# Appendix E

# Northeast Lakeshore TMDL

Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids

**Agricultural Surveys sent to County Land Conservation Departments**

**Brown County**

**Calumet County**

**Door County**

**Fond du Lac County**

**Kewaunee County**

**Manitowoc County**

**Ozaukee County**

**Sheboygan County**

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Brown County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 1. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name:**
**Organization:**
**Email:**
**Phone:**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?*

Potatoes are not grown in Brown County on a commercial/field scale. Snap beans and beets are occasionally grown in rotation with cash grains (corn, soybeans, wheat).

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

None

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

Continuous pasture- the majority of "pastures" in the NEL are earthen lots with 50% or less vegetation. The vegetation provides little or no feed to the animals. Rotational grazing is getting more popular so there are a few areas of gazed land, but the majority are earthen cattle lots.

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*
The pasture seems a bit high. Most of the areas delineated as "pasture" on the maps are cropped field or grass/woodland. Actual area where cattle are kept is probably closer to 1-2%.

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 15% | 18% | 13,059 |
| Continuous Corn | 3% | 4% | 2,978 |
| Dairy Rotation | 45% | 56% | 40,477 |
| Potato/Vegetable | 0.1% | 0.2% | 130 |
| Hay | 5% | 6% | 4,674 |
| Pasture | 12% | 15% | 10,823 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*
We do not have any transect data for Brown County.

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**
Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | Cs | Cs | Cs | As | A | A | A | |
| Sequence 2 *(if needed)* | Cs | Cg | S | WW | Cs | As | A | A | A |
| Sequence 3 *(if needed)* | | | | | | | | | |
| Sequence 4 *(if needed)* | | | | | | | | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Headwaters Kewaunee River (40301020301) | 50% | 50% | | | |
| Upper Branch River (40301010501) | 90% | 10% | | | |
| Devils River (40301010202) | 60% | 40% | | | |
| Neshota River (40301010203) | 40% | 60% | | | |
| Middle Branch River (40301010502) | 60% | 40% | | | |
| School Creek (40301020302) | 50% | 50% | | | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | May 30 | Cs- Oct 1, S- Oct 20, Cg-Nov 1 | 3 |
| Average Temperature/Moisture Year | May 15 | Cs-Sept 20, S-Oct 5, Cg-Oct 25 | 4 |
| Warm/Dry Year | May 5 | Cs-Sept 15, S-Oct 1, Cg-Oct 15 | 4 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Field are typically tilled in both the spring and fall. Fields are typically chisel plowed in the fall, usually to a depth of 6-10 inches. There is still some moldboard plowing in the Neshota River watershed. Spring tillage is typically at least two passes in spring with a field cultivator.

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | Wheat is no-tilled after soybeans |
| Continuous Corn | No no-till |
| Dairy | Only no-till is maybe 40% of wheat after soybeans or corn silage |
| Potato/Vegetable | If wheat is included in the rotation maybe no-till wheat after snap beans or soybeans |

*Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below. This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy*** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 90% | 85% | 70% | 85% |
| Fall Vertical till, Spring field cultivate | *25%* | 5% | 5% | | 5% |
| Spring Vertical till | *0%* | | | | 5% |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 5% | 5% | 15% | |
| Fall field cultivate | *50%* | | | | |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | | | 15% | |
| No-till | *25%* | | 5% | | 5% |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Please note that dairy farms often have ~40% of their land in alfalfa which is a perennial crop. Only tillage in preparation for annual crops or alfalfa seeding were considered.

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Headwaters Kewaunee River (40301020301 | Upper Branch River (40301010501) | Devils River (40301010202) | Neshota River (40301010203) | Middle Branch River (40301010502) | School Creek (40301020302) |
|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 55% | 55% | 55% | 55% | 55% | 55% |
| | 16%-30% | *0%* | 10% | 10% | 10% | 10% | 10% | 10% |
| | >30% | *10%* | 30% | 30% | 30% | 30% | 30% | 30% |
| | No-Till/Zone-Till | *5%* | 5% | 5% | 5% | 5% | 5% | 5% |
| Continuous Corn | 0%-15% | *0%* | 10% | 10% | 10% | 30% | 10% | 10% |
| | 16%-30% | *0%* | 40% | 40% | 40% | 40% | 40% | 40% |
| | >30% | *100%* | 50% | 50% | 50% | 30% | 50% | 50% |
| | No-Till/Zone-Till | *0%* | | | | | | |
| Dairy* | 0%-15% | *75%* | 85% | 85% | 85% | 85% | 85% | 85% |
| | 16%-30% | *25%* | 5% | 5% | 5% | 5% | 5% | 5% |
| | >30% | *0%* | 10% | 10% | 10% | 10% | 10% | 10% |
| | No-Till/Zone-Till | *0%* | | | | | | |
| Potato/ Vegetable | 0%-15% | *100%* | 85% | 85% | 85% | 85% | 85% | 85% |
| | 16%-30% | *0%* | 5% | 5% | 5% | 5% | 5% | 5% |
| | >30% | *0%* | 5% | 5% | 5% | 5% | 5% | 5% |
| | No-Till/Zone-Till | *0%* | 5% | 5% | 5% | 5% | 5% | 5% |

*Please note that dairy farms often have ~40% of their land in alfalfa which is a perennial crop. Only field conditions between annual crops or before or after alfalfa seeding were considered.

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Potato/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | P | N/P | N/P | P | P |
| | At-planting | *X* | | N/P | N/P | | |
| | During growing | | N | N | N | P | |
| Placement **(check one per rotation)** | Surface | *X* | N | N | N | P | P |
| | Injection | | | N | N | | |
| Incorporation after application? **(check one per rotation )** | Yes | | P | P | P | | P |
| | No | *X* | N | N | N | P | |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.*

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio =*

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Headwaters Kewaunee River (40301020301) | 40 | 150 | 60 | 190 | 60 | 150 | 20 | 20 |
| Upper Branch River (40301010501) | 50 | 150 | 50 | 190 | 10 | 50 | 20 | 20 |
| Devils River (40301010202) | 40 | 150 | 50 | 190 | 50 | 100 | 20 | 20 |
| Neshota River (40301010203) | 40 | 120 | 50 | 150 | 20 | 100 | 20 | 20 |
| Middle Branch River (40301010502) | 40 | 150 | 50 | 190 | 20 | 100 | 20 | 20 |
| School Creek (40301020302) | 40 | 150 | 60 | 190 | 60 | 150 | 20 | 20 |

Reported in pounds of nutrient per acre. Upper Branch River watershed has several CAFOs which fertilize their crops with manure this means they use very little purchased fertilizer, hence low rate in the table above.

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain (soybeans) | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Headwaters Kewaunee River (40301020301) | 55 bu/ac | 170 bu/ac | 20 tons/ac | 4 tons/ac | - |
| Upper Branch River (40301010501) | 60 bu/ac | 185 bu/ac | 22 tons/ac | 4.5 tons/ac | - |
| Devils River (40301010202) | 55 bu/ac | 170 bu/ac | 20 tons/ac | 4 tons/ac | - |
| Neshota River (40301010203) | 55 bu/ac | 175 bu/ac | 20 tons/ac | 4 tons/ac | - |
| Middle Branch River (40301010502) | 60 bu/ac | 185 bu/ac | 22 tons/ac | 4 tons/ac | - |
| School Creek (40301020302) | 55 bu/ac | 170 bu/ac | 20 tons/ac | 4 tons/ac | - |

Soybean yields used for cash grain yield

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Headwaters Kewaunee River (40301020301) | 20% | 80% |
| Upper Branch River (40301010501) | 10% | 90% |
| Devils River (40301010202) | 20% | 80% |
| Neshota River (40301010203) | 30% | 70% |
| Middle Branch River (40301010502) | 15% | 85% |
| School Creek (40301020302) | 10% | 90% |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | DAILY | Some Spring, Summer between alfalfa cuttings and after wheat harvest, most applied in fall after harvest |
| Application Timing | Daily | Some Spring, Summer between alfalfa cuttings and after wheat harvest, most applied in fall after harvest |
| Followed by Incorporation? (Yes or No) | No, eventually it gets incorporated, usually weeks or months later | Yes, only exception is summer applications between alfalfa cuttings |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*
**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*
**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Headwaters Kewaunee River (40301020301) | 20 tons/ac | 10% | Solid | 17,000 gal/ac | 85% | liquid |
| Upper Branch River (40301010501) | 20 tons/ac | 10% | Solid | 17,000 gal/ac | 85% | liquid |
| Devils River (40301010202) | 20 tons/ac | 10% | Solid | 15,000 gal/ac | 85% | liquid |
| Neshota River (40301010203) | 20 tons/ac | 10% | Solid | 12,000 gal/ac | 75% | liquid |
| Middle Branch River (40301010502) | 20 tons/ac | 10% | Solid | 17,000 gal/ac | 85% | liquid |
| School Creek (40301020302) | 20 tons/ac | 10% | Solid | 17,000 gal/ac | 85% | liquid |

*Incorporation, daily haul = incorporated within 72 hours

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2O_5$)*: Solid: 3 lbs $P_2O_5$/ton; Liquid 6 lbs $P_2O_5$/1000 gal (1st year available)
*N concentration*: Solid: 3 lbs/ton; Liquid 12 lbs/1000 gal

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*
0%

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | 0% |
| Sweep | 15% |
| Knife | 15% |
| Other *(please specify)* | Terra disk: 70% |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Headwaters Kewaunee River (40301020301) | 30 ppm |
| Upper Branch River (40301010501) | 35 ppm |
| Devils River (40301010202) | 25 ppm |
| Neshota River (40301010203) | 20 ppm |
| Middle Branch River (40301010502) | 25 ppm |
| School Creek (40301020302) | 30 ppm |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

<10%, only one rotational grazing operation in NEL (Upper Branch Watershed). Animals on "pasture" are not getting much if any of the feed from grazing. "Pastures" are lots where animals are kept; feed is brought to them.

*Question 24. What are the typical practices of a grazing operation?*

| Characteristic | Typical Practice |
|---|---|
| Animal Type | Beef, horse |
| Number of Animals per Acre | 5 |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | Entire year, some shelter provided in most cases |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Headwaters Kewaunee River (40301020301) | 20% | 0 |
| Upper Branch River (40301010501) | 20% | 0 |
| Devils River (40301010202) | 20% | 0 |
| Neshota River (40301010203) | 20% | 0 |
| Middle Branch River (40301010502) | 20% | 0 |
| School Creek (40301020302) | 20% | 0 |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Calumet County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 2. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Amanda Kleiber**
**Organization: Calumet County Land & Water Conservation Dept**
**Email: Amanda.kleiber@calumetcounty.org**
**Phone: (920) 849-1442**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?* We do not have any potatoes grown in Calumet County. However, we have some canning crops (vegetables – peas, green beans, sweet corn) which are usually grown in a rotation with other cash grain crops.

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

No additional crop rotations in the county.

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

Some areas on the map are colored green for continuous pasture; however, they are permanent grass, not necessarily pasture. For example, a golf course and the airport are marked as pastures on the map. Overall, there should be less green(pastures) on the map.

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 22% | 31% | 32,611 |
| Continuous Corn | 2% | 2% | 2,197 |
| Dairy Rotation | 34% | 47% | 49,434 |
| Potato/Vegetable | 4% | 5% | 5,137 |
| Hay | 5% | 7% | 7,772 |
| Pasture | 6% | 8% | 8,037 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

Pasture numbers seem high. I would adjust the % of county area to the following: 24% cash grain and 36% dairy rotation and 2% pasture

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*
No transect survey data in Calumet County since 2004.

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**
Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | Cs | Cs | A | A | A | A | | |
| Sequence 2 *(if needed)* | Cs | Cs | Cg | A | A | A | A | | |
| Sequence 3 *(if needed)* | Cs | Cs | S | A | A | A | A | | |
| Sequence 4 *(if needed)* | Cs | Cs | W | A | A | A | A | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Cedar Creek (40301010405) | 80 | 10 | 5 | 5 | |
| City of Chilton-South Branch Manitowoc River (40301010404) | 80 | 10 | 5 | 5 | |
| Headwaters Killsnake River (40301010406) | 80 | 10 | 5 | 5 | |
| Headwaters North Branch Manitowoc River (40301010301) | 80 | 10 | 5 | 5 | |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 80 | 10 | 5 | 5 | |
| Killsnake River (40301010407) | 80 | 10 | 5 | 5 | |
| North Branch Manitowoc River (40301010303) | 80 | 10 | 5 | 5 | |
| Pine Creek (40301010403) | 80 | 10 | 5 | 5 | |
| Sheboygan Lake-Sheboygan River (40301011104) | 80 | 10 | 5 | 5 | |
| South Branch Manitowoc River (40301010408) | 80 | 10 | 5 | 5 | |
| Spring Creek (40301010302) | 80 | 10 | 5 | 5 | |
| Stony Brook-South Branch Manitowoc River (40301010402) | 80 | 10 | 5 | 5 | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | June 1 | Nov 15 (grain)<br>Oct 1 (silage) | 4 |
| Average Temperature/Moisture Year | May 15 | Oct 22 (grain)<br>Sept 6 (silage) | 5 |
| Warm/Dry Year | May 1 | Oct 15 (grain)<br>Sept 1 (silage) | 4 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Primarily Fall. Some tillage occurs in the spring depending upon crop and fall harvest weather conditions.

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | Tilled 3 out of 6 years |
| Continuous Corn | Tilled 6 out of 6 years |
| Dairy | Tilled 3 out of 6 years |
| Potato/Vegetable | Always tilled (processors require tillage) |

*<u>Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below.</u> This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 75 | 55 | 70 | 65 |
| Fall Vertical till, Spring field cultivate | *25%* | 10 | 10 | 15 | 15 |
| Spring Vertical till | *0%* | | 15 | 10 | 5 |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 5 | 5 | | |
| Fall field cultivate | *50%* | | | 5 | |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | 10 | 5 | | 15 |
| No-till | *25%* | | 10 | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

****** % crop residue levels estimated in spring after planting (This is when we conservationists think/measure crop residue)***

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Cedar Creek (40301010405) | City of Chilton-South Branch Manitowoc River (40301010404) | Headwaters Killsnake River (40301010406) | Headwaters North Branch Manitowoc River (40301010301) | Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | Killsnake River (40301010407) | North Branch Manitowoc River (40301010303) | Pine Creek (40301010403) | Sheboygan Lake-Sheboygan River (40301011104) | South Branch Manitowoc River (40301010408) | Spring Creek (40301010302) | Stony Brook-South Branch Manitowoc River (40301010402) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 30 | 30 | 25 | 25 | 30 | 25 | 25 | 30 | 30 | 30 | 25 | 30 |
| | 16%-30% | *0%* | 40 | 40 | 35 | 35 | 40 | 35 | 35 | 40 | 40 | 40 | 35 | 40 |
| | >30% | *10%* | 20 | 20 | 25 | 25 | 20 | 25 | 25 | 20 | 20 | 20 | 25 | 20 |
| | No-Till/Zone-Till | *5%* | 10 | 10 | 15 | 15 | 10 | 15 | 15 | 10 | 10 | 10 | 15 | 10 |
| Continuous Corn | 0%-15% | *0%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 16%-30% | *0%* | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| | >30% | *100%* | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| | No-Till/Zone-Till | *0%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Dairy | 0%-15% | *75%* | 70 | 70 | 65 | 65 | 70 | 65 | 65 | 70 | 70 | 70 | 65 | 70 |
| | 16%-30% | *25%* | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | >30% | *0%* | 5 | 5 | 10 | 10 | 5 | 10 | 10 | 5 | 5 | 5 | 10 | 5 |
| | No-Till/Zone-Till | *0%* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Potato/ Vegetable | 0%-15% | *100%* | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | 16%-30% | *0%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | >30% | *0%* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | No-Till/Zone-Till | *0%* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Potato/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | x | x | x | x | x |
| | At-planting | *X* | x | x | x | | |
| | During growing | | x | x | x | x | |
| Placement **(check one per rotation)** | Surface | *X* | X | x | x | x | x |
| | Injection | | | | | | |
| Incorporation after application? **(check one per rotation )** | Yes | | x | x | x | | x |
| | No | *X* | | | | x | |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilize**r per acre (option 2). Please provide more information about the option you choose below.*

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

Reporting option 1: pounds of nutrient per acre used

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Cedar Creek (40301010405) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| City of Chilton-South Branch Manitowoc River (40301010404) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Headwaters Killsnake River (40301010406) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Headwaters North Branch Manitowoc River (40301010301) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Killsnake River (40301010407) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| North Branch Manitowoc River (40301010303) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Pine Creek (40301010403) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Sheboygan Lake-Sheboygan River (40301011104) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| South Branch Manitowoc River (40301010408) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Spring Creek (40301010302) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |
| Stony Brook-South Branch Manitowoc River (40301010402) | 40 | 165 | 40 | 165 | 35 | 175 | 45 | 20 |

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Cedar Creek (40301010405) | 185 | 185 | 22 | 5 | |
| City of Chilton-South Branch Manitowoc River (40301010404) | 185 | 185 | 22 | 5 | |
| Headwaters Killsnake River (40301010406) | 165 | 165 | 20 | 6 | |
| Headwaters North Branch Manitowoc River (40301010301) | 165 | 165 | 20 | 6 | |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 185 | 185 | 22 | 5 | |
| Killsnake River (40301010407) | 165 | 165 | 20 | 6 | |
| North Branch Manitowoc River (40301010303) | 165 | 165 | 20 | 6 | |
| Pine Creek (40301010403) | 185 | 185 | 22 | 5 | |
| Sheboygan Lake-Sheboygan River (40301011104) | 185 | 185 | 22 | 5 | |
| South Branch Manitowoc River (40301010408) | 165 | 165 | 20 | 6 | |
| Spring Creek (40301010302) | 165 | 165 | 20 | 6 | |
| Stony Brook-South Branch Manitowoc River (40301010402) | 185 | 185 | 22 | 5 | |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Cedar Creek (40301010405) | 5 | 95 |
| City of Chilton-South Branch Manitowoc River (40301010404) | 15 | 85 |
| Headwaters Killsnake River (40301010406) | 20 | 80 |
| Headwaters North Branch Manitowoc River (40301010301) | 4 | 96 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 5 | 95 |
| Killsnake River (40301010407) | 15 | 85 |
| North Branch Manitowoc River (40301010303) | 5 | 95 |
| Pine Creek (40301010403) | 5 | 95 |
| Sheboygan Lake-Sheboygan River (40301011104) | 15 | 85 |
| South Branch Manitowoc River (40301010408) | 5 | 95 |
| Spring Creek (40301010302) | 5 | 95 |
| Stony Brook-South Branch Manitowoc River (40301010402) | 6 | 94 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | DAILY | 2 times per year majority |
| Application Timing | Spring & Fall majority<br>little in summer | Spring & fall majority. Some in summer on hay & after winter wheat |
| Followed by Incorporation? (Yes or No) | Not right away, but eventaully | yes |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*
**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*
**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Cedar Creek (40301010405) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| City of Chilton-South Branch Manitowoc River (40301010404) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Headwaters Killsnake River (40301010406) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Headwaters North Branch Manitowoc River (40301010301) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Killsnake River (40301010407) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| North Branch Manitowoc River (40301010303) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Pine Creek (40301010403) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Sheboygan Lake-Sheboygan River (40301011104) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| South Branch Manitowoc River (40301010408) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Spring Creek (40301010302) | 20 | 40 | Solid | 15000 | 100 | Liquid |
| Stony Brook-South Branch Manitowoc River (40301010402) | 20 | 40 | Solid | 15000 | 100 | Liquid |

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2O_5$)*:
*N concentration*:

Cannot provide an estimate. Farms vary so much with what they feed the animals, type of storage(s), what's collected in the storage (feed leachate, milkhouse waste, etc), digesters, etc to have an estimate on behalf of the county.

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*

Very few if any no-till dairies in the county. 0%

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| **Injection method** | **% of Dairy acres receiving manure by injection** |
|---|---|
| Narrow knife | *5* |
| Sweep | *5* |
| Knife | |
| Other *(please specify) Disc Incorporate* | *90* |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Cedar Creek (40301010405) | 46 |
| City of Chilton-South Branch Manitowoc River (40301010404) | 37 |
| Headwaters Killsnake River (40301010406) | 30 |
| Headwaters North Branch Manitowoc River (40301010301) | 30 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 75 |
| Killsnake River (40301010407) | 30 |
| North Branch Manitowoc River (40301010303) | 30 |
| Pine Creek (40301010403) | 36 |
| Sheboygan Lake-Sheboygan River (40301011104) | 46 |
| South Branch Manitowoc River (40301010408) | 29 |
| Spring Creek (40301010302) | 30 |
| Stony Brook-South Branch Manitowoc River (40301010402) | 34 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web map) is grazed?*

Very little acreage in the county is truly grazed. Less than 5% of the pasture acres identified on the map are grazed.

*Question 24. If managed grazing is a significant enough practice to affect water quality, what are the typical practices of a grazing operation?*

Managed grazing is not significant enough in the county to affect water quality

| Characteristic | Typical Practice |
|---|---|
| Animal Type | |
| Number of Animals per Acre | |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Cedar Creek (40301010405) | | |
| City of Chilton-South Branch Manitowoc River (40301010404) | | |
| Headwaters Killsnake River (40301010406) | | |
| Headwaters North Branch Manitowoc River (40301010301) | | 30 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | | |
| Killsnake River (40301010407) | | |
| North Branch Manitowoc River (40301010303) | | 30 |
| Pine Creek (40301010403) | | |
| Sheboygan Lake-Sheboygan River (40301011104) | | |
| South Branch Manitowoc River (40301010408) | | |
| Spring Creek (40301010302) | | 30 |
| Stony Brook-South Branch Manitowoc River (40301010402) | | |

The only irrigation in the Calumet County is from 2 CAFO's who irrigate some of their wastewater on a couple of fields.

Recently, fields with tile drainage were inventoried by using aerial photos in 3 subwatersheds as seen on the chart above. However it is likely that there is more tile drainage in these watersheds that what was identified by air photo interpretation.
Overall, several fields in the county have drain tile installed throughout the county.

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Door County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 3. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Brian Forest**
**Organization: Door County Soil and Water Conservation Department**
**Email: bforest@co.door.wi.us**
**Phone: 920-746-2366**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?*

They are usually grown in a rotation with other cash grains.

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

Yes. There is a rotation that is commonly used that is a hybrid between number 1 and number 4.
This, with the dairy rotation, is the most common utilized:

Grain-Vegetable-Occasional Hay – Vegetable crops such as snap beans or beets are rotated with grain crops such as winter wheat or oats. Hay is occasionally introduced into the rotation, as needed for forage or field chemical requirements.

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

Upon reviewing the data provided, there is a significant discrepancy between displayed rotations and their percent of the total cropland and the values that are tracked by the SWCD. Total cropland acres tracked by the SWCD are 33,819. The total cropland acres presented by this survey is 41,476.

Much of this discrepancy appears to be in the polygons classified as "Pasture". Reviewing the web-based map, many of the delineated areas overly wooded areas, wetlands and other non-agricultural areas. True "pasture" areas are generally not separated by the SWCD, as they are part of many dairy rotations and incorporated into grass/hay portions of the rotation. There are no true grazing operations in this part of the county and traditional pastures are instead feedlots with feed stations that have some grass/alfalfa portions for supplemental feeding.

Regarding the other categories, it is more realistic to break down the rotations as "Dairy Rotation" and "Grain/Vegetable/Occasional Hay". The rotations identified as "Cash Grain" and Potato/Vegetable" should be combined into the "Grain/Vegetable/Occasional Hay" rotation. The others, with the exception of the misrepresented "Pasture" areas, should be combined into the "Dairy Rotation" category.

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

This table has been adjusted to reflect the rotations identified for cropland in the three HUC 12s that reside in Door County. The other rotations identified have been removed, as the following is a more accurate depiction of typical cropping practices by the majority of the cropland operators.

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Dairy Rotation | 32% | 60% | 20286 |
| Grain/Vegetable/Hay | 22% | 40% | 13533 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

Further breakdown by HUC 12:

| HUC 12 | % of county area Dairy Rotation | % of county area Grain/Vegetable/Hay | % of agricultural area Dairy Rotation | % of agricultural area Grain/Vegetable/Hay | rotation area (acres) Dairy Rotation | rotation area (acres) Grain/Vegetable/Hay |
|---|---|---|---|---|---|---|
| Silver (40301020203) | 73% | 10% | 73% | 10% | 2237 | 319 |
| Stony (40301020201) | 22% | 26% | 22% | 26% | 6501 | 7665 |
| Ahnapee (40301020204) | 39% | 19% | 39% | 19% | 11548 | 5549 |

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*
No. The last Cropland Transect Survey done in Door County was 2002.

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**

Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

Several rotations that cover the majority of the cropland operated in dairy rotations were identified. Most were a combination of corn (silage), small grain and alfalfa in varying durations. Rotations were derived from discussion with several operators and CCAs that operate and plan the majority of cropland acres in the TMDL area.

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | WW/O | A | A | A | A | | | |
| Sequence 2 *(if needed)* | Cs | Cs | A | A | A | A | | | |
| Sequence 3 *(if needed)* | Cs | Cs | WW/O | A | A | A | A | | |
| Sequence 4 *(if needed)* | Cs | Cs | Cs | Cs | A | A | A | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

Percentage of cropland operated under each sequence was determined through an analysis of major cropland operators and their predominant rotations.

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Ahnapee River (40301020204) | 80% | 10% | 10% | 0% | 0% |
| Stony Creek-Frontal Lake Michigan (40301020201) | 80% | 0% | 20% | 0% | 0% |
| Silver Creek (40301020203) | 30% | 30% | 40% | 0% | 0% |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize

that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

Answers to this question were generated through discussion with CCAs and the Door County UW-Extension Agriculture Agent.

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | June 4 | September 27 | 2 |
| Average Temperature/Moisture Year | May 24 | September 13 | 4 |
| Warm/Dry Year | May 10 | September 6 | 3 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Tillage occurs during both spring and fall.

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

Designation of tillage for each rotation was developed from review of nutrient management plans, as well as observation by SWCD staff throughout many growing seasons.

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Dairy | 4 out of every 6 years |
| Grain/Vegetable/Hay | 4 out of every 6 years |

*Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below. This table will be used to determine tillage timing and depth.*

Designation of tillage strategies in both rotations were developed through review of submitted nutrient management plans from major cropland operators throughout each of the HUC 12s. Trends were established based on a tally of preferred tillage by each operation and applied across all operated acreage. Dominant tillage practices prevailed and were applied across the cropland for each area.

| Tillage Strategy | % of rotation area using tillage strategy | | |
|---|---|---|---|
| | ***Example*** | **Dairy** | **Grain/Vegetable/Hay** |
| Fall Chisel plow,<br>Spring field cultivate x2 | *0%* | 10% | |
| Fall Vertical till,<br>Spring field cultivate | *25%* | 10% | 5% |
| Spring Vertical till | *0%* | | 5% |
| Fall moldboard plow,<br>Spring field cultivate x2 | *0%* | | |
| Fall field cultivate | *50%* | 15% | 15% |
| Fall disk & chisel plow,<br>Spring field cultivate x2 | *0%* | | 10% |
| No-till | *25%* | 10% | 10% |
| Fall Chisel Plow, No Disk | *0%* | 15% | 10% |
| Alfalfa to Alfalfa, No Tillage | *0%* | 25% | 20% |
| Spring Field Cultivate | *0%* | 15% | 25% |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

Tillage was reviewed in the fall of 2018, as part of the modeling for the Upper Ahnapee River Watershed 9 Element Plan, and revisited for this survey. Results were comparable across all of the HUC 12s, as the same operators are consistent through each. Staff observations confirmed this.

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Ahnapee River (40301020204) | Stony Creek-Frontal Lake Michigan (40301020201) | Silver Creek (40301020203) |
|---|---|---|---|---|---|
| Dairy | 0%-15% | *75%* | 70% | 70% | 70% |
| | 16%-30% | *15%* | 10% | 10% | 10% |
| | >30% | *10%* | 15% | 15% | 15% |
| | No-Till/Zone-Till | *0%* | 0% | 0% | 0% |
| Grain/ Vegetable/ Hay | 0%-15% | *100%* | 80% | 80% | 80% |
| | 16%-30% | *0%* | 10% | 10% | 10% |
| | >30% | *0%* | 10% | 10% | 10% |
| | No-Till/Zone-Till | *0%* | 0% | 0% | 0% |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

Information for this question was generated from review of submitted nutrient management plans, as well as discussion with CCAs.

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Potato/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | | Some | Some | | |
| | At-planting | *X* | X | X | X | X | X |
| | During growing | | X | X | X | X | X |
| Placement **(check one per rotation)** | Surface | *X* | X | X | X | X | X |
| | Injection | | | Some | Some | | |
| Incorporation after application? **(check one per rotation )** | Yes | | At Planting | Some | Some | At Planting | At Planting |
| | No | *X* | X | X | X | X | X |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.*

Information for this question was generated from review of submitted nutrient management plans, as well as discussion with CCAs.

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Ahnapee River (40301020204) | 23 | 65 | 44 | 122 | 30 | 90 | 23 | 42 |
| Stony Creek-Frontal Lake Michigan (40301020201) | 23 | 65 | 44 | 122 | 30 | 90 | 23 | 42 |
| Silver Creek (40301020203) | 23 | 65 | 44 | 122 | 30 | 90 | 23 | 42 |

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio =*

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

Information for this question was generated from review of submitted nutrient management plans, as well as discussion with CCAs.

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *EXAMPLE* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Ahnapee River (40301020204) | 175 bu | 175 bu | 26 tons | 5 tons | 5 tons |
| Stony Creek-Frontal Lake Michigan (40301020201) | 160 bu | 160 bu | 22 tons | 4 tons | 5 tons |
| Silver Creek (40301020203) | 170 bu | 170 bu | 24 tons | 4.5 tons | 5 tons |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

Information provided in this question is based on SWCD experience, and the many years of work previous to address daily hauling and implement storage to efficiently and appropriately deal with field applications.

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Ahnapee River (40301020204) | 0% | 100% |
| Stony Creek-Frontal Lake Michigan (40301020201) | 0% | 100% |
| Silver Creek (40301020203) | 0% | 100% |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

Information provided in this question is based on SWCD experience, and the many years of work previous to address daily hauling and implement storage to efficiently and appropriately deal with field applications.

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | ------ | Spring and Fall |
| Application Timing | ------ | Pre Planting and Post Harvest |
| Followed by Incorporation? (Yes or No) | ------ | Yes |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*

**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*
**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

Upon review of cropping within the three HUC 12s, it became clear that manure applications were not equal across the landscape, based on the scale of operation. Throughout the entire NEL TMDL area, 30% of the cropland is operated by CAFOs. The manure applications made on this cropland is generally at higher rates

than non-CAFO operations. The calculations are reflected in the flowing table, with each split made for each HUC 12.

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Ahnapee River (40301020204) | | | | 35% - 15000 gal<br>65% - 8000 gal | 70% | Liquid |
| Stony Creek-Frontal Lake Michigan (40301020201) | | | | 20% - 15000 gal<br>80% - 8000 gal | 70% | Liquid |
| Silver Creek (40301020203) | | | | 55% - 15000 gal<br>45% - 8000 gal | 70% | Liquid |

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2 0_5$)*: Range 4 – 12 lbs/1000 gal
*N concentration*: Range 13 – 28 lbs/1000 gal

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*

0% - There are no truly no-till operations occurring.

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | |
| Sweep | |
| Knife | 100% |
| Other *(please specify)* | |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

The SWCD receives annual nutrient management plans from the majority of operators within the project area. 95% of the cropland is covered in a NMP. The SWCD tracks soil P levels as they are recorded, and maps them with other field attributes.

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Ahnapee River (40301020204) | 30 |
| Stony Creek-Frontal Lake Michigan (40301020201) | 18 |
| Silver Creek (40301020203) | 29 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

0% - There are no true grazing operations in this part of the county, areas identified as pasture or grazing areas are essentially supplemental feeding for dedicated feed stations.

*Question 24. What are the typical practices of a grazing operation?*

There are no true grazing operations in this part of the county, areas identified as pasture or grazing areas are essentially supplemental feeding for dedicated feed stations.

| Characteristic | Typical Practice |
|---|---|
| Animal Type | --- |
| Number of Animals per Acre | --- |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | --- |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Ahnapee River (40301020204) | | |
| Stony Creek-Frontal Lake Michigan (40301020201) | | |
| Silver Creek (40301020203) | | |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

There is a CAFO operation (Permit No. WI-0062863-03-0) located at 44°44.2367618'N, 87°30.0024110'W, which currently discharges process wastewater to an unnamed tributary within the Ahnapee River Watershed and groundwaters of the state. The WPDES permit for this operation has identified a compliance schedule to correct this, with corrective measures required by 11/1/18.

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Fond du Lac County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 4. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR

kimberly.oldenborg@wisconsin.gov

608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Becky Wagner**

**Organization: Fond du Lac County LWCD**

**Email: becky.wagner@fdlco.wi.gov**

**Phone: (920) 906-4681**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?*

**No potatoes are grown in our county other than a few CSA farms in this watershed, and a few canning vegetable crops specifically lima beans, some canning peas and sweet corn are grown but in conjunction with a rotation with other cash grains and forages. Vegetable crops planted during any given season are very dependent on the market and canning company contracts, so I am not factoring these crops into our rotations for this watershed.**

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

**I would change your 'cash grain' rotation to 'row crop' rotation, and include corn silage**.

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

**The large all cash grain (orange) area north of ST. Peter and Wh should be dairy rotation. There is a misconception that just because there are 'cash' grain fields, does not mean that they are void of a dairy presence, with the exporting of manure to these fields, and the selling of corn silage to the dairies. Therefore, that area north of St. Peter that is all orange fits the dairy rotation and should be brown unless you add another rotation that says row crop with dairy affiliation.**

**I would also need to look at our NMP map to see why all those areas are white. These areas would be a dairy rotation as well.**

**We do not have that much continuous hay (yellow), vegetable (red) or continuous corn (purple) rotations as is shown on the map. This is a very strong dairy, row crop watershed in Fond du Lac County**.

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

**The percentage of dairy is low. The percentage of continuous hay and vegetables are high.**

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | **15%** | **22%** | **12,387** |
| Continuous Corn | **3%** | **4%** | **2,073** |

| | | | |
|---|---|---|---|
| Dairy Rotation | **37%** | **54%** | **30,181** |
| Potato/Vegetable | **2%** | **3%** | **1,821** |
| Hay | **9%** | **13%** | **7,158** |
| Pasture | **2%** | **3%** | **1,913** |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*

**No we have not conducted a Cropland Transect Survey since 2004. If you want specific crop system information I can refer to my NMP's via SNAP Plus to get farm/field detail.**

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**

Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

**CScv = Corn silage with cover crop seeded after silage harvest**

**OPfAs = Oats peas forage with alfalfa seeding**

**OfAs = Oats forage with alfalfa seeding**

**WWg+s = Winter wheat grain plus straw**

**As = Alfalfa spring seeding (direct)**

**Cgbs = Corn grain baled straw**

| **Typical Dairy Sequence(s)** | **Year** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** *(if needed)* | **7** *(if needed)* | **8** *(if needed)* | **9** *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | **Cs** | **Cs** | **Cs** | **OPfAs** | **A** | **A** | **A** | | |
| Sequence 2 *(if needed)* | **Cscv** | **Cscv** | **OfAs** | **A** | **A** | **A** | | | |
| Sequence 3 *(if needed)* | **Cs** | **S** | **Cs** | **WWg +s** | **As** | **A** | **A** | **A** | |
| Sequence 4 *(if needed)* | **Cs** | **S** | **Cs** | **As** | **A** | **A** | **A** | | |
| Sequence 5 *(if needed)* | **Cgbs** | **Cs** | **Cg** | **Cs** | **OfAs** | **A** | **A** | **A** | **A** |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | ***60 %*** | ***5 %*** | ***10 %*** | ***10 %*** | ***15 %*** |
| Community of Mt. Calvary (40301011101) | **20%** | **5%** | **20%** | **30%** | **25%** |
| Feldner's Creek-Sheboygan River (40301011103) | **30%** | **5%** | **10%** | **30%** | **25%** |
| Headwaters Sheboygan River (40301011102) | **40%** | **20%** | **20%** | **5%** | **15%** |
| Headwaters South Branch Manitowoc River (40301010401) | **35%** | **5%** | **20%** | **10%** | **30%** |
| Sheboygan Lake-Sheboygan River (40301011104) | **50%** | **5%** | **10%** | **15%** | **20%** |
| Stony Brook-South Branch Manitowoc River (40301010402) | **60%** | **10%** | **20%** | **5%** | **5%** |
| Upper Mullet River (40301010901) | **40%** | **5%** | **5%** | **20%** | **30%** |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | **May 25** | **Corn silage = Sept 24**<br>**Corn grain = Nov 5**<br>**Soybeans = Oct 26**<br>**Winter wheat Aug 2** | **3** |

| | | | |
|---|---|---|---|
| Average Temperature/Moisture Year | **May 15** | **Corn silage = Sept 14**<br>**Corn Grain = Oct 22**<br>**Soybeans = Oct 17**<br>**Winter Wheat = Jul 30** | **4** |
| Warm/Dry Year | **May 5** | **Corn Silage = Sept 10**<br>**Corn Grain = Oct 15**<br>**Soybeans = Oct 10**<br>**Winter Wheat July 17** | **4 potentially 5** |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Both

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | ***Tilled 1 out of every 6 years*** |
| Cash Grain | **Tilled 6 out of 8 years** |
| Continuous Corn | **Tilled all 8 years** |
| Dairy | **Tilled 4 out of 8 years** |

*Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below. This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | **10%** | **10%** | **80%** | **NA** |
| Fall Vertical till, Spring field cultivate | *25%* | **30%** | **30%** | **40%** | **NA** |
| Spring Vertical till | *0%* | **20%** | **50%** | **30%** | **NA** |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | **1%** | **1%** | **1%** | **NA** |
| Fall field cultivate | *50%* | **5%** | **20%** | **30%** | **NA** |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | **1%** | **10%** | **10%** | **NA** |
| No-till | *25%* | **10%** | **10%** | **5%** | **NA** |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Community of Mt. Calvary (40301011101) | Feldner's Creek-Sheboygan River (40301011103) | Headwaters Sheboygan River (40301011102) | Headwaters South Branch Manitowoc River (40301010401) | Sheboygan Lake-Sheboygan River (40301011104) | Stony Brook-South Branch Manitowoc River (40301010402) | Upper Mullet River (40301010901) |
|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | ***85%*** | **30%** | **30%** | **30%** | **20%** | **20%** | **30%** | **20%** |
| | 16%-30% | ***0%*** | **50%** | **50%** | **50%** | **50%** | **60%** | **50%** | **70%** |
| | >30% | ***10%*** | **10%** | **15%** | **15%** | **25%** | **15%** | **15%** | **5%** |
| | No-Till/Zone-Till | ***5%*** | **10%** | **5%** | **5%** | **5%** | **5%** | **5%** | **5%** |
| Continuous Corn | 0%-15% | ***0%*** | **20%** | **30%** | **20%** | **20%** | **30%** | **40%** | **40%** |
| | 16%-30% | ***0%*** | **60%** | **50%** | **60%** | **50%** | **60%** | **40%** | **50%** |
| | >30% | ***100%*** | **15%** | **15%** | **15%** | **20%** | **5%** | **15%** | **5%** |
| | No-Till/Zone-Till | ***0%*** | **5%** | **5%** | **5%** | **10%** | **5%** | **5%** | **5%** |
| Dairy | 0%-15% | ***75%*** | **40%** | **60%** | **40%** | **70%** | **60%** | **70%** | **70%** |
| | 16%-30% | ***25%*** | **50%** | **30%** | **50%** | **30%** | **40%** | **30%** | **20%** |
| | >30% | ***0%*** | **10%** | **10%** | **10%** | **0%** | **0%** | **0%** | **10%** |
| | No-Till/Zone-Till | ***0%*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** |
| Potato/ Vegetable | 0%-15% | ***100%*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| | 16%-30% | ***0%*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| | >30% | ***0%*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| | No-Till/Zone-Till | ***0%*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |

## CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Potato/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | **X** | **X** | **X** | **X** | **NA** |
| | At-planting | *X* | **X** | **X** | **X** | **X** | **NA** |
| | During growing | | **X** | **X** | **X** | **X** | **NA** |
| Placement **(check one per rotation)** | Surface | *X* | **X** | | | **X** | **NA** |
| | Injection | | | **X** | **X** | | **NA** |
| Incorporation after application? **(check one per rotation )** | Yes | | **X** | **X** | **X** | | **NA** |
| | No | *X* | | | | **X** | **NA** |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.*

***Reporting option 1: Pounds of nutrient per acre***

***Phosphorus type (phosphorus P or phosphate $P_2O_5$):***

***Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.):***

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Community of Mt. Calvary (40301011101) | **20** | **140** | **20** | **190** | **10** | **60** | **NA** | **NA** |
| Feldner's Creek-Sheboygan River (40301011103) | **20** | **120** | **20** | **140** | **5** | **60** | **NA** | **NA** |
| Headwaters Sheboygan River (40301011102) | **20** | **140** | **20** | **190** | **5** | **60** | **NA** | **NA** |
| Headwaters South Branch Manitowoc River (40301010401) | **20** | **160** | **20** | **190** | **10** | **70** | **NA** | **NA** |
| Sheboygan Lake-Sheboygan River (40301011104) | **20** | **140** | **20** | **160** | **10** | **70** | **NA** | **NA** |
| Stony Brook-South Branch Manitowoc River (40301010402) | **20** | **130** | **20** | **170** | **5** | **50** | **NA** | **NA** |
| Upper Mullet River (40301010901) | **20** | **140** | **20** | **140** | **5** | **50** | **NA** | **NA** |

*Reporting option 2: Pounds of **fertilizer** per acre*

*Typical N:P:K Ratio =*

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

**The average yields throughout all the sub-watersheds are as follows:**

**Corn grain = 170bu**

**Corn Silage = 15-20T/ac**

**Soybeans = 60 bu**

**Winter Wheat = 75 bu**

**Established Alfalfa = 4-6T/ac**

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Community of Mt. Calvary (40301011101) | **See above** | **170 bu** | **18 tons** | **5 tons** | **NA** |
| Feldner's Creek-Sheboygan River (40301011103) | **See above** | **150 bu** | **12 tons** | **4 tons** | **NA** |
| Headwaters Sheboygan River (40301011102) | **See above** | **190 bu** | **20 tons** | **5 tons** | **NA** |
| Headwaters South Branch Manitowoc River (40301010401) | **See above** | **190 bu** | **20 tons** | **5 tons** | **NA** |
| Sheboygan Lake-Sheboygan River (40301011104) | **See above** | **150 bu** | **15 tons** | **4 tons** | **NA** |

| | | | | | |
|---|---|---|---|---|---|
| Stony Brook-South Branch Manitowoc River (40301010402) | See above | 180 bu | 20 tons | 5 tons | NA |
| Upper Mullet River (40301010901) | See above | 150 bu | 12 tons | 4 tons | NA |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Community of Mt. Calvary (40301011101) | 50 | 50 |
| Feldner's Creek-Sheboygan River (40301011103) | 25 | 75 |
| Headwaters Sheboygan River (40301011102) | 15 | 85 |
| Headwaters South Branch Manitowoc River (40301010401) | 10 | 90 |
| Sheboygan Lake-Sheboygan River (40301011104) | 25 | 75 |
| Stony Brook-South Branch Manitowoc River (40301010402) | 20 | 80 |
| Upper Mullet River (40301010901) | 60 | 40 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | **DAILY** | **SPRING AND FALL** |
| Application Timing | **DAILY** | **SPRING AND FALL** |
| Followed by Incorporation?<br>(Yes or No) | **50% incorporated** | **80% injected or incorporated** |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*

**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*

**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Community of Mt. Calvary (40301011101) | 15T | 50% | solid | 10,000 | 80% | liquid |
| Feldner's Creek-Sheboygan River (40301011103) | 20T | 50% | solid | 12,000 | 80% | liquid |
| Headwaters Sheboygan River (40301011102) | 20T | 50% | solid | 15,000 | 80% | liquid |
| Headwaters South Branch Manitowoc River (40301010401) | 25T | 50% | solid | 10,000 | 80% | liquid |
| Sheboygan Lake-Sheboygan River (40301011104) | 20T | 50% | solid | 12,000 | 80% | liquid |
| Stony Brook-South Branch Manitowoc River (40301010402) | 20T | 50% | solid | 16,000 | 80% | liquid |
| Upper Mullet River (40301010901) | 20T | 50% | solid | 10,000 | 80% | liquid |

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2O_5$)*:

*N concentration*:

**N surface applied liquid and slurry with average 3-5% DM = 5lbs/1000gallons liquid manure**

**N incorporated within 72 hours, liquid and slurry average = 7lbs/1000gallons liquid manure**

**N injected, liquid and slurry manure = 9lbs/1000gallons liquid manure**

**P205 = 4lbs P205/1000 gallons of liquid and slurry manure**

**N surface for solid manure = 4lbs/ton**

**N incorporated within 72 hours = 5lbs/ton**

**N immediately incorporated = 6lbs/ton**

**P2O5 = 5lbs/ton**

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*

**Very little of this watershed practices no till so 5% would be injected in no till fields.**

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | **10** |
| Sweep | **30** |
| Knife | **60** |
| Other *(please specify)* | |

## SOIL PHOSPHORUS (QUESTION 22)

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Community of Mt. Calvary (40301011101) | **30** |
| Feldner's Creek-Sheboygan River (40301011103) | **38** |
| Headwaters Sheboygan River (40301011102) | **48** |
| Headwaters South Branch Manitowoc River (40301010401) | **50** |
| Sheboygan Lake-Sheboygan River (40301011104) | **36** |
| Stony Brook-South Branch Manitowoc River (40301010402) | **42** |
| Upper Mullet River (40301010901) | **42** |

## GRAZING (QUESTIONS 23 – 24)

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

10%

*Question 24. What are the typical practices of a grazing operation?*

| Characteristic | Typical Practice |
|---|---|
| Animal Type | **Dairy** |
| Number of Animals per Acre | **2** |
| Grazing Timing & Duration (Entire Growing Season,<br>Year-Round, Spring Only, etc.) | **Spring, Summer, Fall** |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

**The majority of the cropped acreage in this watershed (all the sub-watersheds in the above tables, not the table below…not in our county) are tiled. I can provide specific tiled information as needed and requested.**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Headwaters Kewaunee River (040301020304) | | |
| Upper Branch River (040301010502) | | |
| Devils River (040301010203) | | |
| Neshota River (040301010204) | | |
| Village of Reedsville-Mud Creek (040301010603) | | |
| Middle Branch River (040301010503) | | |
| School Creek (040301020304) | | |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

**I have multiple years of field and farm specific phosphorus (PTP and PI) and soil loss information, along with detailed maps showing the restricted areas, hydrologic, karst and topographical information. If there is a particular area of concern in which you need more accurate information, I will be happy to share the data I have for that area.**

# Northeast Lakeshore TMDL: Agricultural Land Management Questionnaire for Kewaunee County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 5. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Davina Bonness**
**Organization: Kewaunee County Land & Water Conservation Department**
**Email: bonness.davina@kewauneeco.org**
**Phone: 920-845-8743**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?*

No potatoes are grown in Kewaunee County (that I am aware of). All vegetables are grown in rotation with cash grain cropping.

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

No

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.*** *No*

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

Yes

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 12% | 16% | 23,609 |
| Continuous Corn | 4% | 5% | 8,096 |
| Dairy Rotation | 40% | 54% | 82,976 |
| Potato/Vegetable | 2% | 2% | 3,163 |
| Hay | 6% | 8% | 12,723 |
| Pasture | 11% | 15% | 22,147 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**

Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | Cs | Cs | Oat/A | A | A | A | | |
| Sequence 2 *(if needed)* | | | | | | | | | |
| Sequence 3 *(if needed)* | | | | | | | | | |
| Sequence 4 *(if needed)* | | | | | | | | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Ahnapee River (40301020204) | 100 | | | | |
| Black Creek (40301010201) | 100 | | | | |
| Casco Creek-Kewaunee River (40301020304) | 100 | | | | |
| Headwaters Kewaunee River (40301020301) | 100 | | | | |
| Jambo Creek (40301010103) | 100 | | | | |
| Kewaunee River (40301020305) | 100 | | | | |
| Krok Creek-East Twin River (40301010102) | 100 | | | | |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 100 | | | | |
| Molash Creek-Frontal Lake Michigan (40301010101) | 100 | | | | |
| Rio Creek (40301020202) | 100 | | | | |
| Scarboro Creek (40301020303) | 100 | | | | |
| School Creek (40301020302) | 100 | | | | |
| Silver Creek (40301020203) | 100 | | | | |
| Stony Creek-Frontal Lake Michigan (40301020201) | 100 | | | | |
| Tisch Mills Creek-East Twin River (40301010104) | 100 | | | | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | 5/21-6/7 | 5/31-6/7 | 4 |
| Average Temperature/Moisture Year | 5/7-5/31 | 5/25-5/31 | 4-5 |
| Warm/Dry Year | 5/1-5/7 | 5/15-5/30 | 4 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

*Both*

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | Tilled 1 out of 2 years |
| Continuous Corn | Tilled every year |
| Dairy | Every Year |
| Potato/Vegetable | N/A |

*Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below. This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 60 | 60 | 60 | |
| Fall Vertical till, Spring field cultivate | *25%* | 10 | 10 | 10 | |
| Spring Vertical till | *0%* | 10 | 10 | 10 | |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 5 | 5 | 5 | |
| Fall field cultivate | *50%* | 5 | 5 | 5 | |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | 0 | 0 | 0 | |
| No-till | *25%* | 10 | 10 | 10 | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*
*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Ahnapee River (40301020204) | Black Creek (40301010201) | Casco Creek-Kewaunee River (40301020304) | Headwaters Kewaunee River (40301020301) | Jambo Creek (40301010103) | Kewaunee River (40301020305) | Krok Creek-East Twin River (40301010102) | Mashek Creek-Frontal Lake Michigan (40301020205) | Molash Creek-Frontal Lake Michigan (40301010101) | Rio Creek (40301020202) | Scarboro Creek (40301020303) | School Creek (40301020302) | Silver Creek (40301020203) | Stony Creek-Frontal Lake Michigan (40301020201) | Tisch Mills Creek-East Twin River (40301010104) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 0 | 20 |
| | 16%-30% | *0%* | 50 | 50 | 30 | 50 | 10 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| | >30% | *10%* | 10 | 10 | 50 | 10 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 50 | 10 |
| | No-Till/Zone-Till | *5%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Continuous Corn | 0%-15% | *0%* | 20 | 20 | 20 | 20 | N/A | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | N/A | 20 |
| | 16%-30% | *0%* | 50 | 50 | 50 | 50 | N/A | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | N/A | 50 |
| | >30% | *100%* | 10 | 10 | 10 | 10 | N/A | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | N/A | 10 |
| | No-Till/Zone-Till | *0%* | 10 | 10 | 10 | 10 | N/A | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | N/A | 10 |
| Dairy | 0%-15% | *75%* | 20 | 20 | 20 | 20 | 32 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 0 | 20 |
| | 16%-30% | *25%* | 50 | 50 | 50 | 50 | 30 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| | >30% | *0%* | 10 | 10 | 10 | 10 | 30 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 40 | 10 |
| | No-Till/Zone-Till | *0%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Potato/ Vegetable | 0%-15% | *100%* | | | | | | | | | | | | | | | |
| | 16%-30% | *0%* | | | | | | | | | | | | | | | |
| | >30% | *0%* | | | | | | | | | | | | | | | |
| | No-Till/Zone-Till | *0%* | | | | | | | | | | | | | | | |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Potato/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | x | x | x | n/a | |
| | At-planting | *X* | x | x | x | n/a | |
| | During growing | | | | | n/a | |
| Placement **(check one per rotation)** | Surface | *X* | | | | n/a | |
| | Injection | | x | x | x | n/a | |
| Incorporation after application? **(check one per rotation )** | Yes | | | | | n/a | |
| | No | *X* | x | x | x | n/a | |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.*

*Reporting option 1: Pounds of **nutrient** per acre ----- SEE SPREADSHEET!*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio =*

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Ahnapee River (40301020204) | | | | | | | | |
| Black Creek (40301010201) | | | | | | | | |
| Casco Creek-Kewaunee River (40301020304) | | | | | | | | |
| Headwaters Kewaunee River (40301020301) | | | | | | | | |
| Jambo Creek (40301010103) | | | | | | | | |
| Kewaunee River (40301020305) | | | | | | | | |
| Krok Creek-East Twin River (40301010102) | | | | | | | | |
| Mashek Creek-Frontal Lake Michigan (40301020205) | | | | | | | | |
| Molash Creek-Frontal Lake Michigan (40301010101) | | | | | | | | |
| Rio Creek (40301020202) | | | | | | | | |
| Scarboro Creek (40301020303) | | | | | | | | |
| School Creek (40301020302) | | | | | | | | |
| Silver Creek (40301020203) | | | | | | | | |
| Stony Creek-Frontal Lake Michigan (40301020201) | | | | | | | | |
| Tisch Mills Creek-East Twin River (40301010104) | | | | | | | | |

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Ahnapee River (40301020204) | 170 | 170 | 20 | 3 | |
| Black Creek (40301010201) | 170 | 170 | 20 | 3 | |
| Casco Creek-Kewaunee River (40301020304) | 170 | 170 | 20 | 3 | |
| Headwaters Kewaunee River (40301020301) | 170 | 170 | 20 | 3 | |
| Jambo Creek (40301010103) | 170 | 170 | 20 | 3 | |
| Kewaunee River (40301020305) | 170 | 170 | 20 | 3 | |
| Krok Creek-East Twin River (40301010102) | 170 | 170 | 20 | 3 | |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 170 | 170 | 20 | 3 | |
| Molash Creek-Frontal Lake Michigan (40301010101) | 170 | 170 | 20 | 3 | |
| Rio Creek (40301020202) | 170 | 170 | 20 | 3 | |
| Scarboro Creek (40301020303) | 170 | 170 | 20 | 3 | |
| School Creek (40301020302) | 170 | 170 | 20 | 3 | |
| Silver Creek (40301020203) | 170 | 170 | 20 | 3 | |
| Stony Creek-Frontal Lake Michigan (40301020201) | 170 | 170 | 20 | 3 | |
| Tisch Mills Creek-East Twin River (40301010104) | 170 | 170 | 20 | 3 | |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Ahnapee River (40301020204) | 36 | 64 |
| Black Creek (40301010201) | 27 | 73 |
| Casco Creek-Kewaunee River (40301020304) | 2 | 98 |
| Headwaters Kewaunee River (40301020301) | 0 | 100 |
| Jambo Creek (40301010103) | 20 | 80 |
| Kewaunee River (40301020305) | 5 | 95 |
| Krok Creek-East Twin River (40301010102) | 0 | 100 |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 0 | 100 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 23 | 77 |
| Rio Creek (40301020202) | 0 | 100 |
| Scarboro Creek (40301020303) | 32 | 68 |
| School Creek (40301020302) | 9 | 91 |
| Silver Creek (40301020203) | 18 | 82 |
| Stony Creek-Frontal Lake Michigan (40301020201) | 100 | 0 |
| Tisch Mills Creek-East Twin River (40301010104) | 25 | 75 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | DAILY | 7 months (1-2x per field) |
| Application Timing | Year round | Spring / Fall (with summer applications following alfalfa. |
| Followed by Incorporation? (Yes or No) | 80% of time, no | Yes, except for summer months following alfalfa |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*
**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*
**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Ahnapee River (40301020204) | 10-17 T | 20 | Solid | 11,000 g | 50 | Liquid |
| Black Creek (40301010201) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-12,000 g | Sum*<br>Sp/Fall* | Solid<br>Liquid |
| Casco Creek-Kewaunee River (40301020304) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Headwaters Kewaunee River (40301020301) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Jambo Creek (40301010103) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Kewaunee River (40301020305) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Krok Creek-East Twin River (40301010102) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 10-17 T | 20 | Solid | 7500 g<br>10-18,000 g | "" | Liquid |
| Molash Creek-Frontal Lake Michigan (40301010101) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-15,000 g | "" | Liquid |
| Rio Creek (40301020202) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-12,000 g | "" | Liquid |
| Scarboro Creek (40301020303) | 10-17 T | 20 | Solid | 5-6,000 g<br>10,000 g | "" | Liquid |
| School Creek (40301020302) | 10-17 T | 20 | Solid | 5-6,000 g<br>12-20,000 g | "" | Liquid |
| Silver Creek (40301020203) | 10-17 T | 20 | Solid | 5-6,000 g<br>10-18,000 g | "" | Liquid |
| Stony Creek-Frontal Lake Michigan (40301020201) | 10-17 T | 20 | Solid | No Storages | | |
| Tisch Mills Creek-East Twin River (40301010104) | 10-17 T | 20 | Solid | 5-7,000 g<br>6-12,000 g | "" | Liquid |

***SUMMER APPLICATIONS ARE almost always UNINCORPORATED ONTO ALFALFA**
***SPRING/FALL APPLICATIONS ARE 50-75% (ISH) INCORPORATED**

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.* ***(See Spreadsheet – Tab 2)***

*P concentration (please specify- P or $P_2O_5$)*:
*N concentration*:

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | *50* |
| Sweep | *0* |
| Knife | *50* |
| Other *(please specify)* | |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Ahnapee River (40301020204) | 25.4 |
| Black Creek (40301010201) | 30.8 |
| Casco Creek-Kewaunee River (40301020304) | 38.0 |
| Headwaters Kewaunee River (40301020301) | 30.5 |
| Jambo Creek (40301010103) | 33.8 |
| Kewaunee River (40301020305) | 37.0 |
| Krok Creek-East Twin River (40301010102) | 38.0 |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 30.2 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 30.4 |
| Rio Creek (40301020202) | 30.8 |
| Scarboro Creek (40301020303) | 36.5 |
| School Creek (40301020302) | 42.2 |
| Silver Creek (40301020203) | 26.4 |
| Stony Creek-Frontal Lake Michigan (40301020201) | 24.4 |
| Tisch Mills Creek-East Twin River (40301010104) | 33.6 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

*Question 24. What are the typical practices of a grazing operation?*

| Characteristic | Typical Practice |
|---|---|
| Animal Type | Beef |
| Number of Animals per Acre | 2-3 |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | 9 Months (usually in barn in the winter months) |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation – water only |
|---|---|---|
| Ahnapee River (40301020204) | 10 | 0 |
| Black Creek (40301010201) | 10 | 0 |
| Casco Creek-Kewaunee River (40301020304) | 20 | 0 |
| Headwaters Kewaunee River (40301020301) | 30 | 0 |
| Jambo Creek (40301010103) | 2 | 0 |
| Kewaunee River (40301020305) | 30 | 0 |
| Krok Creek-East Twin River (40301010102) | 30 | 1% |
| Mashek Creek-Frontal Lake Michigan (40301020205) | 30 | 1% |
| Molash Creek-Frontal Lake Michigan (40301010101) | 50 | 0 |
| Rio Creek (40301020202) | 30 | 0 |
| Scarboro Creek (40301020303) | 30 | 0 |
| School Creek (40301020302) | 30 | 0 |
| Silver Creek (40301020203) | 5 | 0 |
| Stony Creek-Frontal Lake Michigan (40301020201) | 5 | 0 |
| Tisch Mills Creek-East Twin River (40301010104) | 30 | 0 |
| | | |
| | | |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Manitowoc County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 6. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Tony Smith, Bruce Riesterer, Jerry Halverson**
**Organization: Manitowoc County Soil & Water Conservation Dept.**
**Email: tonysmith@co.manitowoc.wi.us**
**Phone: 920-683-4183**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own?*

Yes, mainly grown in rotation. Snapbeans, red beets and carrots are the primary vegetables grown in Manitowoc County - no potatoes.

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below.*

Remove potatoes from the potato/vegetable rotation.

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

Some of the hay and pasture acres are alfalfa in the dairy rotation or idle non-harvested grass areas.

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 14% | 20% | 51,818 |
| Continuous Corn | 2% | 4% | 9,366 |
| Dairy Rotation | ~~32%~~ 35% | ~~47%~~ 52% | ~~121,656~~ 134,656 |
| ~~Potato~~/Vegetable | 1% | 2% | 5,633 |
| Hay | ~~7%~~ 3% | ~~10%~~ 5% | ~~25,984~~ 12,975 |
| Pasture | ~~12%~~ 4% | ~~17%~~ 6% | ~~45,033~~ 15,569 |
| Non-harvested CRP & other idle grassland | 8% | 11% | 28,544 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*
*No*

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**
Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| **Typical Dairy Sequence(s)** | **Year** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** *(if needed)* | **7** *(if needed)* | **8** *(if needed)* | **9** *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | Cs | Cg | Cs | A | A | A | | |
| Sequence 2 *(if needed)* | | | | | | | | | |
| Sequence 3 *(if needed)* | | | | | | | | | |
| Sequence 4 *(if needed)* | | | | | | | | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Cato Falls-Manitowoc River (40301010603) | 100% | | | | |
| Cedar Creek (40301010405) | 100% | | | | |
| Cedar Lake (40301011105) | 100% | | | | |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 100% | | | | |
| Devils River (40301010202) | 100% | | | | |
| East Twin River (40301010105) | 100% | | | | |
| Francis Creek-West Twin River (40301010204) | 100% | | | | |
| Jambo Creek (40301010103) | 100% | | | | |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 100% | | | | |
| Lower Branch River (40301010503) | 100% | | | | |
| Manitowoc River (40301010605) | 100% | | | | |
| Meeme River (40301010801) | 100% | | | | |
| Middle Branch River (40301010502) | 100% | | | | |
| Molash Creek-Frontal Lake Michigan (40301010101) | 100% | | | | |
| Pine Creek-Frontal Lake Michigan (40301010702) | 100% | | | | |
| Point Creek (40301010703) | 100% | | | | |
| Silver Creek (40301010701) | 100% | | | | |
| Tisch Mills Creek-East Twin River (40301010104) | 100% | | | | |
| Upper Pigeon Creek (40301010802) | 100% | | | | |
| Village of Reedsville-Mud Creek (40301010601) | 100% | | | | |
| Village of St. Nazianz-Mud Creek (40301010602) | 100% | | | | |
| West Twin River (40301010205) | 100% | | | | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | May 25 | October 20 | 4 |
| Average Temperature/Moisture Year | May 15 | October 1 | 5 |
| Warm/Dry Year | May 5 | September 20 | 5 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Primary tillage is fall.

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | 2 of 4 |
| Continuous Corn | 2 of 4 |
| Dairy | 3 of 7 |
| Vegetable | 5 of 5 |

*Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below. This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 30 | 30 | 50 | 5 |
| Fall Vertical till, Spring field cultivate | *25%* | 0 | 0 | 5 | 5 |
| Spring Vertical till | *0%* | 10 | 10 | 5 | 0 |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 40 | 30 | 30 | 90 |
| Fall field cultivate | *50%* | 0 | 5 | | 0 |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | 0 | 0 | 0 | 0 |
| No-till | *25%* | 10 | 20 | 5 | 0 |
| Other *(please specify)* Spring moldboard, field cultivate x2 | *0%* | 10 | 5 | 5 | 0 |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the **two** tables below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| Crop Rotation | Crop Residue Class (% of crop residue) | *EXAMPLE (% of area within each crop residue class)* | Cato Falls-Manitowoc River (40301010603) | Cedar Creek (40301010405) | Cedar Lake (40301011105) | Centerville Creek-Frontal Lk MI (40301010704) | Devils River (40301010202) | East Twin River (40301010105) | Francis Creek-West Twin River (40301010204) | Jambo Creek (40301010103) | Little Manitowoc River-Frontal Lk MI (40301010604) | Lower Branch River (40301010503) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | 16%-30% | *0%* | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | >30% | *10%* | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| | No-Till/Zone-Till | *5%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Continuous Corn | 0%-15% | *0%* | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| | 16%-30% | *0%* | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| | >30% | *100%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | No-Till/Zone-Till | *0%* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Dairy | 0%-15% | *75%* | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| | 16%-30% | *25%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | >30% | *0%* | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | No-Till/Zone-Till | *0%* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Vegetable | 0%-15% | *100%* | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 16%-30% | *0%* | | | | | | | | | | |
| | >30% | *0%* | | | | | | | | | | |
| | No-Till/Zone-Till | *0%* | | | | | | | | | | |

| Crop Rotation | Crop Residue Class (% of crop residue) | *EXAMPLE (% of area within each crop residue class)* | Lower Branch River (40301010503) | Manitowoc River (40301010605) | Meeme River (40301010801) | Middle Branch River (40301010502) | Molash Creek-Frontal Lk MI (40301010101) | Pine Creek-Frontal Lk MI (40301010702) | Point Creek (40301010703) | Silver Creek (40301010701) | Tisch Mills Creek-East Twin River (40301010104) | Upper Pigeon Creek (40301010802) | Village of Reedsville-Mud Creek (40301010601) | Village of St. Nazianz-Mud Creek (40301010602) | West Twin River (40301010205) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | 16%-30% | *0%* | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | >30% | *10%* | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| | No-Till/ Zone-Till | *5%* | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Continuous Corn | 0%-15% | *0%* | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| | 16%-30% | *0%* | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| | >30% | *100%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | No-Till/ Zone-Till | *0%* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Dairy | 0%-15% | *75%* | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| | 16%-30% | *25%* | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | >30% | *0%* | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | No-Till/ Zone-Till | *0%* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Potato/ Vegetable | 0%-15% | *100%* | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 16%-30% | *0%* | | | | | | | | | | | | | |
| | >30% | *0%* | | | | | | | | | | | | | |
| | No-Till/ Zone-Till | *0%* | | | | | | | | | | | | | |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | X | X | X | X | X |
| | At-planting | *X* | X | X | X | | X |
| | During growing | | X | X | X | X | X |
| Placement **(check one per rotation)** | Surface | *X* | X | | | X | X |
| | Injection | | | X | X | | |
| Incorporation after application? **(check one per rotation )** | Yes | | X | X | X | | X |
| | No | *X* | | | | X | |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilize**r per acre (option 2). Please provide more information about the option you choose below.*

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio =*

| | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Vegetable – Snap Beans | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *12* | *30* | *60* | *20* | *50* |
| Cato Falls-Manitowoc River (40301010603) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Cedar Creek (40301010405) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Cedar Lake (40301011105) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Devils River (40301010202) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| East Twin River (40301010105) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Francis Creek-West Twin River (40301010204) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Jambo Creek (40301010103) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Lower Branch River (40301010503) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Manitowoc River (40301010605) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Meeme River (40301010801) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Middle Branch River (40301010502) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Pine Creek-Frontal Lake Michigan (40301010702) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Point Creek (40301010703) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Silver Creek (40301010701) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Tisch Mills Creek-East Twin River (40301010104) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Upper Pigeon Creek (40301010802) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Village of Reedsville-Mud Creek (40301010601) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| Village of St. Nazianz-Mud Creek (40301010602) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |
| West Twin River (40301010205) | 70 | 170 | 70 | 170 | 40 | 75 | 50 | 43 |

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Vegetable – Snap Beans |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Cato Falls-Manitowoc River (40301010603) | 180 bu | 180 bu | 25 tons @ 65% moisture | 5 tons @ 15% moisture | 6 tons |
| Cedar Creek (40301010405) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Cedar Lake (40301011105) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Devils River (40301010202) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| East Twin River (40301010105) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Francis Creek-West Twin River (40301010204) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Jambo Creek (40301010103) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Lower Branch River (40301010503) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Manitowoc River (40301010605) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Meeme River (40301010801) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Middle Branch River (40301010502) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Molash Creek-Frontal Lake Michigan (40301010101) | 160 bu | 160 bu | 20 tons | 4 tons | 6 tons |
| Pine Creek-Frontal Lake Michigan (40301010702) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Point Creek (40301010703) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Silver Creek (40301010701) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Tisch Mills Creek-East Twin River (40301010104) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Upper Pigeon Creek (40301010802) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Village of Reedsville-Mud Creek (40301010601) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| Village of St. Nazianz-Mud Creek (40301010602) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |
| West Twin River (40301010205) | 180 bu | 180 bu | 25 tons | 5 tons | 6 tons |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Cato Falls-Manitowoc River (40301010603) | 10 | 90 |
| Cedar Creek (40301010405) | 10 | 90 |
| Cedar Lake (40301011105) | 5 | 95 |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 5 | 95 |
| Devils River (40301010202) | 10 | 90 |
| East Twin River (40301010105) | 5 | 95 |
| Francis Creek-West Twin River (40301010204) | 5 | 95 |
| Jambo Creek (40301010103) | 15 | 85 |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 10 | 90 |
| Lower Branch River (40301010503) | 5 | 95 |
| Manitowoc River (40301010605) | 10 | 90 |
| Meeme River (40301010801) | 5 | 95 |
| Middle Branch River (40301010502) | 5 | 95 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 5 | 95 |
| Pine Creek-Frontal Lake Michigan (40301010702) | 5 | 95 |
| Point Creek (40301010703) | 5 | 95 |
| Silver Creek (40301010701) | 5 | 95 |
| Tisch Mills Creek-East Twin River (40301010104) | 5 | 95 |
| Upper Pigeon Creek (40301010802) | 0 | 100 |
| Village of Reedsville-Mud Creek (40301010601) | 5 | 95 |
| Village of St. Nazianz-Mud Creek (40301010602) | 5 | 95 |
| West Twin River (40301010205) | 10 | 90 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm | | |
|---|---|---|---|---|
| Application Frequency | DAILY | After Winter Wheat | After Corn & Soybeans | After 2nd & 3rd Crop Alfalfa |
| Application Timing | Daily | Early August | Mid-September thru December | June - August |
| Followed by Incorporation? (Yes or No) | No | Yes | Yes | No |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*

**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*

**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE – After Corn, Soybeans & Wheat | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Cato Falls-Manitowoc River (40301010603) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Cedar Creek (40301010405) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Cedar Lake (40301011105) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Centerville Creek-Frontal Lk MI (40301010704) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Devils River (40301010202) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| East Twin River (40301010105) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Francis Creek-West Twin River (40301010204) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Jambo Creek (40301010103) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Little Manitowoc River-Frontal Lk MI (40301010604) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Lower Branch River (40301010503) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Manitowoc River (40301010605) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Meeme River (40301010801) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Middle Branch River (40301010502) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Molash Creek-Frontal Lk MI (40301010101) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Pine Creek-Frontal Lk MI (40301010702) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Point Creek (40301010703) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Silver Creek (40301010701) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Tisch Mills Creek-East Twin River (40301010104) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Upper Pigeon Creek (40301010802) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Village of Reedsville-Mud Creek (40301010601) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| Village of St. Nazianz-Mud Creek (40301010602) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |
| West Twin River (40301010205) | 10 tons | 4 | Semi-Solid | 15,000 gals | 85 | Liquid |

Note: Stored manure applied after 2nd & 3rd crop alfalfa = 8,000 liquid gallons/acre.

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2O_5$)*: 3 ppm P2O5/1000 gallons
*N concentration*: 7 ppm/1000 gallons

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices. 50% of no-till acres*

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| **Injection method** | **% of Dairy acres receiving manure by injection** |
|---|---|
| Narrow knife | *5* |
| Agressive Sweep | *80* |
| Aerway | *5* |
| Ripple Coulter | *10* |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Cato Falls-Manitowoc River (40301010603) | 34 |
| Cedar Creek (40301010405) | 34 |
| Cedar Lake (40301011105) | 34 |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 34 |
| Devils River (40301010202) | 34 |
| East Twin River (40301010105) | 34 |
| Francis Creek-West Twin River (40301010204) | 34 |
| Jambo Creek (40301010103) | 34 |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 34 |
| Lower Branch River (40301010503) | 34 |
| Manitowoc River (40301010605) | 34 |
| Meeme River (40301010801) | 34 |
| Middle Branch River (40301010502) | 34 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 34 |
| Pine Creek-Frontal Lake Michigan (40301010702) | 34 |
| Point Creek (40301010703) | 34 |
| Silver Creek (40301010701) | 34 |
| Tisch Mills Creek-East Twin River (40301010104) | 34 |
| Upper Pigeon Creek (40301010802) | 34 |
| Village of Reedsville-Mud Creek (40301010601) | 34 |
| Village of St. Nazianz-Mud Creek (40301010602) | 34 |
| West Twin River (40301010205) | 34 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

32%

*Question 24. What are the typical practices of a grazing operation?*

| **Characteristic** | **Typical Practice** | |
|---|---|---|
| Animal Type | Dairy | Beef |
| Number of Animals per Acre | 1 Animal Unit/Acre | 2 Animal Units/Acre |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | May-November | May-November |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Cato Falls-Manitowoc River (40301010603) | 33 | 0 |
| Cedar Creek (40301010405) | 33 | 0 |
| Cedar Lake (40301011105) | 33 | 1 |
| Centerville Creek-Frontal Lake Michigan (40301010704) | 33 | 0 |
| Devils River (40301010202) | 33 | 0 |
| East Twin River (40301010105) | 33 | 0 |
| Francis Creek-West Twin River (40301010204) | 33 | 0 |
| Jambo Creek (40301010103) | 33 | 0 |
| Little Manitowoc River-Frontal Lake Michigan (40301010604) | 33 | 0 |
| Lower Branch River (40301010503) | 33 | 0 |
| Manitowoc River (40301010605) | 33 | 0 |
| Meeme River (40301010801) | 33 | 0 |
| Middle Branch River (40301010502) | 33 | 0 |
| Molash Creek-Frontal Lake Michigan (40301010101) | 33 | 0 |
| Pine Creek-Frontal Lake Michigan (40301010702) | 33 | 0 |
| Point Creek (40301010703) | 33 | 0 |
| Silver Creek (40301010701) | 33 | 0 |
| Tisch Mills Creek-East Twin River (40301010104) | 33 | 0 |
| Upper Pigeon Creek (40301010802) | 33 | 2 |
| Village of Reedsville-Mud Creek (40301010601) | 33 | 0 |
| Village of St. Nazianz-Mud Creek (40301010602) | 33 | 0 |
| West Twin River (40301010205) | 33 | 0 |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*
N/A

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Ozaukee County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 7. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Jeffrey P Bell**
**Organization: Ozaukee County Land & Water Management Department**
**Email: jbell@co.ozaukee.wi.us**
**Phone: 262-284-8274**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans. Jeff Bell, Cg-B or 1Cg-SB

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation. Jeff Bell, C

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn. Jeff Bell, Cg-Cs-4Alf or Cg – Cs – P/o's – 4Alf

4. Potato/Vegetable – Potato and vegetable plantings alternate each year. In some cases, a vegetable is grown for two years followed by potatoes. Vegetables commonly planted are sweet corn, beans, peas, carrots, peppers, onions, and cucumbers. Jeff Bell, even though we have one cannery in the watershed and one just outside in our county. The only vegetable crops grown in significant acres are Snap-Beans & Pea's.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas. Jeff Bell, H or Alf

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present. Jeff Bell, Past

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own? Potatoes are not grown in Ozaukee County. Or at least not in these watersheds. Snap Beans and some peas are the only significant vegetable crops grown. By state rules they can only be planted in a rotation that has a space of three or more years before being planted in the same field. This is especially true if agricultural waste and/or human sludge is applied.*

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below. You could add a bunch, it all depends on how picky you want to be. One factor that is coming into play in the last couple of years is "Cover Crops".*

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.*** *No*

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 30% | 39% | 11,791 |
| Continuous Corn | 2% | 2% | 605 |
| Dairy Rotation | 28% | 45% | 13,605 |
| Bean & Pea/ Vegetable | 2% | 2% | 605 |
| Hay | 2% | 2% | 605 |
| Pasture | 10% | 10% | 3,024 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*

We have done the transect survey consistently every year. The problem is that we don't have the time to break out the three HUC 12 watersheds, nor can we say the info would work in the equations as we never ran any reports off the transect survey to date.

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**

Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | Cs | Cs/Alf | Alf | Alf | Alf | Alf | Cg | |
| Sequence 2 *(if needed)* | Cs | Cs | SB | WW | P/O | Alf | Alf | Alf | |
| Sequence 3 *(if needed)* | Cs cc | Cs cc | SB | WW | P/O | Alf | Alf | Alf | |
| Sequence 4 *(if needed)* | Cs cc | Cs cc | WW | SB | Alf | Alf | Alf | Cg | |
| Sequence 5 *(if needed)* | | | | | | | | | |

Cc = cover crop (usually Cereal Rye) SB = Soybeans P/O = pea's/Oats

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Sauk Creek (40301011204) | 25 | 50 | 15 | 10 | |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 25 | 50 | 15 | 10 | |
| City of Belgium (40301011002) | 10 | 50 | 25 | 15 | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | 7/1 | 6/14 | 1 first year, 3-4 cuttings following hay years |
| Average Temperature/Moisture Year | 6/1 | 6/7 | 2 first year, 3-4 cuttings following hay years |
| Warm/Dry Year | 6/1 | 6/1 | 2 first year, 3-4 cuttings following hay years |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Mainly Fall, but more no-till is showing up with cover crops lately

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | 1 out of 4 years, mainly with soybeans |
| Continuous Corn | Never |
| Dairy | 1 out of 6 years, associated with ww or SB |
| Snap beans & Sweet Peas/Vegetable | Never |

*<u>Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below.</u> This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Potato/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 50 | 40 | 40 | 70 |
| Fall Vertical till, Spring field cultivate | *25%* | 50 | 40 | 40 | 15 |
| Spring Vertical till | *0%* | 0 | 0 | 0 | 0 |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 0 | 0 | 0 | 0 |
| Fall field cultivate | *50%* | 0 | 0 | 0 | 0 |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | 0 | 0 | 0 | 15 |
| No-till | *25%* | 0 | 20 | 20 | 0 |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable acreage with after-harvest crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*

*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

***Residue After Planting***

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Sauk Creek (40301011204) | Sucker Creek-Frontal Lake Michigan (40301011203) | City of Belgium (40301011002) |
|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 25 | 25 | 30 |
| | 16%-30% | *0%* | 30 | 30 | 35 |
| | >30% | *10%* | 50 | 40 | 30 |
| | No-Till/Zone-Till | *5%* | 5 | 5 | 5 |
| Continuous Corn | 0%-15% | *0%* | 25 | 25 | 25 |
| | 16%-30% | *0%* | 50 | 50 | 50 |
| | >30% | *100%* | 20 | 20 | 20 |
| | No-Till/Zone-Till | *0%* | 5 | 5 | 5 |
| Dairy | 0%-15% | *75%* | 40 | 40 | 40 |
| | 16%-30% | *25%* | 15 | 15 | 15 |
| | >30% | *0%* | 40 | 40 | 40 |
| | No-Till/Zone-Till | *0%* | 5 | 5 | 5 |
| Potato/ Vegetable | 0%-15% | *100%* | 100 | 100 | 100 |
| | 16%-30% | *0%* | 0 | 0 | 0 |
| | >30% | *0%* | 0 | 0 | 0 |
| | No-Till/Zone-Till | *0%* | 0 | 0 | 0 |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | X | x | X | | X |
| | At-planting | *X* | X | X | X | x | X |
| | During growing | | X | X | X | | X |
| Placement **(check one per rotation)** | Surface | *X* | | | | X | |
| | Injection | | X | X | X | | X |
| Incorporation after application? **(check one per rotation )** | Yes | | x | X | x | | |
| | No | *X* | | | | X | x |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.*

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*: Reporting on liquid
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*: Reporting on liquid

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio* = Not reporting on Solid Fertilizer

*** Making assumptions on a whole rotation is just wrong. Each crop is very different. This is simply bad info to put in a model.

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Potato/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *120* | *30* | *60* | *20* | *50* |
| Sauk Creek (40301011204) | 60 | 160 | 60 | **160** | 30 | **100** | 30 | 60 |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 60 | 160 | 60 | **160** | 30 | **100** | 30 | 60 |
| City of Belgium (40301011002) | 60 | 160 | 60 | **160** | 30 | **100** | 30 | 60 |

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Potato/ Vegetable |
| *EXAMPLE* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Sauk Creek (40301011204) | 160 | 160 | 15 | 5-6 | No clue |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 160 | 160 | 15 | 5-6 | No Clue |
| City of Belgium (40301011002) | 160 | 160 | 15 | 5-6 | No Clue |

*** Making assumptions on a whole rotation yields is just wrong. Each crop is very different. This is simply bad info to put in a model.

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Sauk Creek (40301011204) | 20 | 80 |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 20 | 80 |
| City of Belgium (40301011002) | 0 | 100 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm |
|---|---|---|
| Application Frequency | DAILY | Twice per year |
| Application Timing | Daily | Spring & Fall |
| Followed by Incorporation? (Yes or No) | No | Yes |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*
**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*
**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).*

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Sauk Creek (40301011204) | 10 ton | 0 | Solid | 15,000 gal | 90 | Liquid |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 10 ton | 0 | Solid | 15,000 gal | 90 | Liquid |
| City of Belgium (40301011002) | 5 ton | 0 | solid | 10,000 gal | 90 | Liquid |

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.* No

*P concentration (please specify- P or $P_2O_5$)*: No
*N concentration*: No

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.*
0%

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.*

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | *30* |
| Sweep | *30* |
| Knife | *40* |
| Other *(please specify)* | |

**SOIL PHOSPHORUS (QUESTION 22)**
An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-

summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Sauk Creek (40301011204) | 30 |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 30 |
| City of Belgium (40301011002) | 30 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed? 70%*

*Question 24. What are the typical practices of a grazing operation?*

| Characteristic | Typical Practice |
|---|---|
| Animal Type | Cattle, horses, goats |
| Number of Animals per Acre | 2 |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | Year-Round |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Sauk Creek (40301011204) | 95 - 100 | 0 |
| Sucker Creek-Frontal Lake Michigan (40301011203) | 95 - 100 | 0 |
| City of Belgium (40301011002) | 95 - 100 | 0 |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*

# Northeast Lakeshore TMDL:
# Agricultural Land Management Questionnaire for Sheboygan County

**BACKGROUND**

The Wisconsin Department of Natural Resources, with support from the U.S. Environmental Protection Agency, has initiated a Total Maximum Daily Load (TMDL) study for nutrient- and sediment-impaired waters in the Northeast Lakeshore (NEL) TMDL. As part of this effort, the Soil and Water Assessment Tool (SWAT) watershed model will be used to simulate runoff volumes and phosphorus and sediment loading to surface waters from nonpoint sources, including runoff from agricultural lands.

Inputs for the SWAT model setup include estimates of variables describing the agricultural land management practices used throughout the modeled area. Practices are defined in *management tables*. A management table describes one specific combination of planting, tillage, fertilizer/manure application, and harvest practices applied to a portion of the modeled area (see Table 1). For the NEL SWAT model, several different management tables will be prepared to capture variation in agricultural practices across the basins that make up Wisconsin's NE lakeshore.

**Table 8. Example SWAT agricultural land management table.**

| Year | Month | Day | Operation | Type | Amount |
|---|---|---|---|---|---|
| 1 | May | 3 | Till | Disk Plow | - |
| 1 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 1 | May | 15 | Plant | Corn Grain | - |
| 1 | October | 15 | Harvest | Corn Grain | - |
| 1 | October | 30 | Till | Chisel Plow | - |
| 2 | May | 3 | Till | Disk Plow | - |
| 2 | May | 15 | Fertilizer | 9:23:30 | 200 lbs/ac |
| 2 | May | 15 | Plant | Soybean | - |
| 2 | October | 15 | Harvest | Soybean | - |
| 2 | October | 30 | Till | Chisel Plow | - |

**INSTRUCTIONS**

This document contains 24 questions on agricultural management practices in your county. Your responses will be used to guide SWAT model setup. SWAT model output will be used to calculate TMDL load allocations and reductions needed to meet water quality standards. Accurate inputs for SWAT modeling are therefore critical for generating realistic estimates of phosphorus/sediment load reductions. **For this phase of the TMDL study, we are not requesting information on agricultural management down to the scale of individual farms or fields. Most questions in this survey ask for a description of average practices for your county's 12-digit hydrologic units (HUC12s).** HUC12 boundaries correspond to the subwatersheds defined in the NEL SWAT model and are displayed for reference in 1) Attachment A and 2) a web-based map. More detailed information may be requested at a later time for site-scale TMDL implementation planning.

*Tip 1: Unless specified, answer questions based on average practices and conditions in the last 5 years.

*Tip 2: While filling out this survey, consider seeking input from others as well (agronomists, UW Extension, agricultural agent etc.). **Additionally, please contact kimberly.oldenborg@wisconsin.gov or call 608-266-7037 if you have questions about this survey or would like to set up a meeting to discuss this survey.**

Please prepare responses directly in this file and deliver by **June 28th, 2019** in electronic format (Word or PDF) via email to:

Kim Oldenborg, WDNR
kimberly.oldenborg@wisconsin.gov
608-266-7037

I thank you in advance for taking the time to provide us with agricultural land management practices in your county. I look forward to working together to improve water quality in Wisconsin's northeast lakeshore basins!

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*PLEASE ENTER YOUR NAME AND CONTACT INFORMATION IN THE SPACE BELOW*

**Respondent Name: Christopher Ertman**
**Organization: Sheboygan County Planning and Conservation**
**Email: chris.ertman@sheboygancounty.com**
**Phone: (920) 459-1375**

**AGRICULTURAL LAND USE (QUESTIONS 1 – 5)**

Six general crop rotations have been identified in the NE Lakeshore TMDL area using the Wiscland 2 data layer. See below for descriptions of these crop rotations as defined in Wiscland 2.

1. Cash Grain – Corn grain and soybean plantings alternate each year. In some cases, corn grain is grown for two years in a row followed by soybeans. Occasionally, a grain (e.g., wheat, barley, or oats) will be planted in place of soybeans.

2. Continuous Corn - Corn grain or corn silage grown every year in a 6-year rotation.

3. Dairy – Areas with rotations of corn grain, corn silage, and alfalfa. Typically, a cover crop between corn and alfalfa years. Occasionally, soybeans or a grain (e.g., wheat, barley, or oats) are planted in place of corn.

4. Cash grain/Vegetable – Corn grain, soybeans, winter wheat and vegetable plantings alternate each year. Vegetables commonly planted are sweet corn, beans, and peas.

5. Continuous Hay – Lands covered by planted perennial herbaceous vegetation (legumes and grasses) and harvested for use as livestock forage. May include mowed areas.

6. Continuous Pasture - Lands covered by herbaceous vegetation, primarily perennial grasses, used for grazing livestock. Kentucky bluegrass is the most common pasture grass, but many other grass species are grazed. A variety of forbs may be present.

The crop rotation map shown in Attachment A and the web-based map will be used to determine the rotation acreages in model subwatersheds. Modeled acreages and yields will be verified using estimates of acres harvested and crop yields reported by USDA National Agricultural Statistics Service by county. Your input is needed to further verify rotation definitions and maps.

*Question 1. In your county, are potatoes and vegetables usually grown in rotation with other cash grains or on their own? No potatoes are grown. Sweet corn, canning peas, and snap beans in rotation with other cash grains.*

*Question 2. Based on your knowledge of crop rotations in your county, would you add any rotations to the six listed above? If yes, please describe below. No. Just modify the Potato/Vegetable to Cash Grain/Vegetable*

*Question 3. Attachment A and the web-based map display the six general crop rotations in your county. Do any areas stand out as being misclassified?* ***When looking for misclassified areas, please focus on the "bigger picture" and avoid verifying rotations on the field level.***

*Question 4. The table below displays the area of each rotation as a percentage of total county area and agricultural area. Do these percentages seem to accurately represent the area of each rotation in your county?*

No. I have adjusted the percentages.

| Rotation | % of county area | % of agricultural area | rotation area (acres) |
|---|---|---|---|
| Cash Grain | 18% | 25% | 36,638 |
| Continuous Corn | 1% | 2% | 3,647 |
| Dairy Rotation | 27% | 57% | 83,605 |
| Cash grain/Vegetable | 3% | 5% | 7,750 |
| Hay | 4% | 6% | 9,447 |
| Pasture | 6% | 5% | 7,179 |

**Note: Areas outside the NE Lakeshore TMDL were excluded from percent area calculations.*

*Question 5. Rotation maps can also be verified using Cropland Transect Survey data. We have acquired 2004 transect data from the Conservation Technology Information Center (CTIC). Has your county conducted crop and tillage transect surveys since 2004? If yes, can you share recently collected transect data for this project?*
No.

**DAIRY CROP SEQUENCES (QUESTION 6 - 7)**
Your input is needed to refine the sequence of crops planted in each year of the Dairy rotation.

*Question 6. In the table below, please describe the sequence(s) of corn grain (Cg), corn silage (Cs), alfalfa (A), Soybean (S), Winter Wheat (Ww), and/or oats (O) in a typical dairy rotation. This table will be used to determine if the Dairy rotation should be modeled using one single crop sequence or if multiple Dairy rotations should be defined.* ***Please focus on sequences with a significant acreage (at least 10% of the total dairy acres in a HUC12).***

| Typical Dairy Sequence(s) | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 *(if needed)* | 7 *(if needed)* | 8 *(if needed)* | 9 *(if needed)* |
| *EXAMPLE* | *Cs* | *Cs* | *Cs* | *Cs* | *A* | *A* | | | |
| Sequence 1 | Cs | S | Cg | S | Cs | A | A | A | |
| Sequence 2 *(if needed)* | Cs | Ww | A | A | A | | | | |
| Sequence 3 *(if needed)* | Cs | A | A | A | | | | | |
| Sequence 4 *(if needed)* | | | | | | | | | |
| Sequence 5 *(if needed)* | | | | | | | | | |

*Question 7. If more than one rotation is typical in your county, please use the table below to estimate the percentage of your county's Dairy acres using the crop sequences listed above by HUC12 subwatershed.*

| HUC12 | % Dairy Sequence 1 | % Dairy Sequence 2 | % Dairy Sequence 3 | % Dairy Sequence 4 | % Dairy Sequence 5 |
|---|---|---|---|---|---|
| *EXAMPLE* | *90 %* | *10 %* | *0 %* | *0 %* | *0 %* |
| Barr Creek-Frontal Lake Michigan (40301011202) | 80% | 10% | 10% | | |
| Black River (40301011201) | 80% | 10% | 10% | | |
| City of Belgium (40301011002) | 80% | 10% | 10% | | |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 80% | 10% | 10% | | |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 80% | 10% | 10% | | |
| Lower Mullet River (40301010903) | 80% | 10% | 10% | | |
| Lower Onion River (40301011004) | 80% | 10% | 10% | | |
| Lower Pigeon Creek (40301010804) | 80% | 10% | 10% | | |
| Mid Onion River (40301011003) | 80% | 10% | 10% | | |
| Middle Mullet River (40301010902) | 80% | 10% | 10% | | |
| Middle Pigeon Creek (40301010803) | 80% | 10% | 10% | | |
| Otter Creek-Sheb. R. (40301011107) | 80% | 10% | 10% | | |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 80% | 10% | 10% | | |
| Sheboygan Lake-Sheboygan River (40301011104) | 80% | 10% | 10% | | |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 80% | 10% | 10% | | |
| Upper Onion River (40301011001) | 80% | 10% | 10% | | |
| Upper Pigeon Creek (40301010802) | 80% | 10% | 10% | | |

**PLANTINGS AND HARVESTS (QUESTION 8)**

SWAT management tables ask for planting and harvest dates for each crop planted. For the NEL SWAT model, management tables will initially be setup using average planting and harvest dates for the Basin. We recognize that dates can vary widely from year-to-year depending on temperature and moisture conditions. The initial planting dates will be varied as part of model sensitivity analysis to evaluate how much of an effect they have on modeled runoff and phosphorus/sediment loads. Your input is needed to determine average, early, and late planting and harvest dates in the NEL and to determine an appropriate number of cuttings per year for the Continuous Hay rotation.

*Question 8. In the table below, please estimate average planting dates (50% of crop planted) in your county in cool/wet, average, and warm/dry years. Also, please estimate the typical number of hay cuttings.*

| Temperature/Moisture Condition | Average Planting Date | Average Harvest Date | Number of Hay Cuttings |
|---|---|---|---|
| Cool/Wet Year | Jun 6 | Nov 15 | 3 |
| Average Temperature/Moisture Year | May 20 | Oct 21 | 5 |
| Warm/Dry Year | May 10 | Oct 1 | 4 |

**TILLAGE AND CROP RESIDUE (QUESTIONS 9 – 12)**

When defining tillage practices in SWAT management tables, key variables are the timing of tillage, depth of tillage, and amount of protective crop residue remaining on the surface following tillage. Your input is needed to determine appropriate tillage timing, tillage depth, and residue levels for each crop rotation. Tillage settings will also be informed by Cropland Transect Survey data. If you have conducted transect surveys since 2004, please provide the transect data for this project (see question 5).

*Question 9. In your county, are fields typically tilled in the spring, fall, or both?*

Both.

*Question 10. Sometimes landowners identify fields as no-till, when they in fact do receive some tillage. Please describe the frequency of tillage on no-till fields.*

| Crop Rotation | # of years tilled in a rotation |
|---|---|
| *Example* | *Tilled 1 out of every 6 years* |
| Cash Grain | Tilled 3 out of 4 years;3/4 |
| Continuous Corn | Tilled every year |
| Dairy | Tilled 3 out of 7 years |
| Cash Grain/Vegetable | Tilled every year |

*<u>Question 11. Please estimate the % of each rotation area that uses the tillage strategies listed below.</u> This table will be used to determine tillage timing and depth.*

| Tillage Strategy | % of rotation area using tillage strategy | | | | |
|---|---|---|---|---|---|
| | ***Example*** | **Continuous Corn** | **Cash Grain** | **Dairy** | **Cash Grain/Vegetable** |
| Fall Chisel plow, Spring field cultivate x2 | *0%* | 55% | 20% | 35% | 50% |
| Fall Vertical till, Spring field cultivate | *25%* | 0% | 0% | 0% | 0% |
| Spring Vertical till | *0%* | 0% | 5% | 2% | 0% |
| Fall moldboard plow, Spring field cultivate x2 | *0%* | 10% | 3% | 15% | 10% |
| Fall field cultivate | *50%* | 0% | 0% | 0% | 0% |
| Fall disk & chisel plow, Spring field cultivate x2 | *0%* | 0% | 0% | 0% | 0% |
| No-till | *25%* | 0% | 25% | 10% | 10% |
| Fall Vertical till, Spring Vertical till | *0%* | 10% | 7% | 3% | 10% |
| Fall Chisel plow, Spring field cultivate x1 | *0%* | 25% | 40% | 35% | 20% |
| Other *(please specify)* | *0%* | | | | |

*Question 12. In the table below, please estimate the percentage of your county's Cash Grain, Continuous Corn, Dairy, and Cash grain/Vegetable acreage with after-planting crop residue levels of 0%-15%, 16%-30%, >30%, and percentage under No-Till/Zone-Till by HUC12 subwatershed.*
*This table will be used to determine the number of tillage classes to model for each crop rotation and the relative area of each tillage class per model subwatershed.*

| **Crop Rotation** | **Crop Residue Class (% of crop residue)** | ***EXAMPLE (% of area within each crop residue class)*** | Barr Creek-Frontal Lake Michigan (40301011202) | Black River (40301011201) | City of Belgium (40301011002) | City of Sheboygan Falls-Sheboygan River (40301011108) | Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | Lower Mullet River (40301010903) | Lower Onion River (40301011004) | Lower Pigeon Creek (40301010804) | Mid Onion River (40301011003) | Middle Mullet River (40301010902) | Middle Pigeon Creek (40301010803) | Otter Creek-Sheb. R. (40301011107) | Sevenmile Creek-Frontal Lake Michigan (40301010705) | Sheboygan Lake-Sheboygan River (40301011104) | Sheboygan River-Frontal Lake Michigan (40301011109) | Upper Onion River (40301011001) | Upper Pigeon Creek (40301010802) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Grain | 0%-15% | *85%* | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | 16%-30% | *0%* | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% | 45% |
| | >30% | *10%* | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | No-Till/Zone-Till | *5%* | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% |
| Continuous Corn | 0%-15% | *0%* | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% |
| | 16%-30% | *0%* | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| | >30% | *100%* | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| | No-Till/Zone-Till | *0%* | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Dairy | 0%-15% | *75%* | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% |
| | 16%-30% | *25%* | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| | >30% | *0%* | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | No-Till/Zone-Till | *0%* | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| Cash grain/ Vegetable | 0%-15% | *100%* | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% |
| | 16%-30% | *0%* | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% |
| | >30% | *0%* | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% |
| | No-Till/Zone-Till | *0%* | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

**CHEMICAL FERTILIZER APPLICATIONS (QUESTIONS 13 – 15)**

Chemical fertilizer applications will be modeled for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations. Important settings for chemical fertilizer applications include application rate, placement, and whether application is followed by incorporation. Note that when defining fertilizer application rates, our focus is on the amount of **phosphorus** and **nitrogen** applied. Application rates for potassium are less relevant for this project. Your input is needed to determine appropriate chemical fertilizer application settings for the Cash Grain, Continuous Corn, Dairy, and Potato/Vegetable rotations.

*Question 13. Using the table below, please describe the characteristics of a typical chemical fertilizer application for each crop.*

| Characteristic | | *Example* | Cash Grain | Corn Grain | Corn Silage | Hay | Cash grain/ Vegetable |
|---|---|---|---|---|---|---|---|
| Application timing **(check all that apply)** | Pre-panting | *X* | X | X | X | | X |
| | At-planting | *X* | X | X | X | X | X |
| | During growing | | X | X | X | | |
| Placement **(check one per rotation)** | Surface | *X* | X | X | X | | |
| | Injection | | | | | | X |
| Incorporation after application? **(check one per rotation )** | Yes | | | | | | X |
| | No | *X* | X | X | | | |

*Question 14. Using the table below, please estimate typical annual chemical fertilizer application rates for Cash Grain, Continuous Corn, Dairy, and Cash Grain/Vegetable rotations in your county by HUC12 subwatershed. You can choose to report fertilizer rates in pounds of **nutrient** per acre (option 1) or pounds of **fertilizer** per acre (option 2). Please provide more information about the option you choose below.* **Used a rotation average not one crop except the Continuous Corn rotation. The P is what a farmer with an excessively high P test is applying.**

*Reporting option 1: Pounds of **nutrient** per acre*
*Phosphorus type (phosphorus P or phosphate $P_2O_5$)*:
*Nitrogen type (ammonium $NH_4$, Urea $CH_4N_2O$, ect.)*:

*Reporting option 2: Pounds of **fertilizer** per acre*
*Typical N:P:K Ratio =*

| HUC12 | Chemical Fertilizer Application Rate (lb/acre/yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cash Grain | | Continuous Corn | | Dairy | | Cash grain/ Vegetable | |
| | P | N | P | N | P | N | P | N |
| *EXAMPLE* | *60* | *130* | *70* | *12* | *30* | *60* | *20* | *50* |
| Barr Creek-Frontal Lake Michigan (40301011202) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Black River (40301011201) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| City of Belgium (40301011002) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 32 | 75 | 30 | 160 | 10 | 50 | 28 | 80 |
| Lower Mullet River (40301010903) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Lower Onion River (40301011004) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Lower Pigeon Creek (40301010804) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Mid Onion River (40301011003) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Middle Mullet River (40301010902) | 32 | 75 | 30 | 160 | 10 | 50 | 28 | 80 |
| Middle Pigeon Creek (40301010803) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Otter Creek-Sheb. R. (40301011107) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Sheboygan Lake-Sheboygan River (40301011104) | 32 | 75 | 30 | 160 | 10 | 50 | 28 | 80 |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 32 | 70 | 30 | 150 | 10 | 47 | 28 | 75 |
| Upper Onion River (40301011001) | 32 | 75 | 30 | 160 | 10 | 50 | 28 | 80 |
| Upper Pigeon Creek (40301010802) | 32 | 75 | 30 | 160 | 10 | 50 | 28 | 80 |

*Question 15. Crop yield targets could also inform the selection of appropriate fertilizer application rates. For example, areas with high yield targets may also be receiving high rates of fertilizer application. Can you provide estimates of crop yields by HUC12 subwatershed?*

| HUC12 | Crop Yield Targets (yield/acre/yr) | | | | |
|---|---|---|---|---|---|
| | Cash grain | Corn grain | Corn silage | Hay | Cash grain/ Vegetable |
| *Example* | *170 bu* | *150 bu* | *10 tons/ac* | *3 tons/ac* | *400 cwt* |
| Barr Creek-Frontal Lake Michigan (40301011202) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Black River (40301011201) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| City of Belgium (40301011002) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Kiel Marsh State Wildlife Area-Sheboygan River | 170 bu | 170 bu | 25 tons/ac | 5.5 tons/ac | 10 tons/ac |
| Lower Mullet River (40301010903) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Lower Onion River (40301011004) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Lower Pigeon Creek (40301010804) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Mid Onion River (40301011003) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Middle Mullet River (40301010902) | 170 bu | 170 bu | 25 | 5.5 tons/ac | 10 tons/ac |
| Middle Pigeon Creek (40301010803) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Otter Creek-Sheb. R. (40301011107) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Sheboygan Lake-Sheboygan River (40301011104) | 170 bu | 170 bu | 25 tons/ac | 5.5 tons/ac | 10 tons/ac |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 150 bu | 150 bu | 20 tons/ac | 4.5 tons/ac | 9 tons/ac |
| Upper Onion River (40301011001) | 170 bu | 170 bu | 25 tons/ac | 5.5 tons/ac | 10 tons/ac |
| Upper Pigeon Creek (40301010802) | 170 bu | 170 bu | 25 tons/ac | 5.5 tons/ac | 10 tons/ac |

**MANURE APPLICATIONS (QUESTIONS 16 – 21)**

Manure applications will be modeled for the Dairy rotation. Important settings for manure applications include application frequency, rate, timing, and whether application is followed by incorporation. Your input is needed to determine appropriate manure application settings.

*Question 16. In the table below, please estimate the percentage of your county's Dairy acreage practicing daily haul of manure versus manure storage by HUC12 subwatershed.*

| HUC12 | % Daily Haul | % Storage |
|---|---|---|
| Barr Creek-Frontal Lake Michigan (40301011202) | 40 | 60 |
| Black River (40301011201) | 40 | 60 |
| City of Belgium (40301011002) | 40 | 60 |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 20 | 80 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 30 | 70 |
| Lower Mullet River (40301010903) | 40 | 60 |
| Lower Onion River (40301011004) | 30 | 70 |
| Lower Pigeon Creek (40301010804) | 40 | 60 |
| Mid Onion River (40301011003) | 40 | 60 |
| Middle Mullet River (40301010902) | 40 | 60 |
| Middle Pigeon Creek (40301010803) | 40 | 60 |
| Otter Creek-Sheb. R. (40301011107) | 20 | 80 |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 30 | 70 |
| Sheboygan Lake-Sheboygan River (40301011104) | 10 | 90 |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 30 | 70 |
| Upper Onion River (40301011001) | 40 | 60 |
| Upper Pigeon Creek (40301010802) | 20 | 80 |

*Question 17. Using the table below, please describe typical manure application practices for a daily haul farm and a manure storage farm in your county.*

| Characteristic | Typical Practice for Daily Haul Farm | Typical Practice for Storage Farm | |
|---|---|---|---|
| Application Frequency | Every two weeks | 2X per year | |
| Application Timing | Year round | April-May | Sept-November |
| Followed by Incorporation? (Yes or No) | No | Yes | Yes |

*Question 18. In the table below, please estimate typical manure application rates and form (liquid or solid) for a daily haul farm and a manure storage farm in your county by HUC12.*

**tip 1: Application Rate refers to the average rate per an application (i.e. not a yearly or rotational average)*

**tip 2: % Incorporated refers to a spectrum starting with 0% (surface spreading and no tillage) and ending with 100% (injection).* Daily haul may take weeks months to complete a field and may include covering the same area of the field more than once. Storage incorporation includes surface spread and worked in within 3 days.

| HUC12 | DAILY HAUL | | | STORAGE | | |
|---|---|---|---|---|---|---|
| | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form | Application Rate (tons or 1000 gals per acre) | % incorporated | Manure Form |
| Barr Creek-Frontal Lake Michigan (40301011202) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Black River (40301011201) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| City of Belgium (40301011002) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Lower Mullet River (40301010903) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Lower Onion River (40301011004) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Lower Pigeon Creek (40301010804) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Mid Onion River (40301011003) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Middle Mullet River (40301010902) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Middle Pigeon Creek (40301010803) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Otter Creek-Sheb. R. (40301011107) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Sheboygan Lake-Sheboygan River (40301011104) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Upper Onion River (40301011001) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |
| Upper Pigeon Creek (40301010802) | 1.5 tons/ac | 30 | Pack or freestall | 10,000 gal/ac | 80 | Liquid |

*Question 19. Are you able to provide an estimate of the range or average concentration of N and P in manure in your county? If so, please express as lb per ton or lb per 1000 gal.*

*P concentration (please specify- P or $P_2O_5$)*: Solid- 3 lbs/ton P2O5 book value; Liquid 3 lbs P2O5 /1,000 gal book value
*N concentration*: 2 lbs/ ton

*Question 20. What percent of Dairy Rotation acres under no-till receive injected manure? Manure injection can have similar effects on soil residue as tillage practices.* None.

*Question 21: Of the Dairy Rotation acres that receive manure by injection, please estimate what percent of Dairy acres use the injection methods below. This table will be used to determine the depth of soil disturbance and soil residue disturbance. *tip: values in table should sum to 100%.* Used Manitowoc Co. numbers

| Injection method | % of Dairy acres receiving manure by injection |
|---|---|
| Narrow knife | *5* |
| Sweep | *80* |
| Ripple coulter | *10* |
| Aerway | *5* |

**SOIL PHOSPHORUS (QUESTION 22)**

An important parameter for SWAT modeling is the initial phosphorus content of soils throughout the modeled area. We have acquired average soil phosphorus by county based on 2010-2014 soil testing from the UW Soil Testing Lab ( http://uwlab.webhosting.cals.wisc.edu/wp-content/uploads/sites/17/2016/06/DATCP-soil-summary-2010-to-2014-1.xlsx ) Your input is needed to estimate finer-scale soil phosphorus values. Estimates of average soil P per HUC12 can be generated by averaging values from a group of representative Nutrient Management Plans for farms in each HUC12.

*Question 22. In the table below, please estimate average soil phosphorus per HUC12. Estimates can be derived from a review of representative Nutrient Management Plans for each HUC12.*

| HUC12 | Average Soil P (parts per million) |
|---|---|
| Barr Creek-Frontal Lake Michigan (40301011202) | 40 |
| Black River (40301011201) | 40 |
| City of Belgium (40301011002) | 40 |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 40 |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 40 |
| Lower Mullet River (40301010903) | 40 |
| Lower Onion River (40301011004) | 40 |
| Lower Pigeon Creek (40301010804) | 40 |
| Mid Onion River (40301011003) | 40 |
| Middle Mullet River (40301010902) | 40 |
| Middle Pigeon Creek (40301010803) | 40 |
| Otter Creek-Sheb. R. (40301011107) | 40 |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 40 |
| Sheboygan Lake-Sheboygan River (40301011104) | 40 |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 40 |
| Upper Onion River (40301011001) | 40 |
| Upper Pigeon Creek (40301010802) | 40 |

**GRAZING (QUESTIONS 23 – 24)**

SWAT management tables can be setup to model animal grazing on pastured lands. Required inputs include the animal type and count, timing of the start of grazing, and number of grazing days. Your input is needed to determine the prevalence of managed grazing in areas classified as Continuous Pasture and, if grazing is significant, to determine appropriate grazing settings.

*Question 23. In a given year, what percentage of your county's Pasture acreage (as identified in Attachment A or the web-based map) is grazed?*

*Question 24. What are the typical practices of a grazing operation?*

| Characteristic | Typical Practice |
|---|---|
| Animal Type | Beef steer |
| Number of Animals per Acre | 1 |
| Grazing Timing & Duration (Entire Growing Season, Year-Round, Spring Only, etc.) | May-November |

**OPTIONAL SECTION: IRRIGATION AND AGRICULTURAL DRAIN TILE**

| HUC12 | Percent of fields with ag tile | Percent of fields with irrigation |
|---|---|---|
| Barr Creek-Frontal Lake Michigan (40301011202) | 60 | 0% |
| Black River (40301011201) | 60 | 0% |
| City of Belgium (40301011002) | 60 | 0% |
| City of Sheboygan Falls-Sheboygan River (40301011108) | 60 | 0% |
| Kiel Marsh State Wildlife Area-Sheboygan River (40301011106) | 30 | 0% |
| Lower Mullet River (40301010903) | 60 | 0% |
| Lower Onion River (40301011004) | 60 | 0% |
| Lower Pigeon Creek (40301010804) | 60 | 0% |
| Mid Onion River (40301011003) | 60 | 0% |
| Middle Mullet River (40301010902) | 60 | 0% |
| Middle Pigeon Creek (40301010803) | 60 | 0% |
| Otter Creek-Sheb. R. (40301011107) | 50 | 0% |
| Sevenmile Creek-Frontal Lake Michigan (40301010705) | 60 | 0% |
| Sheboygan Lake-Sheboygan River (40301011104) | 30 | 0% |
| Sheboygan River-Frontal Lake Michigan (40301011109) | 60 | 0% |
| Upper Onion River (40301011001) | 30 | 0% |
| Upper Pigeon Creek (40301010802) | 60 | 0% |

**ADDITONAL INPUT**

If there are significant agricultural land management practices in your county that were not mentioned in this survey and could affect water quality, please elaborate below and/or provide any relevant data. Thank you!

*For example, if you know of barnyards with significant runoff, we would need the location and size of each barnyard.*