Healthy Lake Huron
Clean Water. Clean Beaches

Garvey-Glenn Watershed Project

July 2014

MAITLAND VALLEY CONSERVATION AUTHORITY

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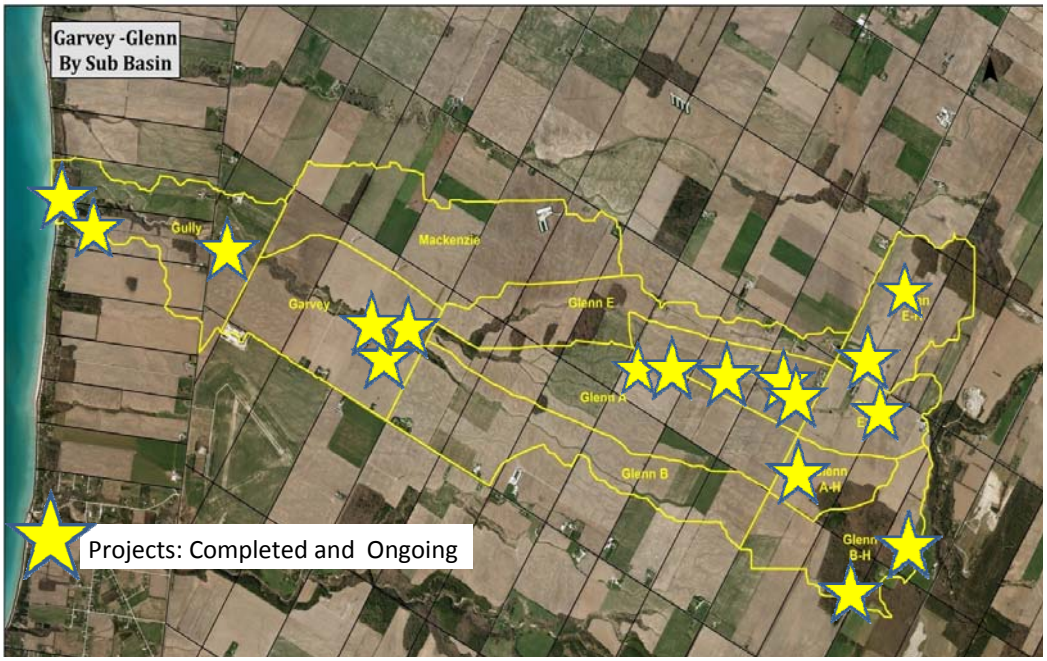
Garvey-Glenn Watershed Project

Goal:

A) To improve soil and water quality in the Garvey-Glenn watershed through coordinating BMP projects based on the intersection of landowner interest and level of priority for the watershed. B) To record and monitor the process, and demonstrate the efficacy of such an approach for other watersheds.



Contributors

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BACKGROUND

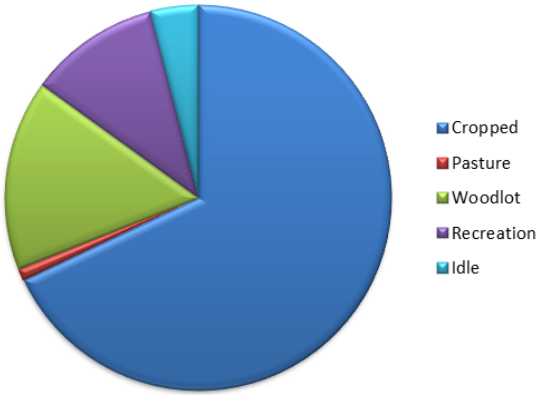
The Garvey-Glenn is one of five priority watersheds in the Healthy Lake Huron initiative, a project that aims to improve the water quality along the southeastern shore of Lake Huron. Water quality begins in the fields and woodlots, lawns and parking lots that make up the headwaters of any given watercourse. This is why the Healthy Lake Huron initiative is dealing with lakeshore water quality on a watershed basis.

Relative to the other four priority areas, the Garvey Creek-Glenn Drain is a small watershed. It drains approximately 3500 acres of farmland and its watercourses follow 89 metres of fall to empty directly into Lake Huron, 15 kilometres north of Goderich, ON.

Originally forested, the Garvey-Glenn watershed is now an intensively farmed agricultural area with cottages along the lakeshore. In this watershed, the Maitland Valley Conservation Authority (MVCA) aims to work with farmers inland to understand how best to protect top soil and nutrients from runoff, thereby improving water quality.

The Huron Slope physiographic region is defined by a gently sloping, largely flat area of area of land located immediately to the lee of Lake Huron. This area is characterized by heavy, clay soils that overlay the clay -rich St. Joseph's Till. In the upper reaches of the headwaters, there is a woodlot containing areas of wetland. Downstream of this natural area, water flows both overland and through a network of open and closed drains. Through the middle of the watershed the watercourses merge and form more defined valleys, many of which are forested. Before entering Lake Huron, this creek flows through a deep forested gully which is actively eroding.

Land Use in Garvey-Glenn



In 2011 the MVCA, in collaboration with nearly 40 landowners in the Garvey-Glenn, began a project that would improve the use agricultural best management practices (BMPs) to improve water quality and demonstrate their usefulness on a watershed-wide scale. MVCA works on behalf of these farmers and landowners to secure available funding for their project goals, as well as collecting soil and water data to monitor the results of ongoing BMPs.

Research has shown that the most effective place to control water contamination is right at the source. In this case, the most cost effective way to keep soil and nutrients out of the watercourse, is to keep them in the field.

To do this, we can build organic matter in the soil because healthy soil can absorb more water, thereby decreasing runoff. We can also plant cover crops or grassed waterways—the roots of this vegetation keep the soil in place. We can also stop the water from leaving the field by building wetlands or berms and filtering the water as it leaves through subsurface drainage.

TIMELINE

2011

Meet with local champion and individual landowners

Landowner meeting: Identified priorities for the Garvey-Glenn watershed

Field walks: MVCA staff walk watersheds to identify issues and suitable locations for BMPs.

Second landowner meeting to present results

Follow– up meetings with individual landowners.

Monitoring of watercourses begins

Landowner Steering Committee formed.

2012

ISCO station constructed on Kerry's Line and

Weather station installed on a landowner's property

5 berms constructed at Glenn E2- Headwaters

2013

2.5 acres planted to trees to retire fragile land along the Garvey creek

4 berms designed for Glenn E - Headwaters

Soil samples taken of 1500 acres

2 berms and grassed waterway designed for Glenn A - Headwaters

2014

85% of landowners participate in Soil Health Survey

3 level-loggers installed at mid-waters

Stantec surveys three sub-basins for future design and meets with landowner to design

2 acres planted to trees

2 informational signs designed

***Monitoring of watercourses / Rural Stormwater Management Model Project ongoing**

After the water leaves the field, there is the potential to filter it before it reaches the watercourse by buffering the Garvey Creek with trees and shrubs. Watercourses that meander and are shaded, that develop pools and riffles are able to self clean.

Solutions become more costly the further we get from the source of the problem.

Cottagers at the shoreline came to MVCA with concerns of gully erosion. But instead of dealing with the symptoms at the near shore area, they were willing to work with farmers upstream to address stormwater management problems. Changes in the watershed's land use have also changed the way that the water moves across the landscape. After storms, the water now drains very quickly and this has increased both the volume and velocity of water in the watercourses at peak flow, causing increased erosion both in the fields and along watercourses. Furthermore, the removal of fencerows in fields has allowed for more runoff of top soil and nutrients, contributing to decreased water quality and algal fouling at the beach area.

Thus, the strategy of this project is to start implementing BMPs at the headwaters to slow the overland runoff, and work systematically towards the gully. As many of the low draws and

Actively eroding gully near shore

watercourses (sub-basins) cross numerous properties, a landowner cannot address them as an individual, but must cooperate with neighbours.

These BMPs will reduce the velocity of water and the height of peak flows in watercourses after a storm event. The projects in the headwaters will hinge around erosion control berms and wetlands to hold water for a time, while the mid-waters will focus on riparian buffer strips and grassed waterways to protect soil and allow for effective drainage. The cumulative effect of BMPs should decrease the rate of erosion, minimizing topsoil and nutrient loss while improving water quality.

A landowner steering committee was formed near the outset of this project and it advises the MVCA through ad hoc meetings and email communication. Quarterly newsletters are mailed to all landowners and social media sites are updated with news of the project. Yet, the strength of this project lies in the relationships that have been built between the MVCA and individual landowners, along with the intimate knowledge of the watershed due to well-kept notes from field walks and landowner communications. Of course, this is made possible by the limited size of this watershed project.

This project will not only benefit the farmers who implement these improvements on their farms, but through managing stormwater, municipalities will benefit from less need to replace culverts, roads, drainage infrastructure and bridges. The data from this project will benefit the MVCA and other organizations with an increased understanding on the efficacy of these best management practices (BMPs). The entire community will benefit from a healthy watershed that will sustain itself for generations to come.

WATERSHED APPROACH

Issues contributing to water quality problems in a watershed are often complex. Solutions involve multiple landowners, and may require a variety of new management practices to be put in place. These issues are best addressed using a systems approach.

To address the watershed as a whole, it must be understood across property boundaries. Field walks conducted in 2011, took note of the movement of sediment and nutrients to the lake by indicating the active flow pathways and the sources of sediment .

Pathways include:

- Overland flow
- Subsurface drainage
- Open channels

Examples of Source Areas are:

- Erosion prone areas
- Soils with elevated nutrients levels
- Fields with recent nutrient applications

If a source of nutrients is connected to a flow pathway, this can become a critical source area in the watershed. Critical source areas have been shown to contribute a large percentage of the nutrients lost from watershed.

Understanding where flow pathways are, and where the problem areas are within a watershed help us to prioritize areas within a watershed. Watershed assessments that include field walks are key to identifying these areas and coming up with plans to address the issues.

OPPORTUNITIES FOR THE WATERSHED

Headwaters. There are six primary flow pathways through the headwaters area, including open watercourses, as well as closed municipal and closed private drains. The closed drainage pathways do not handle all storm water, and there is typically considerable overland flow above them at some point in the year. Conditions in these low draws vary depending on management practices. Grass waterways, located in some of the low draws, are quite effective at reducing erosion. The amount of erosion through these low draws is also influenced by tillage practices.

The two open watercourses have both well buffered, and poorly buffered sections. Some sections of channel have only limited access to its floodplain.

Several complex drainage issues emerged during the field assessment. Infrastructure needs maintenance and in most cases would need to be upgraded to accommodate stormwater management projects in the headwaters area. Some culverts have been buried with eroded sediment. Catch basins and hickenbottoms need more maintenance or redesign, as some are quickly filled with debris. Closed drains downstream may be at capacity and may need to be resized.

A number of farmers are practicing no-till or lifting their plows in the low draws and this is mitigating erosion. Many pre-existing grass waterways and grass swales are transporting water effectively. Adequate buffer zones along the Glenn-A and Glenn-E drains are creating valuable habitat. Wetland and natural area in the lower section of Glenn-A also provide valuable habitat and have the ability to filter sediment. Portions of the open watercourses have natural dimensions and are transporting sediment effectively. Some windbreaks have been planted along fence lines.

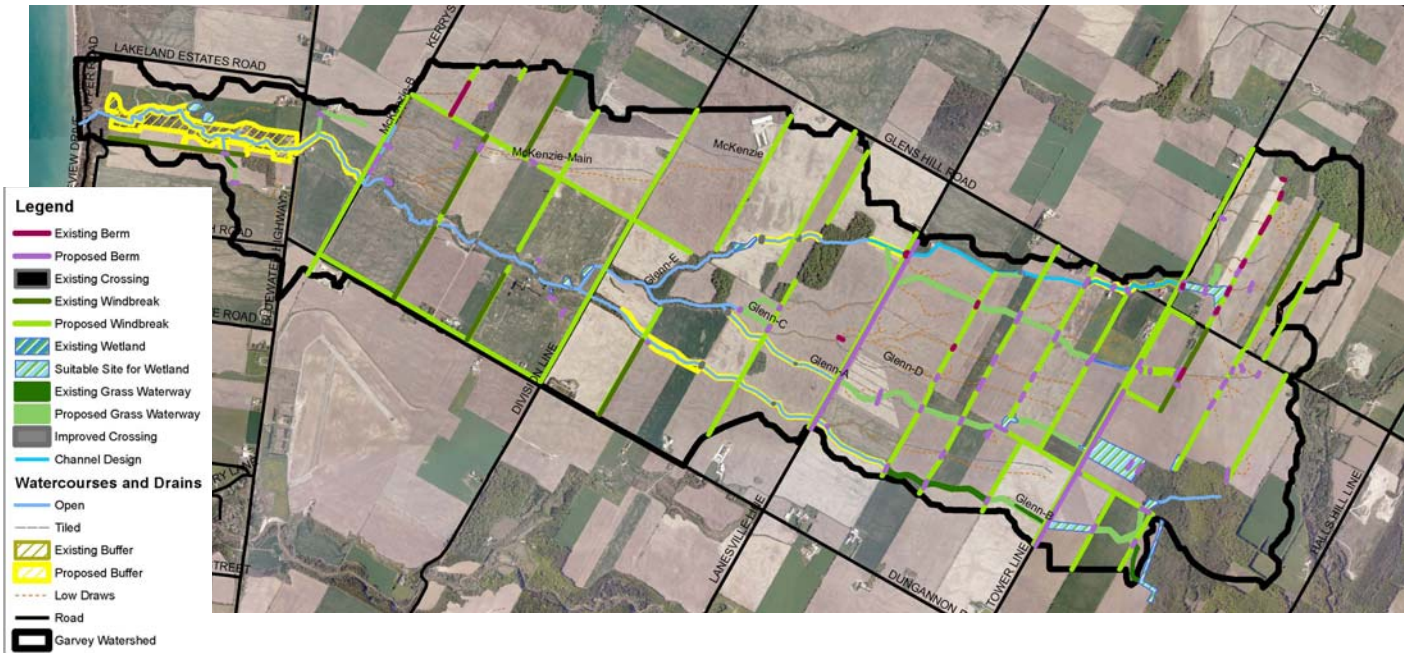
There is an opportunity to hold more water in the woodlot at the headwaters and to construct berms in the low draws along fence lines. Grass waterways along the low draw south of the Glenn-E drain would reduce erosion and existing grass waterways could be fixed to function optimally. There is an opportunity to enhance existing buffers and natural area. The watershed would also benefit from expanding and upgrading the municipal drainage system. Windbreaks between properties in the open expanses would decrease wind erosion.

Mid-waters. Many drains and open channels converge into two channels just east of Division Line, while these two branches join as Garvey Creek just west of the road. It flows through a defined valley that was once pasture and has now reforesting naturally in parts, while there is also evidence of past reforestation projects. According to landowner accounts, flow through this area is less consistent than it used to be and there are fewer fish and turtles. In this area there is pressure to convert the wide valley to farmland but there is also the opportunity to permanently retire it with more reforestation projects.

The Garvey Creek is joined with the drainage water from McKenzie drain at Kerry's Line. There is little to no erosion concerns in this sub-basin, though ponding can occur upstream of McKenzie-B after heavy rains and there is some bank erosion in the open drain along Kerry's Line.

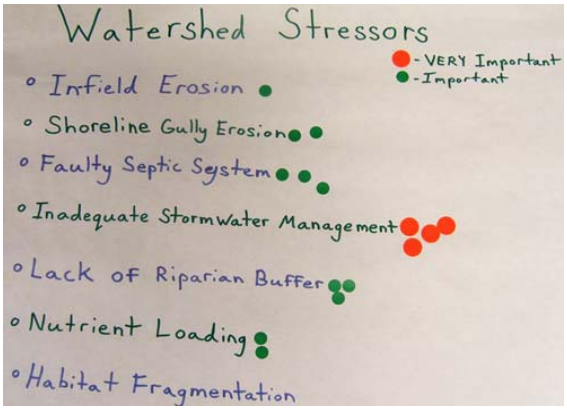
Gully and Shoreline. West of Kerry's Line, the north side of the gully has two active pastures and cattle are fenced out of the watercourse. The valley is forested but the vegetation has difficulty staying on the actively eroding slopes. According to landowners and historical aerial photos, the rate of the gully erosion has increased in recent years and the waterfall at the top end of the gully has been migrating upstream towards highway 21. The erosion poses a risk to private property, most notably the cottages along the creek at the shoreline. The Mid-Huron Beach Property Owners Association have been collectively installing drainage structures to convey water down the bluff to prevent bank slumping.

Optimal Places for BMPs in the Garvey-Glenn



Land in the Garvey-Glenn watershed is owned by about 20 farmers, with four large operators owning about half of the watershed. Understanding the complex issues that farmers face and maintaining a positive relationship with these families is paramount. So MVCA thought it best to let the landowners take the lead.

A PEOPLE-CENTRED APPROACH



A local farmer accompanied staff to make connections to the landowners and after the key farmers in the watershed were on board, all people in the Garvey-Glenn were invited to a meeting at the Kingsbridge church nearby on March 24, 2011. They voted on the most important issues they were dealing with through a collective 'dot exercise' in groups. The primary issues identified were inadequate stormwater management and in-field erosion.

Landowners gave permission to MVCA staff to walk the watercourses, through their properties. As the spring waters were flowing in April and May, MVCA staff walked over 50 kilometres of low draws and watercourses, taking over 3000 georeferenced photos. They saw firsthand the problem areas along with the existing BMPs in the watershed and noted the places that were suitable for future BMPs on aerial photographs. They measured channel dimensions and characteristics for each reach, the size of culverts, the location of tiles and outlets, along with cropping and tillage information. This information was mapped for future reference. All of the possible BMPs in the Garvey Glenn were given an estimated cost of $3.3 million. This budgeting exercise was important for understanding the potential scope of the project and to demonstrate the need for continued support of the project.

Another landowner meeting was held on June 30th, 2011 and MVCA staff presented their findings for further input. They also met with individual landowners to follow-up with field walks and to learn about each farmer's short and long-term goals for their property.

Later in the summer, a landowner steering committee was created and they continue to work with the MVCA. They are consulted on funding and project opportunities and give comment to MVCA staff.

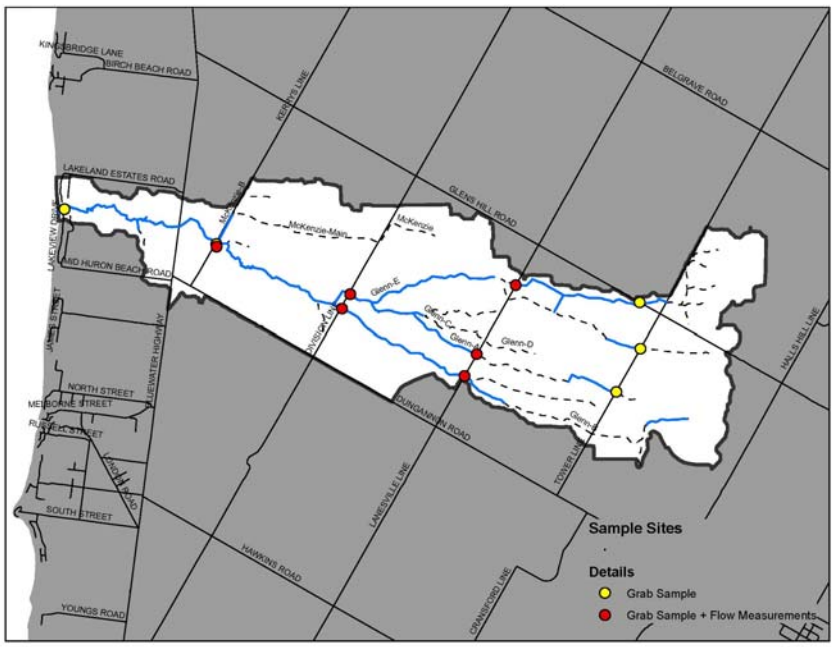
MONITORING THE GARVEY-GLENN

Starting in 2011, 11 sites in the Garvey-Glenn have been monitored for water quality. Flow is now monitored at six of the original 11 sites. Since monitoring began 380 water samples have been sent to the lab to measure suspended solids, total solids and dissolved solids, along with nitrates, ammonia, phosphates and E.coli. Adjacent watersheds have been tested for pesticides, which gives us a rough approximation of what agricultural chemicals we would find in the Garvey-Glenn.

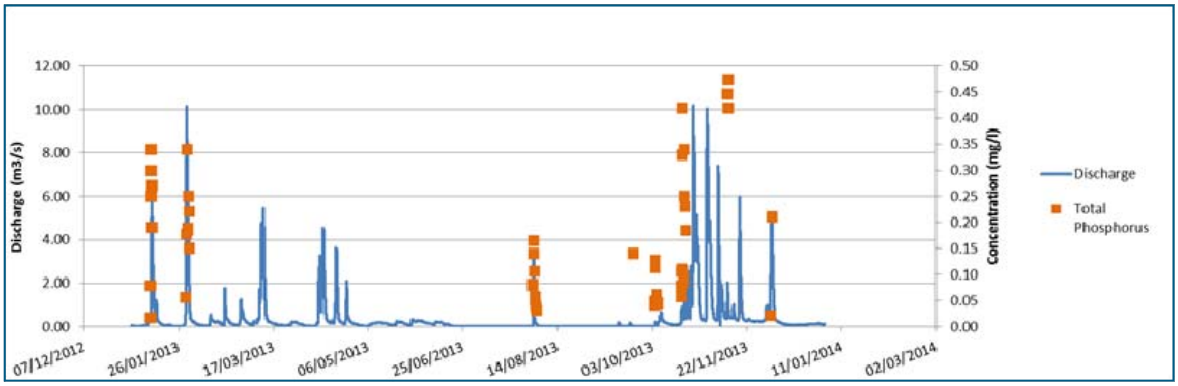
In 2012, a permanent water monitoring station was constructed on the south side of Garvey Creek on Kerry's Line. The station has an automated water sampler that is set up to take samples at regular intervals throughout flow events. This means we get a better understanding of how the concentrations of sediments and nutrients vary during different flow events throughout the year.

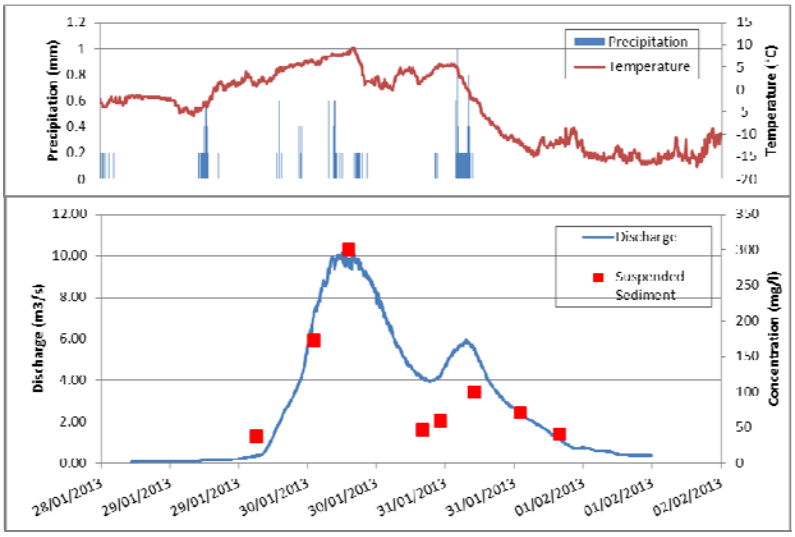
Between 2011 and 2014, concentrations of Phosphorus ranged between 0.003 to 1.4 mg/L, with the highest concentrations occurring during major flow events. For perspective, the provincial water quality objective for Phosphorus is 0.03 mg/L. Concentrations of Nitrates ranged from 0.05mg/L to 36.4 mg/L. 2.93 mg/L is the guideline for freshwaters in order to protect the health of life in and around rivers.

So far at the permanent station in 2014, we've found that E.coli has ranged from 19 colony-forming units (cfu)/100mL to 1150 cfu/100mL. That's a lot of variability just in one site. The median has been 230 cfu/100mL and, to give this number some perspective, the guideline suggest-



This chart shows the variability in the concentration of phosphorus in relation to the flow for 2013, measured at the permanent monitoring station on Kerry's line.





In the example above, a snowmelt combined with rainfall resulted in a major discharge event late January 2013. Concentrations of suspended sediment vary throughout the storm and are related to the rate of discharge.

ed for recreational water in Ontario is 100 cfu of E.coli per 100mL.

Three areas in the Garvey-Glenn were electro-fished in 2011, and four areas in 2014, including a stretch of the watercourse that runs through a wetland. There was an abundance of dace and creek chub, which are warm-water species and indicate that the water temperature is still unsuitable for cold–water trout species.

It is important to know how much runoff there is, and when it is leaving the watershed. In 2013, we saw that about 70 percent of the flow occurred during the non-growing season (November to April). This is important because flow drives the movement of nutrients and sediment to the lake. During the non-growing season, the ground is not covered by crops and this leaves the top soil vulnerable to erosion during heavy rainfall and snow melt events. This stresses the importance of protecting soil during this period. This leads us to the Soil Health Project!

QUICK FACTS

3470 acres in watershed

380 water samples to lab

11 sample sites

6 level loggers

3700 photos taken

1500 acres of soil sampled

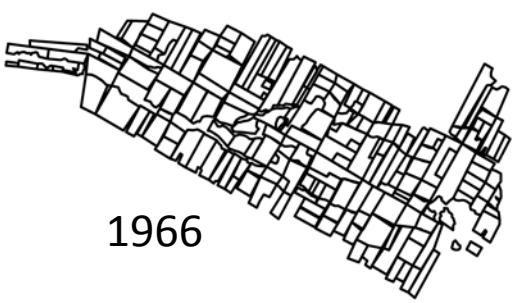
60 kms of fieldwalks

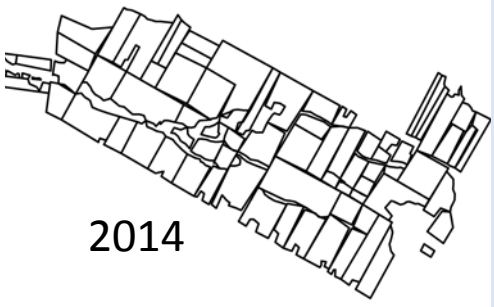
4.5 acres of trees planted

5 berms constructed

6 berms designed

THEN... AND NOW





Over the years, fencerows have been removed to make fields larger and improve a farmer's economy of scale. Fencerows often functioned as small berms and helped to slow down stormwater. The BMPs proposed for the Garvey-Glenn watershed accommodate these large fields and machinery while increasing the soil's ability to stand up to the intense storms we're seeing.

PROMOTING SOIL HEALTH

One of the most effective strategies we can use to protect and improve our soil and water is to avoid problems in the first place. This means focusing on improving soil health, and minimizing the risk of erosion and nutrient losses at the field level first. In 2013, the MVCA and landowners within the Garvey Glenn began a partnership with OMAF on a Soil Health Project. The Soil Health Project builds on the work already happening in the watershed.

There are 4 major components of the Soil Health Project.

1) Continue to demonstrate and monitor erosion control structures installed in the Garvey-Glenn.

2) Develop nutrients balance sheets for all fields in the watershed to help producers make informed decisions.

3) Work with producers to demonstrate practices that improve soil health (i.e., using cover crops and maintaining soil cover year round).

4) Collect land management and soil health data which will be used as part of a larger initiative to develop watershed Soil Health Report Cards.

A large part of this project has been compiling soil test, and land management data for all fields in the watershed with the help of producers. To fill in data gaps, soil samples were collected for 1500 acres where there were no recent sample results available. This data is being compiled to understand the nutrient balance at the watershed scale. In addition, participating landowners will receive nutrient balance sheets for each of their fields in the watershed. This will be another tool producers can use to help make decisions on their farm and possibly avoid over application and/or the unnecessary buildup of nutrients in the soil.

As part of this project, MVCA is working with producers to demonstrate ways of maintaining residue cover during the non-growing season through the use of conservation tillage practices and using cover crops. These practices help to avoid erosion and nutrients losses in the field – before they can get into watercourses and eventually to the lake.

The land management data and soil health data collected is also being used as part of a larger initiative to developing soil health parameters and soil health report cards for Ontario. Being able to effectively monitor soil health in Ontario will be a huge step forward in terms of our ability to improve soil health, because it is hard to manage something if you are not monitoring it.

BEST MANAGEMENT PRACTICES

Research shows that solutions to erosion become more cost-effective the closer we get to the soil. With limited finances, most of our effort should be spent on building soil health and *avoiding* the problem in the first place. Our next focus should be on *controlling*, *trapping* and *treating* the water, first within the field, then at the edge of the field and lastly, at the water-course itself. Following is an example of the best management practices that are promoted in the Garvey-Glenn watershed.

AVOID

SOIL HEALTH— Healthy soils can hold more water and keep their nutrients. Soil health is improved with crop rotations, planting cover crops for the non-growing season and conservation tillage.

4-R's APPROACH—To ensure agricultural nutrients stay out of the watercourse, farmers are working to apply the right amount of the right nutrients in the right place at the right time. As a general rule, fall and winter application should be avoided. Incorporating nutrients into the soil helps to keep them within the soil where they are most beneficial.

CONTROL/TRAP/TREAT

GRASSED WATERWAYS—Grasses along drains, streams and low draws filter sediment and their roots keep soil in place. These strips can be cut for hay and allow machinery to cross easily.

TREE PLANTING—Trees along fields act as windbreaks to protect the soil and crops from desiccation and when planted along watercourses they help to stabilize banks, preventing erosion. Tree roots can also bring up water from deep below the ground and transpire.

EROSION CONTROL BERMS—Properly designed berms both hold and direct water. Hickenbottoms drain this water directly to subsurface drainage tile while French drains filter sediment from water. They are more effective when placed systematically across the landscape and this requires a higher degree of landowner cooperation.

CONSTRUCTED WETLANDS— Vegetated storage areas located on marginal land filter surface runoff before releasing it to rivers or to the water table. By holding back water in wetlands after a rainfall, both the amount and the speed of water downstream is reduced, thereby minimizing erosion on creek beds and gullies.

RIPARIAN BUFFER ZONES— Leaving vegetation along watercourses that run through fields and enhancing the natural areas on either side of a creek help to filter the water that runs through it.

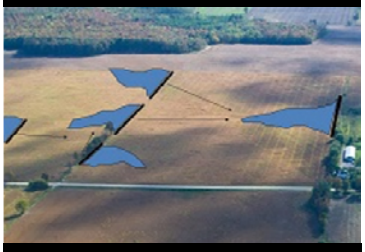
NATURAL CHANNEL DESIGN— Municipal drains and straightened water courses require frequent maintenance, but a meandering channel allows water to dissipate energy and enables waterways to self–clean.


Natural Channel


Constructed Wetland

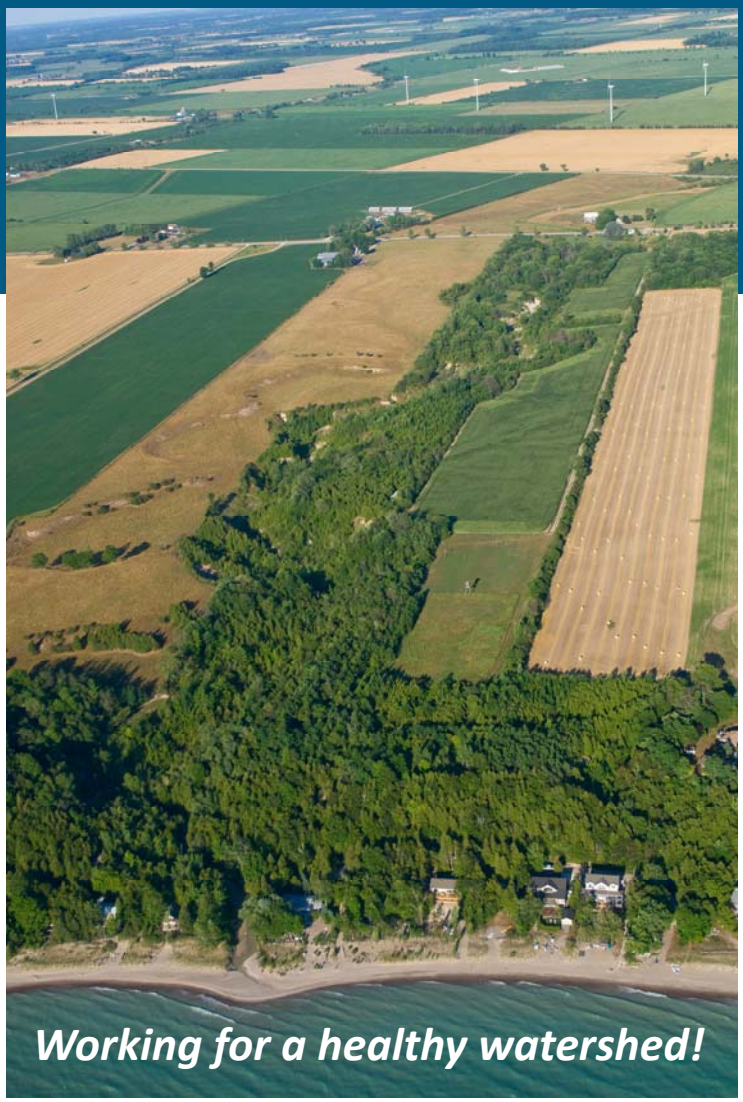

Windbreak


Grassed Waterway


Erosion Control Berm Design


French Drain


Rock Spillway Behind Berm



All photos and maps by the Maitland Valley Conservation Authority and Healthy Lake Huron. For more information, please contact the Maitland Valley Conservation Authority at 519 335 3557 or maitland@mvca.on.ca