60% residue)
  - 50% of non-dairy acres implement Conserve Tillage 1 (30-59% residue)
- Goal is to complete modeling STEPL baseline conditions by end of summer 2018

Brian – couple follow up questions:

1. Please provide estimate of total documented NMP acres within HUC 802.
2. What type of NMP is implemented - NMP 1 (rate only) or NMP2 (rate + other considerations)? I don't recall confirming this today.
3. HUC 903 (see attached maps) has very little dairy acres and is > 85% cash grain acres on Illinois side. Should the conservation tillage practices above apply to this part of watershed or not? You may need to talk to Kirsten/Randy about this – as they are going to be talking to some farmers in those watersheds this summer. Your call.

Andrew Craig
Phone: (608) 267-7695
Andrew.Craig@wisconsin.gov

From: Kirsten James [mailto:kjames@heyassoc.com]
Sent: Wednesday, June 20, 2018 1:56 PM
To: Craig, Andrew D - DNR <Andrew.Craig@wisconsin.gov>; Smetana, Brian <bsmetana@co.walworth.wi.us>
Cc: Dave Kraft <dkraft@heyassoc.com>; Creegan, Lisa J - DNR <Lisa.Creegan@wisconsin.gov>; rjstowe@gmail.com
Subject: Re: Nippersink Watershed Modeling - status check and next steps meeting - June 21st

Good Afternoon All,

As promised, I've attached an agenda for tomorrow's meeting. This document is a hybrid of a general outline and a discussion checklist. I will compile meeting minutes following our discussion tomorrow.

Thanks,

Kirsten James

Water Resource Specialist

PROJECT: Nippersink Watershed Pollutant Modeling 16-0424

TOPIC: McHenry County Watershed Land Use Discussion

DATE: August 28, 2018

STAFF: Hey and Associates, Inc. (Hey) – Dave Kraft, Kirsten James

WITH: Brad Woodson (MCCD), Gabe Powers (MCCD), Ed Weskerna (SWCD), Dave Brandt, Joanna Colletti (McHenry County), Scott Kuykendall (McHenry County), Randy Stowe (NWA)

1. Project Overview (DAK, RS, KNJ)

a. Hey is working with Randy Stowe and the Nippersink Watershed Association to complete updated water quality modeling for the Illinois portion of the Nippersink watershed. Wisconsin DNR is doing the modeling for the Wisconsin side of the watershed. The goal of the modeling is to support an updated watershed plan, that includes both states, and updates the current plan for Illinois that was done in 2008.

b. Review the watershed, focusing primarily on discussing existing agricultural properties and practices within the watershed, but also any other general input

c. Collect anecdotal information, consistent with the approach WDNR has used for recent plans related to agricultural land uses

d. For this pollutant model, we'll be using EPA's Spreadsheet Tool for Estimating Pollutant Load (STEPL). This model requires input parameters and provides regional default parameters to estimate pollutant loading. As part of this project, we will be calculating and quantifying input parameters, as well as refining default values and estimates.

2. Items Discussed

a. Agricultural

  i. Most large cropland operations can likely be assumed to have NMPs in place and are consistently implementing them. Profitability and resources associated with larger operations are large drivers of this assumption.

  ii. Agricultural operations active on MCCD leased land are held to certain standards outlined in the agreements. Standards generally reflect NRCS technical field guide Sections 1-3

    1. MCCD will provide leasing agreement conditions

      a. No fall tillage

      b. 30% residue

    2. MCCD will provide shapefile containing leased land locations

    3. MCCD will provide fence line removal shapefile

  iii. Filter strips are not widely implemented. SWCD is also seeing reduced conservation tillage efforts.

  iv. Conservation Security Program

1. Rewards farmers consistently implementing BMPs. This data is not likely available.

b. Animal Operations

i. Minimal animal operations are present in McHenry county, except for a few, more recent, very large horse farms. Known animal operations were marked on the paper exhibit and web map during the meeting.

c. Municipal

i. Hebron Drainage District

1. **Joanna will provide McDOT shapefile**

ii. Approximately 90% of incorporated areas are on municipal sewer systems.

1. Spring Grove and Johnsburg – residential and commercial are on septic

iii. Assume all unincorporated area are on septic

d. Sludge application sites

i. Health Department multi-year permits

ii. County GP for municipal application

iii. Fox Waterway Dredging storage and land application sites? – talk to Jeff Mengler

iv. Contact DNR/Health Department Connie Jensen

e. Nippersink Floodplain study - ISWS

f. Site specific:

i. Attendees added notes on the large printed map and the digital map.

3. Additional Information

a. If you would like to provide any additional information, please contact us at rjstowe@gmail.com, dkraft@heyassoc.com, or kjames@heyassoc.com.