Pomme de Terre River
Major Watershed
Restoration and Protection
Strategies and Implementation Plan

June 2013 – May 2023

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For the Pomme de Terre River Association

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Disclaimer

This document is an action plan developed as a product of the Minnesota Pollution Control Agency Major Watershed initiative, through funds from the Minnesota Clean Water, Land, and Legacy Amendment. The focus of this document is to list areas where potential voluntary practices and projects could be (but not limited to) implemented to help restore or protect the local water quality, to improve habitat, and to maintain and enhance the recreational value of our water resources. The main goal of this document is to provide a base level prioritization in project areas to assist in the continued utilization and delivery of grant funds from State and Federal agencies which will allow landowners to voluntarily to accomplish water quality goals on their property. For more details, please visit the Pomme de Terre River Association website at pdtriver.org, or contact our Project Coordinator at the Pomme de Terre River Association Office at 12 Hwy 28 E, Ste. 2 in Morris, MN 56267. Or call 320-589-4886, extension 109.

Glossary

Assessment – A study of a water body leading to a decision of impairment or non-impairment, or may reveal there is insufficient data available to determine a status.

AUID – Assessment Unit ID, a numbered reference assigned to specific stream reaches.

BMP – Best Management Practice, a selection of voluntary activities utilized to protect or restore a water resource.

EPA – Environmental Protection Agency

GIS – Geographic Information Systems, an intuitive mapping program utilizing coordinate systems to accurately map project areas and has numerous other applications.

HSPF – Hydrological Simulation Program-FORTRAN. A model that uses hydrological data inputs to measure simulated stream loading at given points in a watershed based on land use changes.

HUC – Hydrologic Unit Code, a numbered reference for specific subwatershed areas. Longer number sequences equate to smaller subwatershed areas.

IBI – Index of Biological Integrity – a score based system to judge the health of water bodies as it relates to biology.

LiDAR – Light Detection and Ranging, a type of map data collection that allows users to build maps using highly accurate information with real elevation accuracy near 1 foot.

Macroinvertebrate – Invertebrate large enough to be seen without magnification.

PMZ – Priority Management Zones

RIM – Reinvest in Minnesota program, a State offered conservation easement that is typically perpetual.

Stream Power Index – A mapping tool designed to show high erosion potential areas used in combination with GIS and LiDAR

Supporting/Non-supporting – Whether a particular body of water is currently meeting statutory standards for water quality versus a designated use. (Supporting or non-supporting of wildlife).

Terrain Analysis – Mapping tool utilizing LiDAR data to determine several factors based on slope and other data inputs.

WAT – Watershed Assessment Tool, a mapping tool developed by the Minnesota Department of Natural Resources to engage users in watershed health exercises.

WASCOB – Water and Sediment Control Basin, an agricultural best management practice designed to trap sediment and control field runoff.

WRP – Wetland Reserve Program, a Federal easement program with a typical lifespan of 30 years.

Zonation – A map-based simulation model based on the values of the user to delineate work areas.

Executive Summary

The Pomme de Terre River located in west-central Minnesota is one of 81 Major Watersheds in Minnesota. A Joint Powers Organization exists to monitor and improve surface water quality through LGU partnerships, called the Pomme de Terre River Association. In 2011 the Pomme de Terre River Association Joint Powers Board adopted a work plan written by the MPCA to complete a Major Watershed priority management zone and community outreach project in the Pomme de Terre Watershed. As part of the Major Watershed work plan, protection and restoration strategies were to be developed based on the long term goals of the Association, incorporating local knowledge and physical data. Priority management zones were to be identified to narrow implementation activity focus, and within these zones, specific sites were to be assessed to help in future BMP implementation and grant applications. Delineation of these sites reflected on the use of current data and technology sources. Mapping tools such as GIS, DNR's Zonation and Watershed Assessment Tool (WAT), Stream Power Index (SPI), Terrain analysis, and the MPCA HSPF model. Further anecdotal information was collected by physical inspection, and these notes were also considered in the process. Based on these PMZs and priority sites, restoration and protection strategies were to be developed utilizing stakeholder and local input, interest from community organizations, and taking into consideration the mission and goals of the Association.

Stakeholders were addressed in several instances throughout the Major Watershed process to determine the level of support and interest. Civic engagement opportunities were leveraged from meetings the Association held independently with different stakeholder groups, and used those relationships to help enhance the prioritizations process. The stakeholder process consisted of an annual meeting in April, 2012 to discuss the workplan specifics and "kick off" the project. The meeting was mostly informational, but a survey was administered to determine the level of involvement to be expected. At the end of the meeting the JPB announced an open sign up period for an 8 week watershed course to educate local interested citizens. This course was aptly named the Pomme de Terre "Watershed Academy" and was instructed by the JPB Project Coordinator and Joe Hauger, MPCA Project Manager. The course offered a wide range of topics including watershed basics, shallow lake ecology, and geomorphology just to name a few. Guest speakers from multiple agencies also played a large role in making the course a success. Throughout these activities a stakeholder base was established, and the organization began prioritizing areas and activities to best manage the water resources in the Pomme de Terre River Watershed. This document fulfills the MPCA product requirement for the PMZ process, and is the product the Association chose to help guide the organization into the future until the process begins again in 2017. Our accomplishments will be measured by the success of our priorities during this time period, and success will be determined by the improvements made to our local surface water quality resources, habitat, and overall watershed health.

Methods

Protection and restoration activities were selected by numerous processes. Each participating County in the JPB has or had a State approved Local Water Management Plan. Because many of the broad priorities included in these local water management plans remain

applicable, this was used as a broad starting point. Other broad priority management suggestions came directly from MPCA. These areas were selected based on findings in both the "Watershed Biotic Stressor Identification Report" as well as the "Watershed Monitoring and Assessment Report", which also were used in the selection of more narrow focus areas. Other PMZs may be defined as activities or other goals such as the installation of buffers or other practices. More specific areas of the watershed were selected by utilizing mapping tools, and modeling software was utilized by both the MPCA and the Minnesota DNR with local input to derive spatially weighted priority zones. Other important information was collected through site surveys and public input. Many locations were known problem areas in need of prioritization or delineation. Combining all of these sources of data creates a product similar to a TMDL implementation plan or water plan, but more site specific, more usable, with better defined goals and objectives for completing the work into the future.

Restoration and Protection Strategies

Restoration and protection strategies are areas or activities that have been identified in the Pomme de Terre Watershed to address current and future water quality concerns. In general restoration activities occur or link to areas in the watershed that currently have a 303(d) listed impairment according to the Clean Water Act. Protection strategies address concerns on water bodies void of impairment and are designed to keep the associated waters from becoming impaired. These strategies are categorized below according to an 11 digit HUC watershed level and are mostly arranged geographically starting from north to south in the watershed. A few watershed units have been grouped together as the current conditions and impairments may be applicable to both. More information on the Pomme de Terre Monitoring and Assessment Report and Stressor ID reports can be found by following the links below or by visiting the MPCA or Pomme de Terre River Association websites.

Pomme de Terre River Watershed Monitoring and Assessment Report

The Monitoring and Assessment report includes information from the first round of intensive watershed monitoring and gives sub-watershed summaries on current conditions and impairments. (MPCA, 2012)

Pomme de Terre River Watershed Biotic Stressor Identification Report

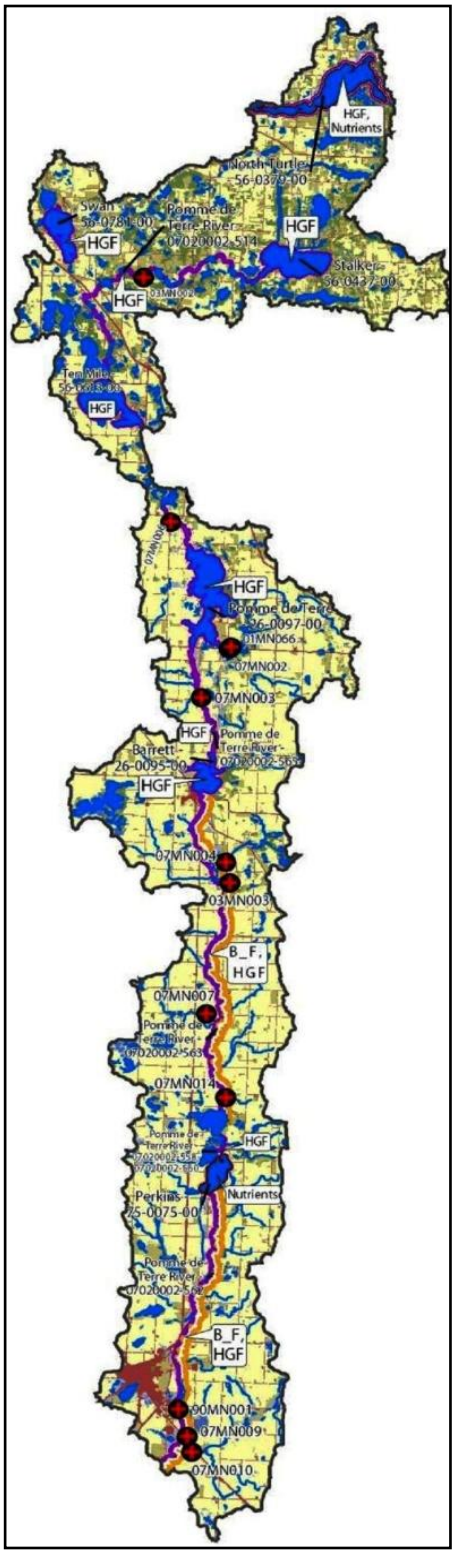
The Pomme de Terre Stressor ID report is a collection of data derived findings that may point to causes for impairment or factors that may be limiting the biologic integrity of the watershed system. (MPCA, 2012)

Pomme de Terre River Watershed Report

This report is a summary of Pomme de Terre Major Watershed process designed by MPCA. This document contains a broad view of the objectives and methods for the Major Watershed process which began in 2007. (MPCA, 2013)

Upper Pomme de Terre Watershed

Summary of conditions/impairments



The Upper Pomme de Terre River from Barrett Lake north is located within the North Central Hardwood Forest ecoregion nearly exclusively, differing from the rest of the watershed which is located in the Northern Glaciated Plains. Here the Pomme de Terre flows from its headwaters at Stalker Lake through a well defined flood plain, bordered by rolling hills, woodlots, and wetlands. As it flows from the Pomme de Terre chain of lakes the landscape changes noticeably, the flood plain widening and flattening and fewer trees adorn the river's edge. There are no stream sections north of Barrett Lake considered impaired, however biological impairments to fish diversity do exist both between Barrett Lake and the Pomme de Terre chain, and the chain to Muddy Creek. The biological impairments are linked to several stressors as identified in the MPCA Stressor ID report, including low dissolved oxygen levels, habitat, altered hydrology, and fish passage obstruction. The following priorities reflect areas where protection or restoration will be focused.

Priority Areas and Activities

Buffers:

Implement and maintain protective riparian buffers along the streams and lakes as well as the main stem in the Upper Pomme de Terre Watershed. These buffers will help ensure the current water conditions do not degrade, limiting more impaired waters listings in the future. Buffer priorities in the following locations as identified by local partners to most effectively prevent further impairments:

- West side of Mineral Lake in Tumuli Township.(WOT)
- South Side of Ten Mile Lake in Tumuli Township.
- North, West and Southwest side of North Turtle Lake in Sverdrup Twp.
- Volen Lake in Sections 18 and 19 of Tordenskjold Twp.
- Unnamed lake in section 31 of Clitherall Twp.
- Sommer Lake in St. Olaf Twp.
- Beebe Lake in St. Olaf Twp.
- Sections 11, 12, & 13 along DNR Protected Stream

in St. Olaf Twp.
- Formo Lake in St. Olaf Twp.
- North Side of Clear Lake Tumuli Twp.
- Section 25 and 36 of Tumuli twp.
- Wetland complex, stream, and pasture buffers in sections 5,6, and 7 in Pelican Lake twp. And sections 1,2,3,10, and 12 of PdT Lake twp.(See map exhibit #1 in appendices for detail)
- Pomme de Terre River north of PdT Lake, sections 11,14,23, and 24 of PdT twp. (map#5) and south of PdT Lake sections 13,14,23,24 and 25. (map #6)
- Stream buffers in Sanford twp. Sections 2,11,12 (map #5)
- Cropland buffers in Pelican Lake twp. Sections 19 and 20, and protected stream in sections 33,34, and 35. (map#5)
- Multiple stream and wetland buffers in Erdahl twp. (See map exhibits #5 and #6 for details).
- Multiple buffer areas in Elk Lake, Lien, Erdahl, and Sanford twps. See map exhibit #6 for specific areas.
- Multiple buffer areas in Land and Roseville twps. See map exhibit #7 for specific details.
- Restore buffer areas on PdT main stem to North PdT Lake, and buffers on the east and south areas of the chain of lakes including North and Middle PdT and Perkins Lake. (Stevens)
- The Pomme de Terre River Association has made program enrollment a priority. Voluntary practices including CRP, CCRP, Grassland Reserve, RIM buffers and other easement opportunities help to ensure protection and restoration of the Pomme de Terre watershed resources for multiple years and in some cases in perpetuity.

Wetlands:

Implement and maintain wetland restoration and upland buffer projects to provide water storage and limit excess nutrients from impacting surface waters. Wetland practices in the following locations have been identified by local partners to most effectively prevent further impairments.

- Section 12,14,24,33 and 34 of Tumuli Twp.(WOT)
- Section 27,33 and 34 of Sverdrup Twp.
- Section 17 of Dane Prairie Twp.
- Section 25 and 36 of Tordenskjold Twp.
- Section 30 of Clitherall Twp.
- Sections 3,4,10,15,16,17, & 18 of St. Olaf Twp.
- Section 1 of Pomme de Terre twp. And Sections 5,6, and 7 of Pelican Lake twp. (Grant) See map exhibit #8 for detail.
- Multiple wetland restorations have been identified near, or adjacent to Pomme de Terre Lake in Grant County. See map exhibit #12 for detailed information.
- Multiple wetland restorations have also been identified near Barrett, Cormorant, and Elk Lakes and surrounding areas. See map exhibit #13.
- Multiple wetland restoration have been identified near the main stem of the PdT River south of Barrett Lake. Also areas around Patchen, Silver, and Shauer Lakes are low lying and have potential for restoration activities.

- Other important activities for this sub watershed area include voluntary program enrollment by local landowners. Wetland restorations both restore and protect water quality and habitat. Programs such as RIM/WRP and CRP wetlands restoration practices ensure practices remain in place for many years and in some cases in perpetuity.

Severe Erosion Sites:

PMZ activities in the watershed revealed sites that may be contributing or have the potential to contribute disproportionately to excess sediment and nutrients entering surface waters. Identified as severe erosion sites, the following is a list of locations where specific sites have been locally confirmed and are the highest priority. In some cases landowner information exists at the LGU level, and resources will be made available to help address these areas. As work continues, other areas are likely to be identified beyond what current information exists. These areas should also be prioritized when identified.

- Section 14 and 11 of Sverdrup Twp. (WOT)
- Section 30 and 32 of Tordenskjold Twp.
- Section 19 of St. Olaf Twp.
- Section 15 of Tumuli Twp.
- Section 31 of Pelican Lake twp. Severe erosion site on the east-central shoreline of Pomme de Terre Lake. (Grant)
- Section 6 of Elk Lake twp. Severe erosion site (head cut/gully) on inlet to the northeast portion of Barrett Lake.
- Section 21 of Elk Lake twp. Gully erosion site on inlet on the north shoreline of Turtle.
- Perkins Lake has shoreland erosion issues as is evidenced by several of the lake properties that have installed rock riprap. Erosions sites are located on the northwest, west, and southern shoreline areas. (Stevens)
- The main stem Pomme de Terre in section 13 of Darnen twp. Severe erosion is currently taking place at the hwy and railroad bridge crossing just south of Morris on MN Hwy 9.

Shoreline Stabilization:

Specific lakes in the Upper Pomme de Terre Watershed area have been identified as having shoreline instability. This portion of the Pomme de Terre major watershed contains the highest prevalence of lakes, with the majority located in West Otter Tail County. Many of these lakes have riparian area erosion issues due to altered hydrology and are unstable. Although the following lakes have been identified as top priorities, numerous others have areas of riparian instability and should not be overlooked for future prioritization.

- North Turtle Lake (WOT)
- South Turtle Lake
- Tamarack Lake
- Stalker Lake
- Long Lake
- Swan Lake
- Mineral Lake
- Indian Lake
- Ten Mile Lake
- North Ten Mile Lake

- Middle Lake
- Barrett (Grant)
- Pomme de Terre
- Cormorant
- Chain of Lakes (North, Middle PdT, Perkins in Stevens Co).

Stormwater Control:

Stormwater control is an essential part of managing water inputs from developed areas and municipalities and can contribute to numerous water quality issues. Numerous stormwater control BMPs will be utilized including rain catchment barrels, rain gardens, pervious pavers, and buffer areas. Areas identified below have been locally identified as top priorities:

- Stalker Lake Golf Course
- City of Dalton
- All developed areas identified in map exhibits #15,16,19,20, and 21
- City of Morris
- T-Man's Beach subdivision on Perkins Lake (See map exhibit #22 for detail)

SSTS Enforcement:

The mission of the Pomme de Terre River Association is to work with landowners on a voluntary basis. The organization does however recognize septic compliance can be problematic in terms of water quality and nutrient inputs. The county members of the Association choose to deal with septic compliance on an individual county basis, and in some cases the programs differ greatly in scope and priority. The following are priorities some partners have identified for inclusion.

- Numerous lakes in West Otter Tail County are undergoing an SSTS abatement program at this time. Non-compliance issues will be dealt with by the County Land Management division.
- SSTS systems that pose imminent public health threats, including those is development areas.
- Rural homesteads along main stem PdT River corridor.
- T-Man's Beach subdivision on Perkins Lake, an estimated 8 systems are currently non-compliant. (See map exhibit #22 for detail)

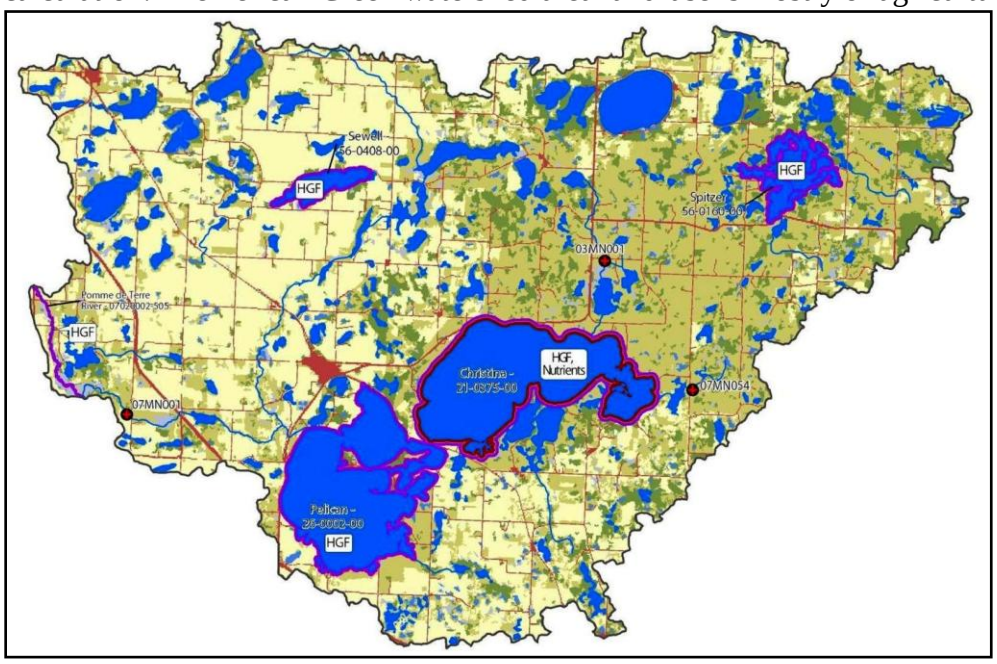
Ag BMP Activities:

Implement AG BMPs such as nutrient management, conservation tillage, grassed waterways, pit closures, terraces and water and sediment control basins within the contributing watersheds to vegetated buffers and wetland restorations identified within the buffer PMZ and wetland PMZ and Severe Erosion PMZ site areas.

Pelican Creek Watershed

Summary of conditions/impairments

The Pelican Creek watershed is comprised of mainly well buffered rolling hills and a fair amount of pasture land. Pelican Creek was listed as an impaired waterway on the draft 303(d) list in 2012 for low IBI scores of macro-invertebrates, however was not included in the Watershed Stressor Identification Report or the Watershed Monitoring and Assessment Report due to an IBI re-calculation. The Pelican Creek watershed area land-use is mostly of agricultural, and has a moderate occurrence of pasture or grazing land and row crops. Some areas in this watershed contain steep slopes where row crop production would be difficult. Hydrologic modifications in the area including increased tile drainage have increased overall flows on Pelican Creek which has caused some stream bank instability. Lack of adequate cattle exclusion measures have also contributed to bank erosion as well as elevated levels of *E. coli* bacteria, however no assessment to that parameter has been made as of 2012 due to insufficient of data. Restoration efforts in this area will include buffers, alternative drain tile methods, cattle exclusion, streambank restorations and lakeshore restorations.



Priority Areas and Activities

Buffers:

Implement restorative riparian buffers to reduce nutrient and sediment loading. Reductions in sediment and nutrient inputs will help improve water quality and will likely improve the macroinvertebrate IBI scores, and will limit the accumulative effects of pollutants downstream. The following areas have been locally identified as priorities by local partners to most effectively prevent further impairments:

- Sections 24, 26, and 34 along the Pelican Creek in St. Olaf Twp. (WOT)

- Buffers on the north side of Pelican Lake in sections 1,2,10,11, and 14 in Pelican Lake twp. (Grant)
- Buffers on the west side of Pelican Lake in section 21 of Pelican Lake twp.
- The southeast side of Pelican Lake in sections 24 and 25 of Pelican Lake twp.
- Buffers on Pelican Creek in sections 3,4,7,9,16,17 and 18 of Pelican Lake twp.
- Pelican Creek in sections 12 and 13 of Pomme de Terre twp.
- Multiple buffers around Lake Christina and surrounding wetlands and streams in Lund twp. See map exhibit #23 for detail. (Douglas)

Wetlands:

Implement wetland restorations to provide water storage and increase wildlife habitat. Water storage helps alleviate the effects of runoff, and lessens pressure on associated buffers to help reduce pollutants from entering surface waters. Wetlands also provide wildlife habitat to fish, birds, macroinvertebrates and many other life forms. The following areas in the Pelican Creek watershed area have been identified as priorities by local partners to most effectively prevent further impairment:

- Wetland restoration in section 5 of Eagle Lake twp. (WOT)
- Wetland restorations in sections 1,2,10, and 11 of Pelican Lake twp. (Grant)
- Sections 24,25,35, and 36 on the southeast side of Pelican Lake in Pelican Creek twp.
- Multiple wetland restorations along Pelican Creek in Pomme de Terre twp. See map exhibit #11 for detail.
- Multiple wetland restorations around Lake Christina in Lund twp. See map exhibit #23 for detail.

Severe Erosion Sites:

Severe erosion sites in the Pelican Creek watershed that may be contributing or have the potential to contribute disproportionately to excess sediment and nutrients entering surface waters have been identified by local partners. At this time only a few locations have been confirmed. As work continues, other areas identified as severe erosion sites will be prioritized.

- Sections 30, 31, & 35 of St. Olaf Twp.

Shoreline Stabilization:

A few specific lakes in the Upper Pelican Creek Watershed area have been identified as having shoreline stabilization or erosion prone areas. Although this watershed area is fairly small, it does contain two of the larger lakes in the Pomme de Terre Watershed as well as numerous others with recreational value.

- Sewell
- Spitzer
- Eagle
- Jolly Ann
- Johnson

- Vinge
- Clear
- Hancock
- Pelican
- Christina
- Torgerson
- Sampson
- Toms

Stormwater Control:

Stormwater control is an essential part of managing water inputs from developed areas and municipalities and can contribute to numerous water quality issues. Areas identified below have been locally identified as priorities for implementing rain gardens or other catchments, rain barrels, or other applicable stormwater control measures:

- Section 12 of Pelican Lake twp. 2 developed areas have been identified. See map exhibit #16 for detail.
- Developed areas around Pelican Lake to include shoreland areas or building site developments. See detail in map exhibit #17
- Developed areas along Pelican Creek in Pelican Lake and Pomme de Terre twps. See map exhibit #18 for detail.

SSTS Enforcement:

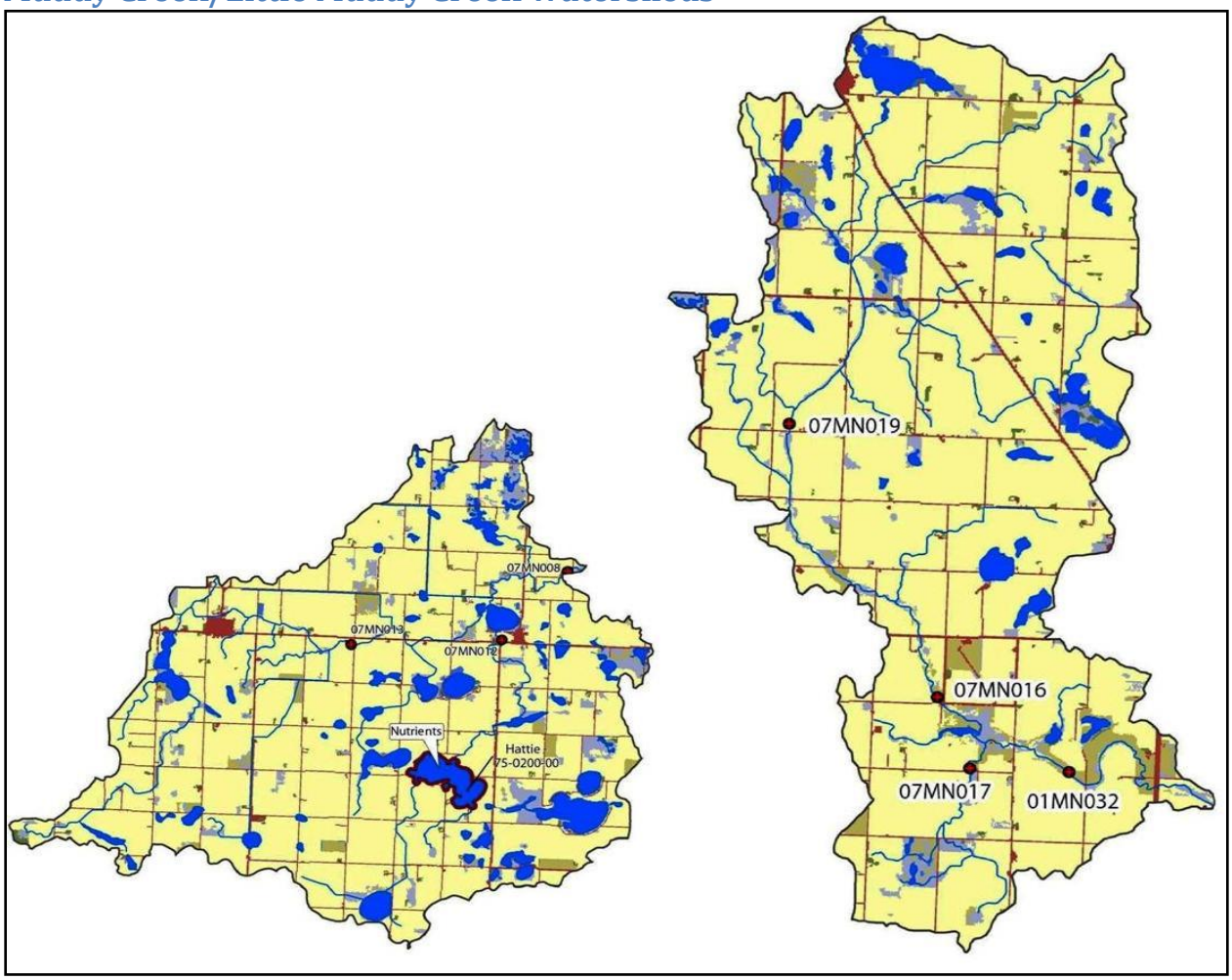
The mission of the Pomme de Terre River Association is to work with landowners on a voluntary basis. The organization does however recognize septic compliance can be problematic in terms of water quality and nutrient inputs. The county members of the Association choose to deal with septic compliance on an individual county basis, and in some cases the programs differ greatly in scope and priority. The following are priorities some partners have identified for inclusion.

- Lakeshore areas in Otter Tail County are currently undergoing an abatement process by the Otter Tail Land and Resource office. Systems not meeting applicable requirements or are classified as imminent health risk will be identified.
- Septic compliance in development areas will be addressed through a loan program applied for by the Pomme de Terre River Association through an MPCA Clean Water Partnership grant which will be applicable throughout the entire Pomme de Terre watershed.

Ag BMP Activities:

Implement Ag BMPs such as nutrient management, conservation tillage, grassed waterways, pit closures, terraces and water and sediment control basins within the contributing watersheds to vegetated buffers and wetland restorations identified within the buffer PMZ and wetland PMZ and Severe Erosion PMZ site areas.

Muddy Creek/Little Muddy Creek Watersheds



Summary of conditions/impairments

Little Muddy Creek and Muddy Creek watershed units were combined for the purpose of common landform/characteristics in the PdT Monitoring and Assessment Report, although they each have their own unique 11-digit HUC. Located entirely within Stevens County, just west of the city of Morris, the primary land use in both watershed units is cropland interspersed with some pasture and a few feedlots. The total drainage area of the two watershed units is 144 square miles. Hattie Lake is the only water body within the sub-watersheds to have any sort of impairment and is listed for excess nutrients. The main stem of Muddy Creek from Chokio west is channelized, and from Chokio east it is statutorily listed as a Class 7 stream – of limited resource value. These two scenarios limit how the waters can be assessed in terms of impairment, and at this time no assessments have been made. There are some data listed in the PdT Monitoring and Assessment report suggesting a more robust collection of information may result in impairments in this watershed. Restoration and protection strategies may be limited, but improving the water quality and habitat is especially important in this area as any issue most certainly contributes to the water quality in the main stem of the Pomme de Terre.

Priority Areas and Activities

Buffers:

Implement riparian buffers to reduce nutrient and sediment loading. Reductions in sediment and nutrient inputs will help improve water quality and will limit the accumulative effects of pollutants downstream. Although Muddy Creek has no impairments, it is a main tributary to the Pomme de Terre and is a priority to help improve water quality south of Morris. The following areas have been locally identified as priorities by local partners:

- Sections 27-29, 31-34 of Morris twp.
- Sections 15, 20-22, and 27-36 of Pepperton twp.
- County ditches and streams near and including Hattie Lake in Scott twp.
- Sections 4-10, 15-32 of Darnen twp.
- Sections 14, 22-27, and 34-36 of Baker twp.

Wetlands:

Implement wetland restorations to provide water storage and increase wildlife habitat. The Muddy Creek/Little Muddy Creek watershed area has a significant amount of wetland restoration potential, especially focused around Hattie, Gorder and Flax lakes. MPCA HSPF models show that increasing the wetland acreage in this watershed will significantly decrease sediment loading to the main channel of the Pomme de Terre. The following watershed locations have been locally identified as priorities:

- Sections 27-29, 31-34 of Morris twp.
- Sections 15, 20-22, and 27-36 of Pepperton twp.
- Streams and ditches inletting and outletting to Hattie, Gorder, and Flax lakes in Scott twp.
- Sections 4-10, 15-32 of Darnen twp
- Sections 14, 22-27, and 34-36 of Baker twp.

Shoreline Stabilization:

Shoreline stabilization opportunities in the Muddy/Little Muddy Creek watershed areas are fairly widespread. Because channelization has the potential to create streambank instability, there are likely numerous locations along the main stem of Muddy Creek that would benefit from streambank stabilization measures. The following areas have been identified as priorities, with other lower priority sites existing beyond the following:

- Shoreline areas on the south side of Lake Hattie
- West side of Gorder Lake
- Streambank areas in sections 24 and 25 in Pepperton twp.
- Sections 17, 18, and 20 in Morris twp.
- Sections 15, 16, and 17 in Darnen twp.

Stormwater Control:

Much of the land area in the Muddy/Little Muddy Creek watershed area is tilled cropland. Little land area exists in municipal development. There are however a few small towns that exist within the watershed area. The following represent locations in this watershed that are priorities for stormwater control measures:

- City of Chokio
- City of Alberta
- City of Donnelly
- Public access and beach area on Hattie Lake.

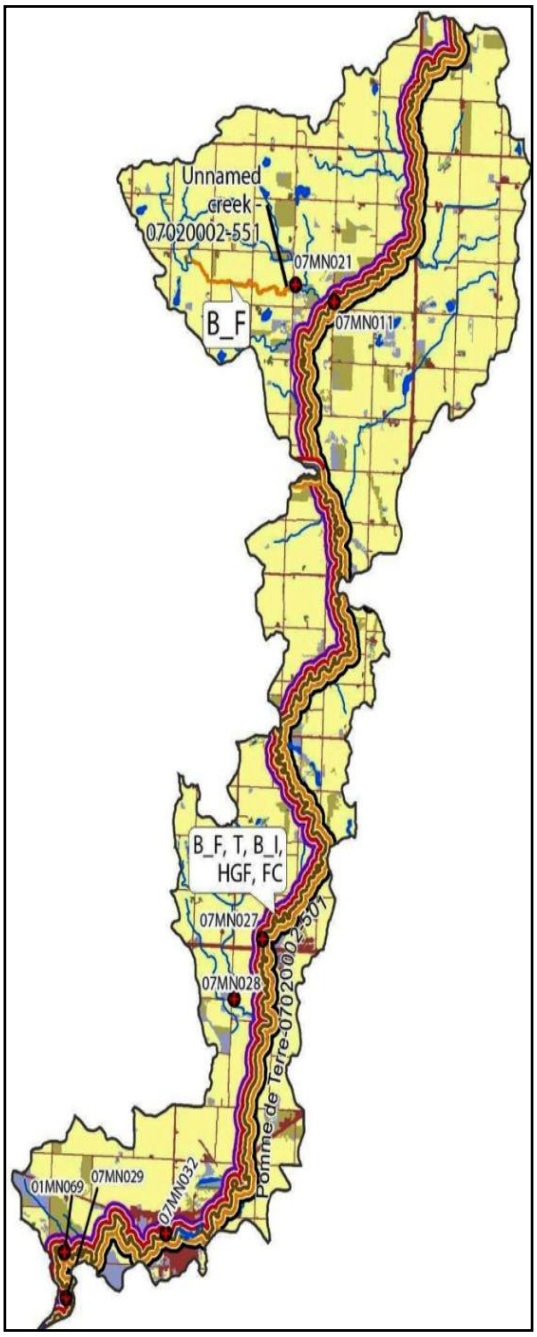
Sediment and Nutrient Control Measures:

The purpose of these measures is to implement BMPs to address excess sediments and nutrients entering the watershed area. The following activities have been identified locally to address these inputs:

- Promote nutrient management BMPs such as conservation tillage, promotion of buffers or grassed waterways, and WASCOBs (Water and sediment control basins).
- Administer Stevens County feedlot program
- Assist non-compliant feedlot operations in the permitting and manure management planning process.
- Livestock exclusion fencing practices.

Lower Pomme de Terre Watershed

Summary of conditions/impairments



The Lower Pomme de Terre River Watershed extends from just south of Morris to Appleton, MN. The Pomme de Terre at this point in the watershed becomes narrow as it flows south. Once the river reaches Appleton it flows westerly through town and turns south where it empties into Marsh Lake, an impoundment of the Minnesota River. This watershed flows through parts of Stevens and Swift counties, with land use comprised mostly of cropland and a limited amount of pasture or other types of grasslands. In the Swift County portion, some of the main channel is well protected by forested riparian areas and deep narrow valleys. Impairments on this section of river include *E. coli*, turbidity, low fish diversity, and low macroinvertebrate diversity due to altered hydrology, limited habitat, and elevated nitrate levels according to the PdT Stressor ID report. Until 2006 this section of river also hosted a dissolved oxygen impairment, but was delisted due to the Appleton Mill Dam removal which had an immediate positive impact on oxygen levels. The Lower PdT Watershed in particular observes the accumulative effects of the watershed as a whole, as the total drainage area to the mouth of this watershed is 880 square miles. Muddy Creek and Drywood Creek are both likely main contributors to the impairments found in the Lower Pomme de Terre. Focused restoration efforts will likely be limited in scope as there are no lakes and few wetlands in this watershed area, leading to an increased effort on implementing BMPs on the main channel of the river.

Priority Areas and Activities

Buffers:

Buffer implementation in this watershed will mostly occur on the main stem of the Pomme de Terre. Little land area exists in this watershed outside the flood corridor, and most of the riparian area is well buffered in natural vegetation and trees, especially as the river nears Appleton. Activities such as RIM buffers, which are permanent vegetation, CRP or any other vegetative buffer practices would be a good fit in this area to help maintain a high percentage of protected flood plain. A few locations that have been identified as potentially needing buffer include:

- Sections 23, and 26 of Darnen twp. (Stevens)
- Sections 10, 11,13, and 14 of Synnes twp. along the Unnamed Creek.
- Sections 20,29, and 32 of Horton twp.
- Sections 8,19,31 of Moyer tw. (Swift)
- Sections 1 and 12 of Appleton twp.

Wetlands:

Implement wetland restorations to provide water storage and increase wildlife habitat. Wetland restorations also help limit sediment loading improving in-stream habitat. The Lower Pomme de Terre has little land area outside the flood plain corridor. Wetland restoration activities are likely limited to the northern portion near the "Unnamed Creek" where the watershed is wider with more land area. The following areas have been locally identified for wetland restorations:

- Sections 7 and 18 of Horton twp. (Stevens)
- Sections 12,13,and 14 of Synnes twp.

Severe Erosion Sites:

Severe erosion sites in the Lower Pomme de Terre watershed have been addressed recently. Two stream barb projects were recently completed on the lower Pomme de Terre, one site south of Morris near the Coleman WMA in 2005, and another site in Appleton in 2012. There are likely other severe erosion sites on this stretch of river, however further field survey is needed to confirm these areas. Erosion has the potential to destroy both riparian and in-stream habitat, a stressor found in this watershed. Correcting severe erosion problems with activities such as stream barbs, or bank restorations have and will help improve habitat conditions.

Sediment and Nutrient Control Measures:

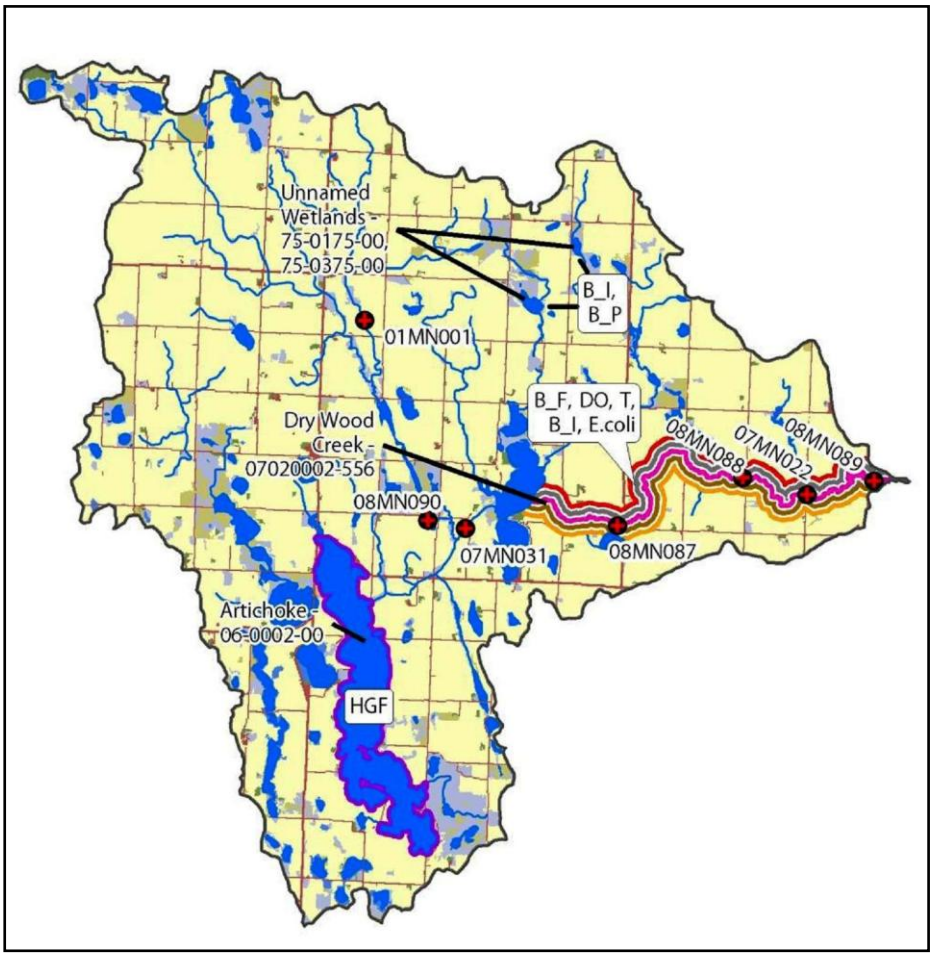
The purpose of these measures is to implement BMPs to address excess sediments and nutrients entering the watershed area. The Lower Pomme de Terre contains numerous impairments to water quality and biology. Ag BMP measures would likely help greatly in reducing excess sediment and nutrients by preventing runoff from entering the watershed. Cover crops, soil residue, and WASCOBs are a few practices considered. The following activities have been identified as logical BMP activities in this area:

- Water and Sediment Control Basins (WASCOBs) in the Unnamed Creek section of the Lower Pomme de Terre watershed to reduce sediment and nutrients from entering the river through runoff.
- Livestock exclusion practices on the main stem of the Pomme de Terre to limit livestock contact with surface waters. This practice ensures a reduction of E.coli bacteria, as well as helps limit bank instability in high traffic areas.

Drywood Creek Watershed

Summary of conditions/impairments

The Drywood Creek watershed is located in parts of Big Stone, Swift, and Stevens Counties. The majority of the land use is agricultural, with quite a bit of pasture acreage, and in general it contains a lot of open space. Several lakes exist in this watershed including Artichoke Lake, Long Lake, and North and South Drywood Lakes. There are many wetlands that exist in this watershed area as well, mostly in the western half. Several impairments exist in the Drywood Creek watershed, including impairments for *E. coli*, Turbidity, low dissolved oxygen, and both fish and macroinvertebrate biology. These impairments are likely attributed to this watershed having a significant number of stressors including low DO, Nitrates, altered hydrology and poor habitat scores. Although no lake assessments have been made beyond the statewide Mercury TMDL, the Drywood lakes most likely would receive impairments in the future. Anecdotal sampling data suggests the nutrient levels (phosphorus, and Chlorophyll-a) are exceedingly high and far above the statutory standards given for these water bodies. Protection and restoration strategies are likely to focus on implementing buffer and cattle exclusion practices to try and reduce nutrient inputs. This watershed contributes greatly to the impairments on the Pomme de Terre River main stem.



Priority Areas and Activities

Buffers:

The Drywood Creek watershed area has several characteristics that may make riparian buffers a fairly easy option for many land owners looking to enroll in conservation programs. Much of the land area is pasture along the creek itself, as the slopes are too steep in many cases to have a large cropland area. Some buffer area in Drywood Creek has been enrolled, including a one mile stretch of the creek just before it enters the Pomme de Terre. More buffer projects of this caliber would help greatly to reduce sediment and nutrient loading in this watershed, especially further west near Artichoke Lake, and North and South Drywood Lake.

- Sections 7-10, 15-23, and 26-34 of Stevens twp. (Stevens)
- Riparian buffer on Drywood Creek in sections 1-6 of Hegbert twp. (Swift)
- The west, south, and east side of South Drywood Lake.
- Riparian buffers along the west, and east side of North Drywood Lake.
- Riparian buffers along Artichoke Creek in sections 7,18, and 19 of Hegbert twp.
- Riparian buffers along Artichoke Creek in sections 13 and 14 of Artichoke twp. (Big Stone)
- Much of Long Lake in Artichoke twp. is cropped to the edge and would benefit from the installation of buffers.
- The north half of Artichoke Lake is not adequately buffered and would benefit from buffers. There are also cropped fields to the edge of the lake on the south bays.

Wetlands:

Implement wetland restoration in the Drywood Creek watershed. Much of Drywood Creek has suffered from altered hydrology and excess amounts of water. Artichoke Lake in particular, which is a DNR/MPCA joint project lake (Sentinel Lakes Program) has grown in size over the last 40 years. Information through the Sentinel Lake website supports this by showing historic aerial photos of the historic lake levels. Restoring wetlands can help store some of the excess water that exists in the landscape, can help to settle out the excess nutrients in runoff, and provide new wildlife habitat, a main stressor inhibiting biology as found in the Stressor ID report.

- Sections 28,33, and 34 of Synnes twp. (Stevens)
- Sections 7-10, 15-23, and 26-34 of Stevens twp.
- Section 24 of Artichoke Lake twp. (Big Stone)
- Sections 1,2, and 3 of Hegbert twp. (Swift)
- Sections 5 and 6 of Fairfield twp.

Severe Erosion Sites:

Numerous severe erosion sites exist in this watershed area. Because of unnaturally high water, portions of Artichoke Lake, the Drywood Lakes, and Drywood Creek have sites that need to be repaired, or prevented from further erosion to correct the many stressors identified in this watershed. Erosion sites have been identified through a geomorphological study conducted by the Minnesota DNR but were not yet available for consideration in this document, but should be considered for future prioritization. The following sites have been locally identified as severe erosion sites:

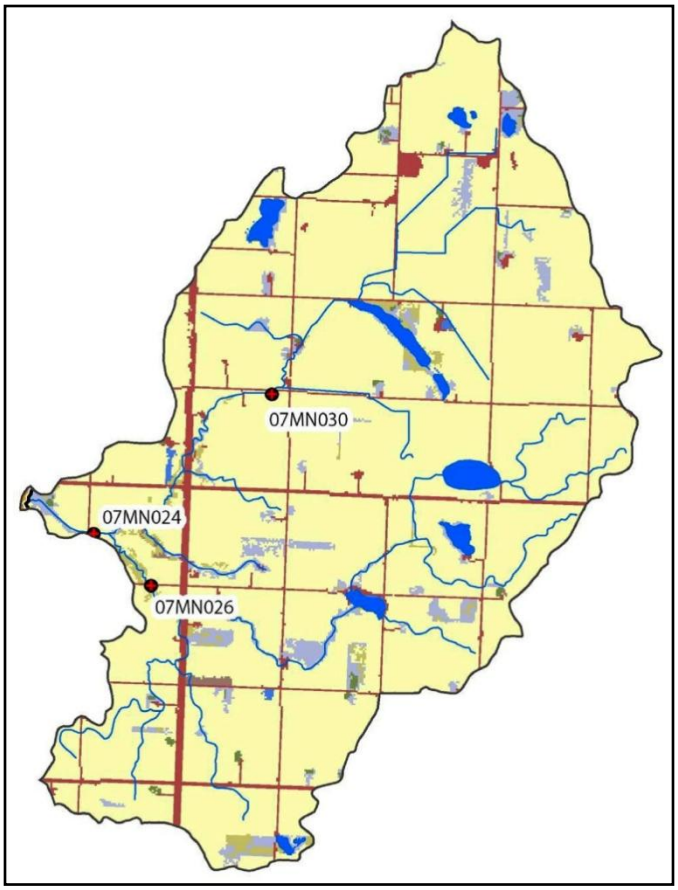
- The island on the north end of Artichoke Lake, section 11 of Artichoke twp. The island has been eroding due to excess water and wave action, introducing thousands of pounds of sediment into the lake yearly. A grant opportunity was sought in 2011 but was unfunded, and should be sought until the issue is remediated.
- North shoreline of Artichoke Lake, section 11 of Artichoke Lake twp. Similarly to the island erosion issue, the north shoreline of Artichoke Lake has seen dramatic erosion in the past years due to excess water creating instability. Surveying has taken place, and the Big Stone SWCD has been working with local Technical Service Area Engineers to design a restoration project. Cost estimates for this large project currently top $100,000.
- A failed dam structure on Drywood Creek in section 1 of Hegbert twp. The dam was originally classified as a fish barrier and installed on Drywood Creek in the 1970s. Failure of the dam structure has caused severe bank erosion on Drywood Creek at the dam site, and should be removed with an erosion control practice installed to prevent further erosion of the stream bank in this area.

Sediment and Nutrient Control Measures:

The Drywood Creek area has a large amount of pasture land due steep slopes making row crop farming difficult. With a large number of pastured animals, there is a high occurrence of these animals accessing surface waters, as well as animal wastes may be introduced more easily. The following practices have been identified to control excess sediment and nutrients.

- Water and Sediment Control Basin (WASCOBs) installation in the Drywood Creek watershed in row cropped fields. Sections 9,10,11, and 12 of Hegbert twp.
- Streambank restorations along Artichoke and Drywood Creek to limit further soil erosion.
- Cattle exclusion fencing along Artichoke and Drywood Creek to limit bank soil disturbance by livestock, and to limit direct nutrient inputs.

Fairfield-Tara Watershed



Summary of conditions/impairments

The Fairfield-Tara Watershed is a small watershed at 29 square miles, and is located almost entirely within Swift County with a small portion in Moore and Horton twps. of Stevens County. The watershed consists of a small, unnamed tributary that flows into the Pomme de Terre River. Land use is predominantly cropland with scattered areas of wetlands and pastureland. There are numerous registered feedlots in this watershed as well, but only a few with over 500 animal units indicating that the majority are small operations. No impairments exist in this small watershed, although the MPCA points out that there has been very limited data collected within the watershed. Protection strategies are likely limited to buffering tributaries or ditches, and limiting cattle exposure to surface waters in this small watershed area.

Priority Areas and Activities

Buffers:

A few wetland areas and small streams exist in the Fairfield-Tara watershed that are un-buffered. Protecting these areas by installing riparian buffers will help ensure the water quality in this watershed does not degrade to the point of impairment.

- Sections 30 and 31 of Moore twp in Stevens County. A small portion of a ditch flowing to the Pomme de Terre has no buffer in this area.
- Sections 1,11, and 15 of Fairfield twp. A largely un-buffered ditch flows into the unnamed tributary and to the Pomme de Terre.
- Sections 7,8,18 of Tara twp. and sections 22,23, and 24 of Fairfield twp along the unnamed tributary. Steep slopes and little buffer have the potential to cause erosion and nutrient loading to the Pomme de Terre.

Wetlands:

Although a small land area, this watershed has several potential wetland restoration sites. Many of these sites can be found simply utilizing aerial photography as the depressions show up well in contrast to surrounding land areas. In addition, modeling outputs from ZONATION show some hot spots which also suggest there are restoration opportunities in this small watershed area. The following have been locally identified:

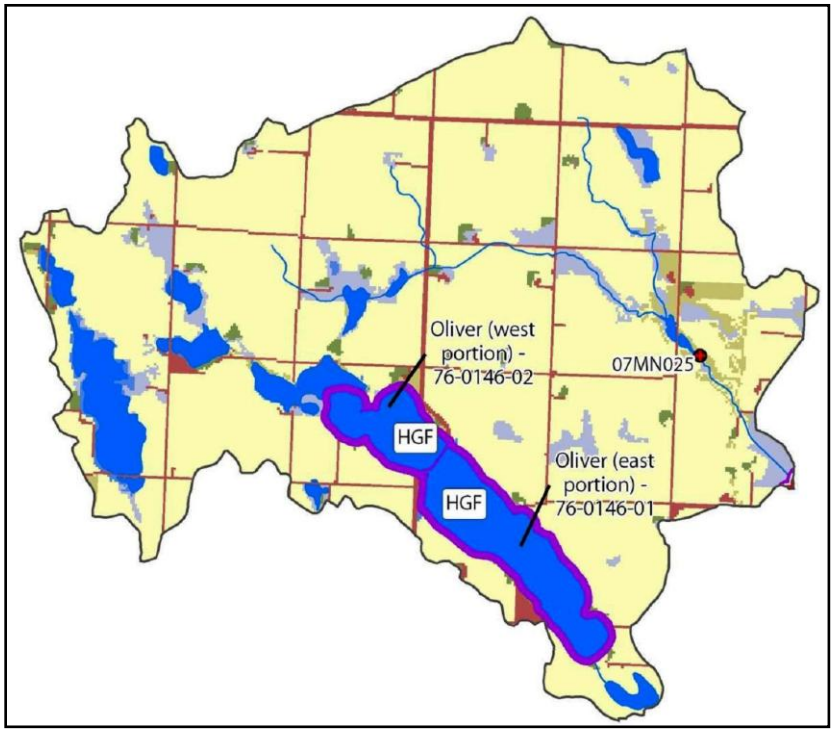
- Section 7,8,18, and 19 of Tara twp. in Swift County. This area has several small, potentially restorable wetland basins.
- Section 11,24, and 26 of Fairfield twp.
- Sections 25 and 36 of Horton twp. in Stevens County.

Sediment and Nutrient Control Measures:

The Fairfield Tara watershed area has a fair amount of pasture land as well as registered feedlots. Sediment and nutrient control measures would help limit inputs from livestock as well as keep runoff from reaching ditches and the unnamed creek that empties into the Pomme de Terre. The following activities have been locally identified:

- Cattle exclusion fencing on pastured areas in the Fairfield Tara watershed along the tributary to, and along the unnamed creek.
- Water and sediment control basins (WASCOBs) in the northeastern portion of the watershed area to limit excess nutrient and sediment runoff.
- Feedlot inspections to ensure limited runoff reaches surface waters.

Lake Oliver Watershed



Summary of conditions/impairments

The Lake Oliver watershed is a small watershed in the southwestern corner of the Pomme de Terre major watershed. The Lake Oliver watershed contains one small, unnamed tributary that flows into the Pomme de Terre River as well as one of the major lakes in the southern half of the watershed in Lake Oliver. The tributary is surrounded by riparian wetlands throughout most of its reach, and flows through a wetland complex before being ditched along the last mile prior to flowing into the Pomme de Terre River. Land use is predominantly cropland, with some pastureland, and due to Lake Oliver a large portion is open surface water. Restoration and protection strategies in this area may be limited to mostly lakeshore and small stream erosion protection. There are no impairments in this watershed.

Priority Areas and Activities

Buffers:

The Lake Oliver watershed is a small watershed however there is significant drainage from a tributary that connects Lake Oliver to the Pomme de Terre River. There is also a large wetland complex including Large Henry Lake in the far western part of the watershed. The following areas have been locally identified:

- West side of Large Henry Lake in section 29 and 20 of Hegbert twp.

- Sections 22,23, and 24 in Hegbert twp. along the tributary on the north end of Lake Oliver.
- Buffers around the west basin of Lake Oliver in section 27 of Hegbert twp. west of CR 5.
- Buffers along the northeast sides of the east basin of Lake Oliver in sections 26 and 36 of Hegbert twp.
- Buffers around the Reu marsh on the far northwest edge of Lake Oliver in sections 21 and 22 of Hegbert twp.

Wetlands:

Relatively few wetland areas exist within this watershed as much of it is surface water already. There are some restorable areas located around Large Henry Lake in the western portion and near the Reu marsh on the northwest side of Lake Oliver. The following areas have been locally identified:

- Sections 20,21,28 and 29 of Hegbert twp. near Large Henry Lake and the Reu marsh.
- Sections 22 and 23 of Hegbert twp. along the unnamed tributary.

Shoreline Stabilization:

There is a high percentage of shoreland area in this watershed attributed to Large Henry and Oliver Lakes. Shoreline stabilization should be considered especially on Lake Oliver as rising water levels have created some areas of significant instability, as well as some out-buildings are now close to, or are now partially underwater. Extensive rock riprap has been placed along CR 5 in Swift County to safeguard the roadway from degradation and to protect a culvert that connects the two basins of Lake Oliver. Priority should be given to areas that are in highest need of repair, especially the west basin of the lake which now incorporates two large wetlands that were not historically part of Oliver. In 2012, a significant portion of the north shoreline of the west basin was enrolled in a pasture buffer program through the PdT Watershed and will be protected until at least 2022. Shoreland areas around the Reu marsh and on the southwest portion of the west basin should be enrolled into a similar program to protect the lake from further nutrient inputs.

Impaired Lakes

Lake Christina - 21037500

Lake Christina is a shallow, eutrophic to hyper-eutrophic basin located in Douglas County within the Pomme de Terre Watershed. It is the only lake in the watershed that is a designated wildlife lake, and is closed to fishing of any kind. The watershed area for this lake is made up of rolling hills and bluffs, is bordered by a natural area owned by the Nature Conservancy, and most of the land-use would be considered grazing land with some agricultural crops. Lake Christina is an important body of water for migrating and resting waterfowl and has been the subject for numerous water quality studies and measures for decades. Fish kills attempted in the 90's and early 2000's using a plant root derived chemical called "rotenone" were successful for short durations in turning the lake to a clear water state. Attempts using this method are typically short term as the lake returns to a turbid state usually after 5 to 6 years. In 2012 a lake drawdown project funded locally with inputs from the Minnesota DNR and Ducks Unlimited came to fruition and pumping began in July. The drawdown is designed to control rough fish species by inducing winter kill through lowering the water level and limiting fish habitat. Rough fish, namely carp are generally considered drivers of poor water quality due to their feeding methods which cause excess sediment to mix in the water column. Returning the water to a clear state would induce submerged aquatic plant growth and help limit internal nutrient loading. It would also provide better duck nesting and feeding habitat. This method is preferred to chemical methods in which success is highly dependent on current lake conditions and weather. Other restoration measures to be considered include buffers, lakeshore restoration, and voluntary land practice changes within the lake watershed area to minimize further nutrient inputs from impacting the lake water quality.

Perkins Lake - 75007500

Perkins Lake is a shallow, moderately eutrophic basin located in Stevens County, and is the largest of what is locally known as the "Chain of Lakes". Perkins Lake is a natural impoundment of the Pomme de Terre River, although a dam does exist on the lake to control water level changes to prevent frequent winter kill events to sustain a recreational fishery. Currently the dam structure is in disrepair and is slated for replacement by DNR in 2016. Perkins Lake is lightly developed with most residences located on the west and south side of the lake. It is an important recreation destination in Stevens County with adequate sport-fishing opportunities, and hosts many species of waterfowl in the fall. Although agricultural row crops dominate the landscape around Perkins Lake, it is fairly well buffered by natural areas, US Fish and Wildlife easements and wetlands. Most nutrient inputs are likely from upstream sources or internal nutrient loading and the lake acts as a settlement basin. Restoration opportunities will be sought on upstream sources and would include buffers, voluntary land-use changes, and other conservation measures. Lakeshore restoration projects will also be considered in areas of need, and septic compliance issues should remain a high priority in the residential areas. A new dam design may also be implemented as a push locally by concerned landowners may have consideration going to a modified dam structure with a fish ladder to improve connectivity and fish passage.

Lake Hattie - 75020000

Lake Hattie is a shallow, hyper-eutrophic lake located in Stevens County in the Pomme de Terre Watershed. There are several outlets and inlets to Hattie, many would be categorized as channelized streams or ditches as well as an unknown number of tile outlet influences. High

phosphate levels, chlorophyll levels, and low secchi disk readings have been common on Hattie for many years. A limited walleye fishery exists with yearly variability. Land use in the Hattie area mostly consists of agricultural row crops. One major observation that can be made with Hattie is the lack of adequate buffer around the majority of the lake. Aerial photos depict row crop fields either bordering the lake or with a thin line of trees present. Restoration activities will include implementing buffer practices, and restoration of other natural wetland areas of which few are left around the lake. Shoreline erosion is fairly limited in Hattie, and a lack of residential areas suggests most of the inputs are of agricultural and/or internal sources. A moderate approach to buffering the ditches and streams near Lake Hattie would be advised to limit excess nutrient inputs, as well as buffering the lakeshore to prevent similar nutrient inputs. Internal loading continues to be a problem in lakes such as Hattie as they typically sustain large rough fish populations. Carp specifically can continue to introduce nutrients into the water column through feeding habits which includes disturbing sediment creating turbid water. There are no comprehensive plans at this time to limit these fish, however other strategies should continue to be used to mitigate further water quality degradation.

North Turtle - 56037900

North Turtle Lake is a eutrophic lake in Otter Tail County in the northern part of the Pomme de Terre Watershed. The majority of the land area surrounding North Turtle Lake is residential, agricultural and interspersed with small wooded areas. North Turtle is considered a "shallow lake" by definition as the majority is 15 feet or less in depth. Although the DNR does not list an inlet or outlet to North Turtle, a pumping station is located on the south end of the lake, which pumps excess lake water into a series of wetlands which eventually make their way to South Turtle Lake. North Turtle Lake was listed on the draft 2012 303(d) list of impaired waters for aquatic recreation. Elevated nutrients and other parameter trends show a decline overall in water quality, and an increased rate of eutrophication. Restoration efforts on North Turtle will include mostly land-use changes (buffers or wetland restorations) throughout the portion of the lake bordered by agricultural land, as well as a continuing SSTS abatement effort which exists through the Otter Tail County Land and Resource office.

Non-Impaired Lakes

There are several lakes in the watershed that are found to be supporting of water quality standards. Protective measures on these supporting lakes and others that are not assessed but believe to be supporting could be broad in range and scope depending on the locality and current lake condition. Assessed lakes that are found to be fully supporting include:

Clear (Otter Tail) – 56055900

Eagle (Otter Tail) – 56025300

Long (Otter Tail) – 56039000

South Turtle (Otter Tail) – 56037700

Stalker (Otter Tail) – 56043700

Swan (Otter Tail) – 56078100
Ten Mile (Otter Tail) – 56061300

Additional Lake Information

Lakes that are not fully assessed but collected data shows trends that the lakes would meet standards if enough data was collected to conduct a full assessment include:

Johnson (Otter Tail) – 56039300
Sewell (Otter Tail) – 56040800
Pomme de Terre (Grant) – 26009700
North Pomme de Terre (Stevens) – 75006100
Middle Pomme de Terre (Stevens) – 75007400

Lakes that are not fully assessed but collected data shows trends that these lakes would NOT meet standards once a full assessment was conducted.

Artichoke (Big Stone) - 06000200
Barrett (Grant) - 26009500
Pelican (Grant) - 26000200
Crystal (Stevens) - 75009700
North Drywood (Swift) - 76016900
Oliver (Swift) – 76014600

Numerous lakes exist in the watershed that are not mentioned above and that have not been accessed, or may not have MPCA submitted data sets for assessment consideration. These lakes are typically either private, or smaller than 100 acres and do not come up for MPCA assessment on a regular basis. Monitoring considerations should be given to some of these lakes that may have restoration potential to improve habitat and water quality conditions, or may be candidates for protection activities. Monitoring for these lakes may occur in the near future, but there are no firm plans at this time to pursue this initiative.

Watershed Monitoring

The Pomme de Terre River Association and several other groups including lake associations have been a part of numerous water quality monitoring projects in the watershed in the past. Most recently the MPCA initiated an Intensive Water Monitoring process in 2007 which included many facets outside of the typical chemical samples, and began assessing biology, habitat, and many other stressors that may contribute to declining or degraded aquatic life conditions. Despite these efforts, numerous data gaps exist in the watershed, as well as past monitoring efforts have led to data interpretations that may need specific monitoring programs to further delineate areas of significant interest. An example of such a situation was brought to light through the Major Watershed monitoring conducted by the PdTRA, in which the Project Coordinator was to take dissolved oxygen samples on a specific reach of the main stem of the Pomme de Terre River. A drastic change in dissolved oxygen content was noticed in an area prone to repeated cattail dams in culverts. Removal of the dams resulted in a noticeable increase in dissolved oxygen within a 3 weak time period.

Other considerations for monitoring include pre and post-implementation monitoring. The Pomme de Terre has been extremely active over the past 3 years in seeking BWSR Clean Water Funds for implementing conservation practices, and numerous projects have been completed without any direct analysis of success from a nutrient or sediment reduction standpoint. The following are monitoring priorities for future projects:

1: Pre and post-implementation monitoring to judge the effectiveness of installed BMPs through Clean Water Partnership, Clean Water Funds, and EPA Section 319 grants.

- Parameters included:
    - Turbidity, *E. coli* (where applicable), Dissolved Oxygen, TSS, Phosphorus, Chlorophyll-a, and Nitrogen (full suite).
- Watershed areas to sample:
    - 3 sites on the Pomme de Terre mainstem, 1 site on each of Pelican Creek, Muddy Creek, and Drywood Creek.

2: Turbidity monitoring. Anecdotal data observed through previous monitoring projects have shown a drastic change in turbidity and water clarity readings between the City of Morris and Drywood Creek. An intense monitoring strategy consisting of multiple sites to effectively delineate the problem area will be utilized. At least 6 sites on the mainstem of the Pomme de Terre River in this area will be analyzed for identifiable changes in turbidity and water clarity.

3: Lake monitoring. Numerous data gaps exist in water quality information gathered on watershed lakes (See “Additional Lake Information” above). Applications to fill these gaps will be sought through applicable grant opportunities such as Section 319, or MPCA Surface Water Assessment Grants to assist in the MPCA’s ability to conduct assessments on these waterbodies.

Watershed Modeling

The Pomme de Terre River Watershed has been the focus of numerous modeling projects since the MPCA Major Watershed restoration and protection efforts started in 2007. The largest to date is the MPCA driven HSPF (Hydrologic Simulation Program – FORTRAN) which gives a simulation model of hydrology and chemical water quality parameters based on precipitation rates and runoff. This model is especially useful on a watershed scale at determining the water quality changes based on BMP implementation scenarios.

In conjunction with HSPF data, another modeling tool was made available during the PMZ process in the Pomme de Terre. The Minnesota DNR has been utilizing a GIS based data model that considers user-based weighted values to determine a best fit for implementation activities. The values are based on local input, and are determined using a pair-wise comparison of different input attributes. See figure 1 below for example. All survey answers were then considered and a weighting scheme was established to guide the model on the strongest values our group had. The model then used those weights and values to shade in a map of the watershed. Areas with the strongest weights and values for a specific parameter such as water quality would accumulate the most color and appear red on the map. These "hot-spots" are then the PMZ areas our group chose based on our own empirical values. See figure 2 for detail. Also see the table on page 30 for details on the tools that were made available to the Pomme de Terre Technical Advisory Committee in completing our priority management zone selections. Both the Technical Advisory Committee and Joint Powers Board completed the survey and there was little change in values that each group selected independently. The products of this model include maps, that are based on available GIS data layers that may or may not be current, and do not necessarily reflect the priorities in this plan, nor do the priorities in this plan reflect what the maps may show. Data gaps and interpretation were the two main weaknesses noted by both groups.

Figure 1

	Strongly prefer	Somewhat prefer	Prefer	Equal	Prefer	Somewhat Prefer	Strongly Prefer	
Biology	O	O	O	O	O	O	O	Water Quality
Biology	O	O	O	O	O	O	O	Hydrology & Geomorphology
Biology	O	O	O	O	O	O	O	Connectivity
Biology	O	O	O	O	O	O	O	Agriculture
Water Quality	O	O	O	O	O	O	O	Hydrology & Geomorphology
Water Quality	O	O	O	O	O	O	O	Connectivity
Water Quality	O	O	O	O	O	O	O	Agriculture
Hydrology & Geomorphology	O	O	O	O	O	O	O	Connectivity
Hydrology & Geomorphology	O	O	O	O	O	O	O	Agriculture
Connectivity	O	O	O	O	O	O	O	Agriculture

Figure 2: ZONATION model output. Simulated Protection and Restoration strategies based on balancing agricultural and ecological benefits.

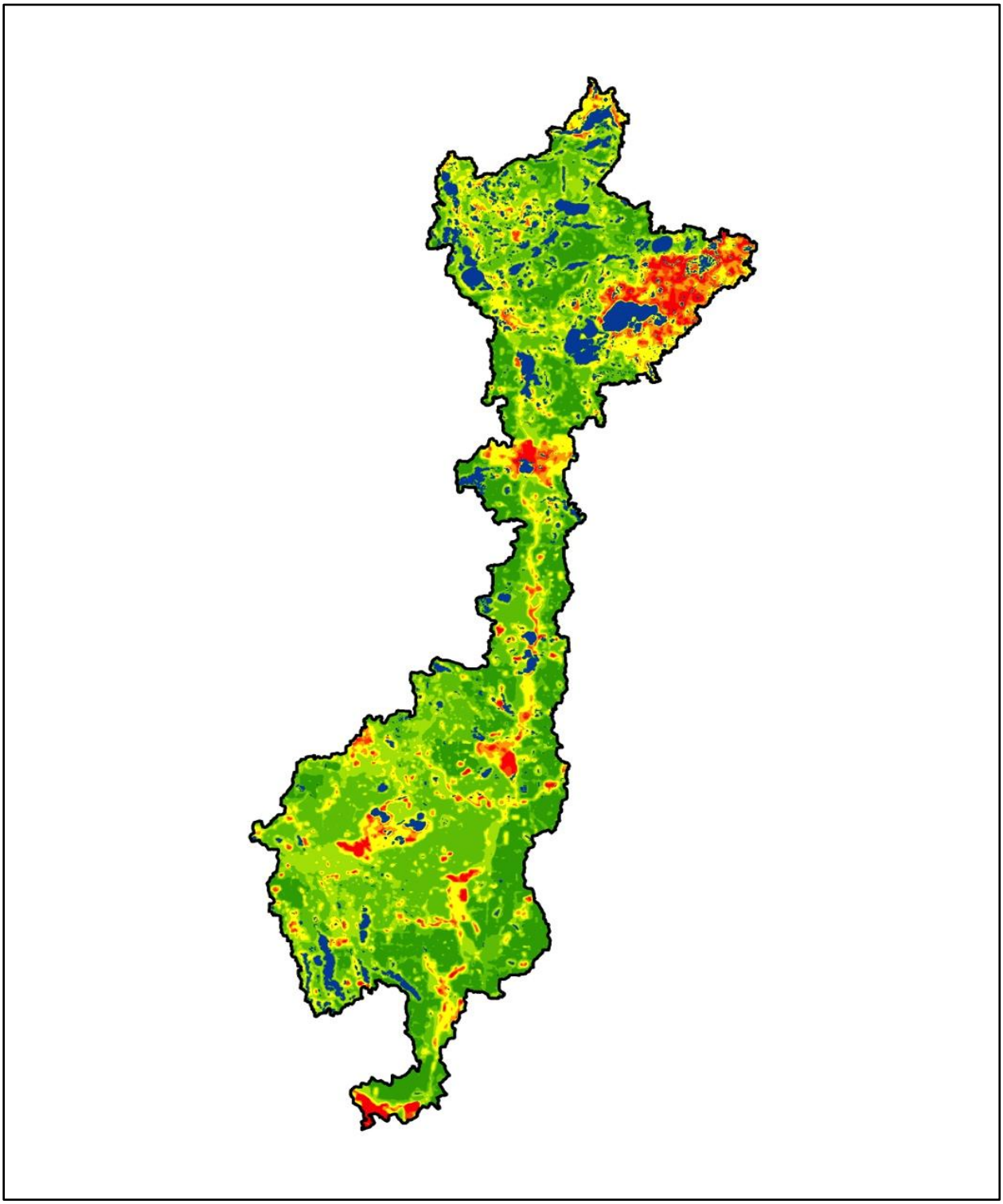


Figure 3

	Human Disturbance Score (HDS)	Hydrological Simulation Program – FORTRAN (HSPF) Model	Environmental Benefits Index (EBI) of the Ecological Ranking Tool	Zonation	Restorable Depressional Wetland Inventory	LiDAR (Light Detection and Ranging)
Description	A general overview of intensity of human-related activity in a watershed as measured by five factors including watershed land cover, riparian land cover, point sources, feedlots, and extent of stream channelization.	Simulation of watershed hydrology and water quality for both conventional and toxic organic pollutants from pervious and impervious land.	Scoring system that allows for the prioritization and ranking of critical lands.	A framework and software for large-scale spatial conservation prioritization; it is a decision support tool for conservation planning. This values-based model can be used to identify areas important for protection and restoration.	Digital data representing drained, potentially restorable wetlands in agricultural landscapes.	An active remote sensing technology that uses laser light to detect and measure surface features on the earth.
Applications	This score gives a quantitative measure of human-related activity in a watershed that can inform whether an emphasis on restoration or protection projects is needed.	Incorporates watershed-scale and non-point source models into a basin-scale analysis framework. Addresses runoff and constituent loading from pervious land surfaces, runoff and constituent loading from impervious land surfaces, and flow of water and transport/ transformation of chemical constituents in stream reaches.	A single score between 0-300 is developed based on three data layers that address potential soil erodibility, surface water erosive potential based on stream power index and proximity to surface waters; and quality of biological habitat	Zonation produces a hierarchical prioritization of the landscape based on the occurrence levels of features in sites (grid cells). It iteratively removes the least valuable remaining cell, accounting for connectivity and generalized complementarity in the process. The output of Zonation can be imported into GIS software for further analysis. Zonation can be run on very large data sets (with up to ~50 million grid cells).	Assists in the restoration of wetlands, to enhance wildlife habitat, to improve surface and ground water quality, and to reduce flood damage.	The link below includes example applications including erosion analysis, water storage to reduce streambank erosion and improve water quality, siting and design of BMPs, wetland mapping, protection, and restoration, and flood control and mapping.
Notes		Local or other partners can work with MPCA HSPF modelers to evaluate at the watershed scale: 1) the efficacy of different kinds or adoption rates of BMPs, and 2) effects of proposed or hypothetical land use changes. Typically used in large watersheds (greater than 100 square miles)	Higher scores indicate the land has relatively high risk for soil erosion due to overland flow and has relatively high quality biological habitat.	The software allows balancing of alternative land uses, landscape condition and retention, and feature-specific connectivity responses.	Created primarily through photo-interpretation of 1:40,000 scale color infrared photographs acquired in April and May, 1991 and 1992. It is necessary to display this dataset in conjunction with the USGS National Wetlands Inventory (NWI) polygons that have a 'd' modifier in their NWI classification code.	This data is available for most MN counties and provides very high resolution (3-meter pixel) data for elevation imagery.
To Find More Information		http://water.usgs.gov/software/HSPF/	http://www.bwsr.state.mn.us/ecological_ranking/	http://www.helsinki.fi/bioscience/consplan/software/Zonation/	*http://deli.dnr.state.mn.us/metadata.html?id=L390002730201*	http://www.mngeo.state.mn.us/chouse/elevation/lidar.html

Stakeholder Summary

Communication and Outreach

Several opportunities were leveraged to address the public through the MPCA Major Watershed Restoration and Protection Strategy process. 3 Stakeholder meetings were held, independently to identify the needs of 3 specific stakeholder groups. The first of the three meetings was targeted at producers. The Technical Advisory Committee of the Association wanted to get a better understanding of how these stakeholders could be serviced by our organization. It was an open forum discussion, and the question was asked: "What can we do for you, and how can we best serve your needs?" The discussion was an open-forum, with the stakeholders compiling a list of practices they thought were most beneficial to them and would impact water quality in our area the most significantly. Atop the list of these practices were buffers and conservation practices such as water and sediment control basins and strip-till or no-till farming practices. The same exact meeting was then held a few months later with stakeholders that own lakeshore property in the watershed, and again finally with individuals that represent cities or urban areas in the watershed. The three meetings gave the Association good direction in how to proceed in trying to improve water quality in the Pomme de Terre while meeting the needs of the stakeholders.

Another opportunity leveraged to communicate and reach out to the public was a Pomme de Terre Watershed Annual Meeting. This meeting was held in April of 2012, and gave those who attended an idea of what this new "Major Watershed" process was all about, and why the MPCA was straying from the traditional 10 year TMDL cycle that some stakeholders had previously been a part of. The meeting also included a survey to find out how much support exists in the watershed for conservation action, and also how many people knew what the Pomme de Terre River Association's goals and objectives were. The last portion of the meeting was dedicated to unveiling a new stakeholder opportunity the Project Coordinator and MPCA project manager designed call the "Pomme de Terre Watershed Academy" which was open to any who attended the meeting or was involved in the previous stakeholder meetings.

The Watershed Academy was an 8 week educational course designed to reach out to truly interested watershed citizens. The course spent each week addressing a wide range of topics, generally increasing in difficulty as the weeks went on. It started out with "What is a watershed?" and finished with an in-depth class on geomorphology – the process in which rivers change through time. Four of the weekly classes featured guest speakers including Kelli Nerem who spoke about monitoring and water chemistry, Todd Call with the DNR who spoke about shallow lakes and lake ecology, Janell Miersch with DNR who came to play "The Watershed Game", and Dave Friedl with DNR who gave an in-depth look into the world of geomorphology. Although attendance varied from week to week, the class consisted of a solid core of interested participants. Further Watershed Academy class are expected to be held in the future at different locations throughout the watershed.

The last opportunity in the wide range of stakeholder outreach was the printing of a watershed stewardship guide. The stewardship guide is a booklet that consists of many types of practices and conservation tactics aimed at all three of the different stakeholder categories, from agriculture to shoreline to cities, all facets were included. The guide was printed to inform all the citizens of the watershed that no matter where they lived, they had an impact on local water quality, and could do easy things to help conserve and protect our local water resources.

Outdoors and Agriculture Groups and Cities Inventory

Outdoors and agriculture related groups represent an interest in the welfare of natural resources largely in support of the recreational and agricultural uses that exist in the Pomme de Terre Watershed. The following is an inventory of cities and groups that have been identified as being a potential partner in expanding our stakeholder base and having input in future projects

Watershed Cities

Alberta

Appleton

Ashby

Barrett

Chokio

Dalton

Donnelly

Morris

Underwood

Area Agriculture Groups

Minnesota Corn Growers Association

West Central Cattlemens Association

Minnesota Soybean Growers Association

Minnesota Farm Bureau

Stevens County Pork Producers

Otter Tail – Grant County Corn and Soybean Growers Association

Minnesota Soybean Research and Promotion Potential

Minnesota Agricultural Waters Resources Coalition

Outdoors Groups

Otter Tail

Ten Mile Lake Association

Stalker Lake Association

Stalker Lake Sportsmans Club

Eagle Lake Association

Eagle Lake Sportsmans Club

South Turtle Lake Improvement District

Lake Country Sportsmen

Otter Tail Pheasants Forever

Otter Tail Ducks Unlimited

Minnesota Deer Hunters Association – Otter Tail Chapter

Grant

Christina-Ina-Anka Lakes Association

Pelican Lake Association

Pomme de Terre Lake Association

Barrett Lake Association

Elk Lake Association

Grant County Ducks Unlimited

Douglas

Pioneer Heritage Conservation Trust

National Wild Turkey Federation – Christina Lake Longbeards

Christina Lake Ducks Unlimited

Stevens

9-F Sportsmans Club

4-H Shooting Sports

Stevens County Pheasants Forever

Stevens County Ducks Unlimited

Deer Hunters of Stevens County

Donnelly Rod and Gun Club

Alberta Wildlife

Chokio Sportsmans Club

Morris Rifle Club

Big Stone

Citizens for Big Stone Lake

Ortonville Kiwanas club

Big Stone Pheasants Forever

Graceville Gun Club

Turkey Federation

Ducks Unlimited

Lake Area Chamber of Commerce

Swift

Swift County Pheasants Forever

Swift County Ducks Unlimited

Chippewa Valley Deer Hunters
Holloway Rod and Gun Club
Appleton Sportsmans Club
Swift County National Wild Turkey Federation

Action Timeline

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Implementation Activities	X	X	X	X	X	X	X	X	X
Stakeholder Involvement	X	X	X	X	X	X	X	X	X
Intensive Watershed Monitoring				X	X	X	X		
WRAP Phase II							X	X	X
Additional Monitoring (Proposed)		X	X		X	X		X	X
Funding Applications	X	X	X	X	X	X	X	X	X
Project Coordination	X	X	X	X	X	X	X	X	X

Acknowledgments

Big Stone SWCD
Big Stone County
Douglas SWCD
Douglas County
Grant SWCD
Grant County
Stevens SWCD
Stevens County
Swift SWCD
Swift County
West Otter Tail SWCD
West Otter Tail County
Dave Friedl – MN DNR
Janell Miersch – MN DNR
Paul Radomski – MN DNR
Kristin Carlson – MN DNR
Todd Call – MN DNR
Joseph Hauger – MPCA
Mark Hanson – MPCA
Katherine Pekarek-Scott – MPCA
Kelli Nerem – MPCA
Kim Laing – MPCA
Chuck Regan – MPCA
Pete Waller – BWSR

Appendix