The State of Farmland

Drainage in Ontario

and other Jurisdictions

OFA-Cities Initiative Planning meeting

January 27th, 2016

Presented by Bill Mayes and Brett Ruck

Drainage Law in Ontario

- 1835 – ”Act to regulate Fence lines and Watercourses”
- 1963 – “Drainage Act” and the “Tile Drainage Act”
- 1975 – “Drainage Act”

Currently

Drainage Act, R.S.O. 1990, c. D.17

https://www.ontario.ca/laws/

So, What is a Drain?

Drainage Act Definition

"drainage works" includes a drain constructed by any means, including

- the improving of a natural watercourse, and
- includes works necessary to regulate the water table or water level within or on any lands or
- to regulate the level of the waters of a drain, reservoir, lake or pond, and
- includes a dam, embankment, wall, protective works or
- any combination thereof;

Drainage Act as a Procedure

- Petition by Landowners
- Appointment of Engineer
  - On-site Meeting, Survey, Design, Report and Assessment
- Report Consideration by Council
- Appeals – Court of Revision, Tribunal, Referee
- Construction
- Grants – Agricultural Drainage Infrastructure Program (A.D.I.P.)
- Assessment

- **Future Maintenance**

Design Considerations

Standard Design Criteria

Hydrologic Design Methods

Hydraulic Design Considerations

Considerations for Societal Concerns:

- Climate Change
- Source Water Protection
- Heritage Interests
- Species at Risk
- Fish and Wildlife Habitat
- Wetlands
- Compliance with legislation such as *Fisheries Act, Conservation Authorities Act, Ontario Water Resources Act, Environmental Assessment Act, Lakes and Rivers Improvement Act* and other legislation.

Emerging and Existing Techniques

- Natural Channel Design
- Two-Stage Channels
- Buffer Strips
- Erosion Protection
- Sedimentation Control
- Water Retention and Wetland Restoration

Special Considerations for Drains in Developed Areas

- Varying Approvals
- Storm water Management Ponds

Drain Management

Maintenance – Drainage Act s.74

Drainage Works constructed under the Drainage Act or any predecessor of the Act, **"shall be maintained and repaired"** by the municipality.

Improvement – Drainage Act s.78

For the better use, maintenance or repair of existing drainage works the municipality may appoint an engineer to prepare a report to

1. Change the course.
2. Make a new outlet.
3. Construct a tile drain.
4. Construct, reconstruct or extend embankments, walls, dykes, dams, reservoirs, bridges, pumping stations or other protective works in connection with the drainage works.
5. Otherwise **improve,** extend to an outlet **or alter**.
6. Cover all or part.
7. Consolidate two or more Drains.

Drain Maintenance

Key Requirements in a Drainage Report

1. Future Maintenance Provision

   Provides Authority to allow drainage superintendents to effectively manage the drainage system after construction

2. Defined Working Space and Access

   Provides an access (Easement) on private lands to Construct and Maintain the drainage system

Drainage in Other Jurisdictions

Samples of Other Drainage Legislation in USA & Canada

Presented by Kenn Smart P. Eng.

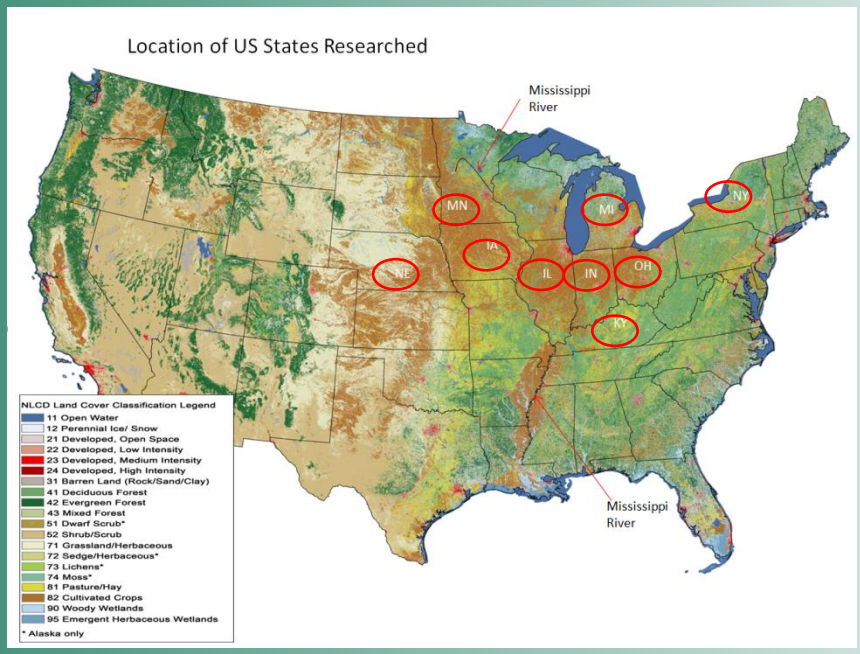
K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS & PLANNERS
KITCHENER • SUDBURY • ENGLEHART • RAINY RIVER

- KSAL are working with OMAF to develop new guides for Drainage Engineers.
- One of the Terms of Reference was to contact 12 different jurisdictions in the United States and Canada
- The primary purpose was to determine what guidance exists at the State and Provincial level regarding design of drains.

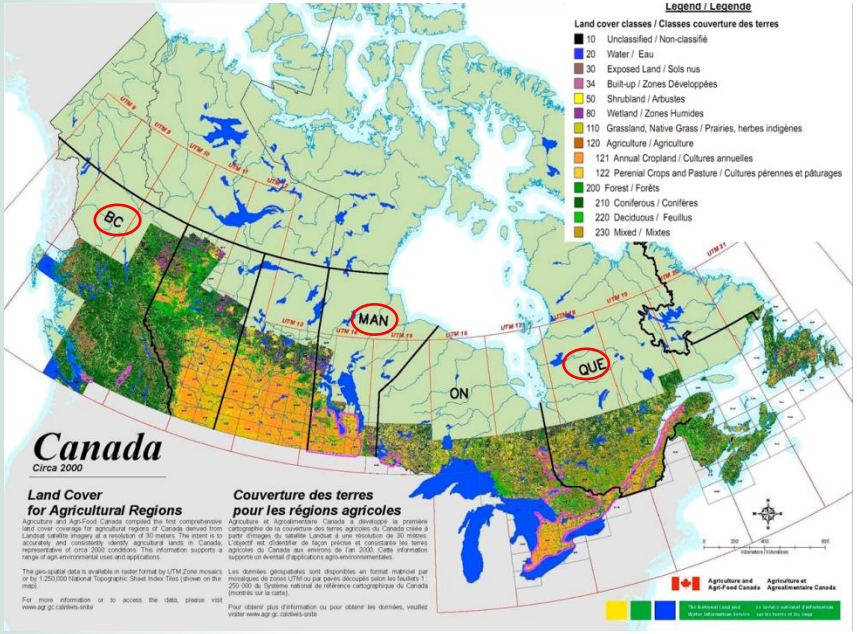
The information in the following slides was stolen from a slideshow in 2014 presented by Ken Smart P. Eng. K. Smart Associates Limited (KSAL)

Jurisdictions Researched

United States



Canada



Federal Legislation is the same in all States. *U.S. Army Corp of Engineers (USACE)* have jurisdiction over waters of the United States.

Most drainage is undertaken at the County level.

United States

Ohio State

- Conservation Districts under the *Ohio County Petition Ditch Law*
- Drainage projects occur primarily to update closed tile drains and open channels.

Quality Control Research

- design and implementation of two stage channels and development of two stage ditch design procedures.

Minnesota State

- Public Drainage Authority, which is a Board of Managers of a County, Metropolitan Water Management Organization or Board of Water and Soil Resources for an Existing Watershed District

Quality Control Research - Mississippi River basin - concerned with nitrate levels in farm tile drainage

- nitrate reduction in tile waters, with a focus on drainage water management
- Drainage Flow Management
- Constructed Water and Nutrient Retention Basins

Nebraska State

- Public Drainage Authority which could be a County Board or a City Council.

- primarily concerned with irrigation and water appropriation with less focus on drainage.
- Wind erosion control is a focus in Nebraska.

There are specific funding agencies to work with certain projects dealing with 2 stage ditches, nitrate reduction, soil management, etc. These groups work on a watercourse level. Watersheds studies have already been completed, providing information and grading on each watercourse.

United States

Iowa State

- Drainage District created by County Board of Supervisors (process similar to Ontario)
- Most of the state is tile drained and emphasis is on closed drains.

Quality Control Research - Mississippi River basin - concerned with nitrate levels in farm tile drainage

- leading state in research/pilot projects addressing constructed wetlands.
- Significant research regarding nitrate reduction and nitrogen removal technologies.
- ***Areas of research include*** Woodchip Bioreactors, Drainage Flow Management, Saturated Riparian Buffers, Constructed Wetlands

Indiana State

- County Drainage Board
- The State has a Ditch Tax to look after the drains.

Quality Control Research - Mississippi River basin - concerned with nitrate levels in farm tile drainage.

- Significant research regarding nitrate reduction and nitrogen removal technologies.

Areas of known research include Drainage Flow Management, Two Stage Ditches and Phosphorus removal, nitrate loadings in tile drainage and reductions that can be achieved through crop management

Illinois State

- Drainage District through the Circuit Court of the County.

Quality Control Research - Mississippi River basin - concerned with nitrate levels in farm tile drainage.

Research regarding nitrate reduction and nitrogen removal technologies.

- ***Areas of known research include*** Drainage Flow Management, Woodchip Bioreactors bacterial activity in woodchip bioreactors used to treat agricultural tile drainage.

Canada

British Columbia

- Does not have equivalent to Drainage Act
- Mainly concerned with quantity control of stormwater.

Manitoba

- Manitoba does not appear to have a communal drainage process.
- The Manitoba Conservation and Water Stewardship Department is now involved with funding improvements to drains.

Phosphorus and Sediment Control Opportunities

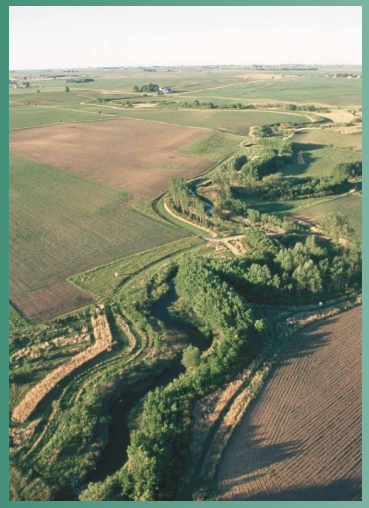
- Buffers
- Constructed Wetlands
- Weep Berms
- Controlled Tile Drainage
- Soil Bioengineering
- Phosphorus Studies in the US
- Two Stage Ditches

Buffers

- There are many types and designs of vegetated buffer strips, each performing specific functions, as every landscape is unique.
- Ultimately, the goal of creating a certain type of buffer strip is to limit or minimize the amount of sediments and nutrients entering the adjacent water body.

Buffer Examples

Riparian Forest Buffer

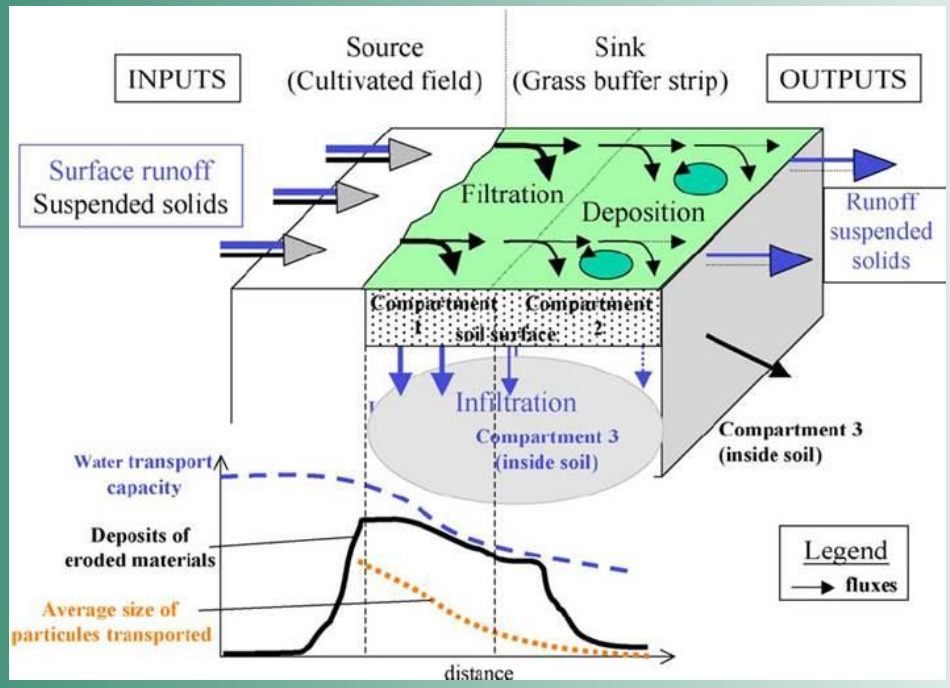


Riparian forest buffer located in Iowa (Wikipedia)

Windbreaks

Windbreaks in North Dakota (Wikipedia)

Effectiveness



Schematic representation of the functioning of a grass buffer (Dorioz et el., 2006).

Maintenance

(Mowing, Removal of Phosphorus Saturated Vegetation, etc.)

Recently mowed buffer in the UK.

Constructed Wetlands

- Constructed wetlands are shallow man-made aquatic systems that provide a more natural level of filtration and habitat
- Recently have become popular as a result of their low cost and potential effective treatment of nonpoint source pollution.
- Multiple agency benefits

Constructed Wetland Examples

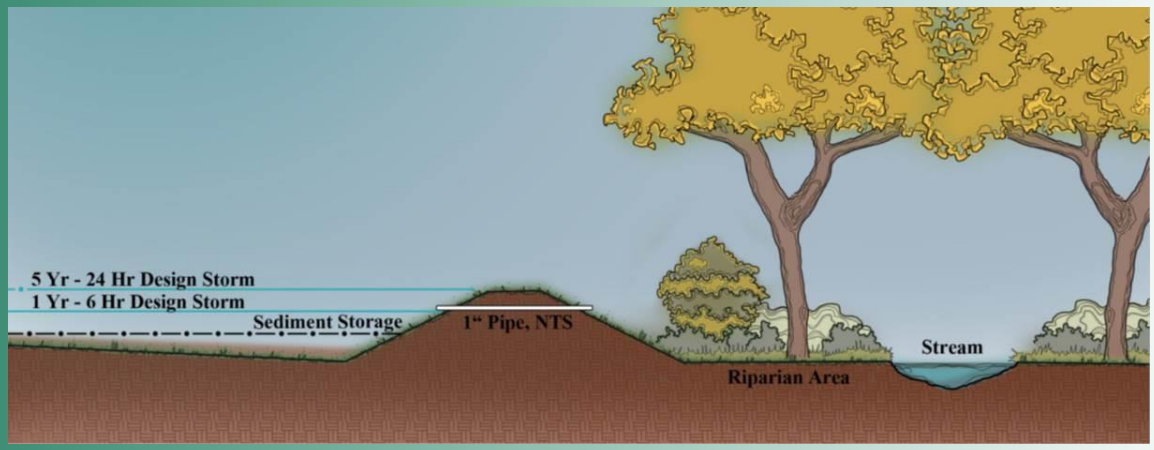
Constructed wetland in the UK actively filtering runoff (MOPS, 2012).

Same constructed wetland and the sediment that had settled out (MOPS, 2012).

Weep Berms

- A weep berm is a structural Best Management Practice (BMP) that is used in combination with grassed or forested riparian buffer to manage runoff volumes and improve water quality (Warner et al., 2011 U.S.).
- Weep berms are sedimentation control BMP's that store sediment and slowly release runoff through multiple outlets.
- Weep berms are sized according to the runoff contributed to the watershed or area of concern.

Weep Berm Examples



Engineered Buffers

Cross-sectional view of a contour weep berm (Warner et al., 2011).

Slow release of water from weep berm outlets to grassed riparian zone (Barnett et al., 2010).

Controlled Tile Drainage

- Controlled Tile Drainage is the process of managing the timing and the amount of water discharged from agricultural drainage systems into another waterbody.
- With controlled tile drainage, flow control structures are installed on the tile headers. The structures are lowered in the spring to permit free drainage and allow for filed operations and improved soil aeration.
- The structures are then raised to restrict drainage, storing nutrient rich water that crops can access during the growing season.

Controlled Tile Drainage Examples

Installation of controlled drainage structure (USDA, 2013).

Cross sections of uncontrolled drainage (left) and controlled drainage (right) (Agriculture and Agri-Food Canada).

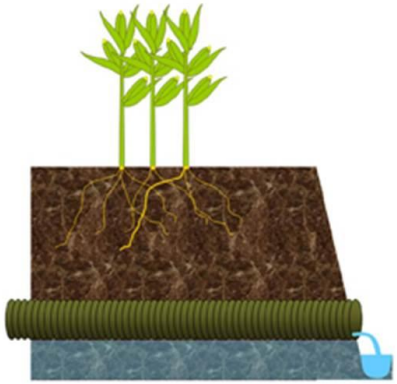


Figure 1: Uncontrolled drainage

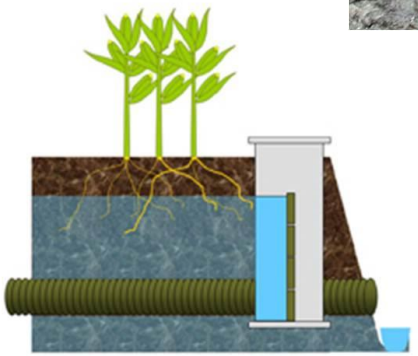


Figure 2: Controlled tile drainage

Soil Bioengineering

- Bioengineering is a technique for bank stabilization that incorporates the use of vegetation and engineering structures to increase slope stability.
- Examples include: Fascines, brush mattresses, live cribwalls, and brush layering

Soil Bioengineering Examples

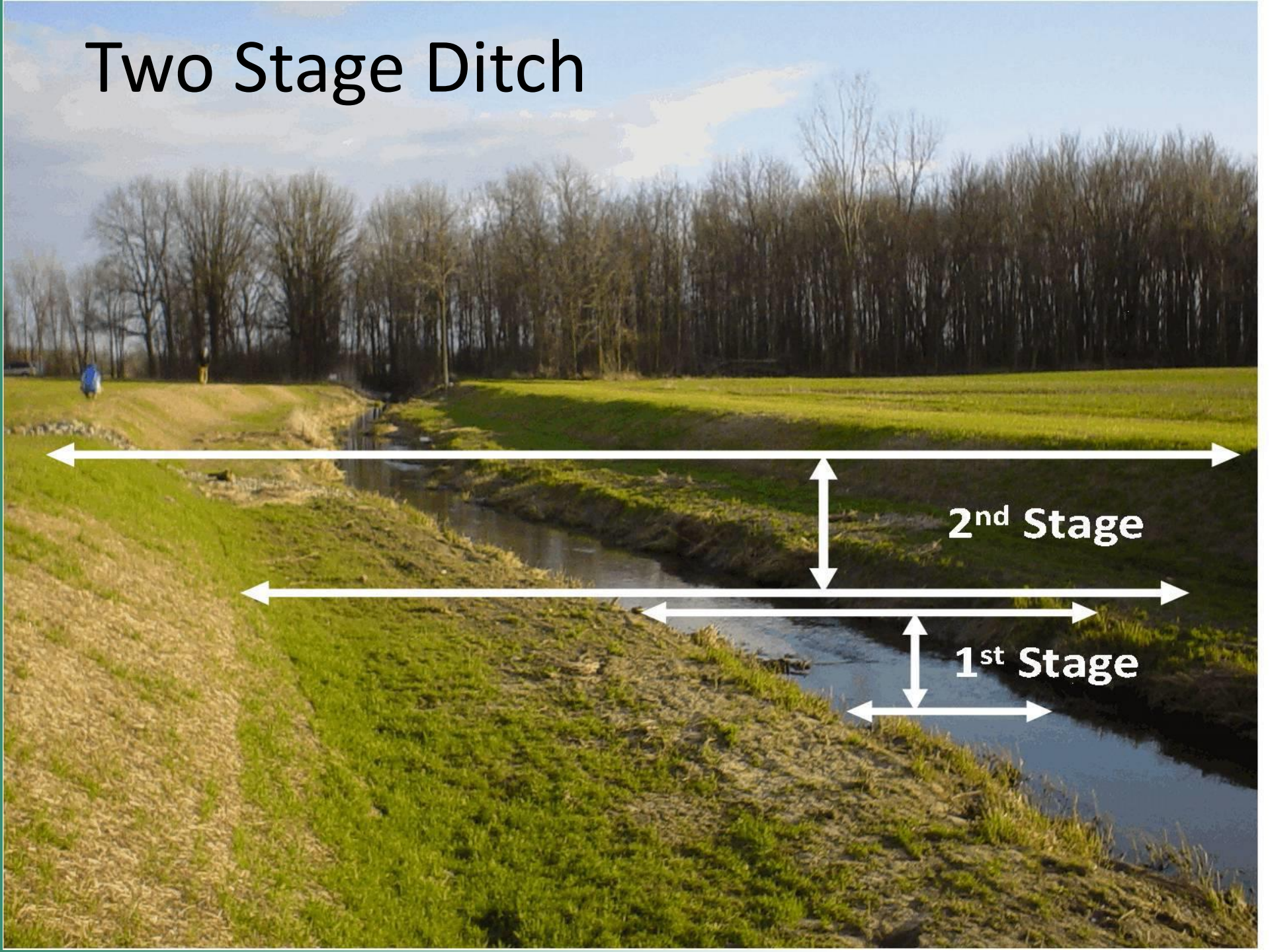
Live cribwall installed along Beaver Creek in Fort Erie (Ian Smith).

Vegetated geogrid installed along the outside of a meander bend. Rip rap is used to further protect the toe of bank (Kane County Environmental Management).

Two-Stage Ditches

- The two-stage agricultural drainage ditch is a solution for creating drainage ditches that behave more like natural streams.
- Two-stage ditches are composed of a narrow main channel and a wider floodplain constructed above the mean water level.
- During low stage, the main channel sustains enough flow velocity to prevent excessive sedimentation (Vastila & Jarvela, 2011).
- During high glow periods, when the majority of nutrient transport occurs, the stream benches act a miniature floodplane.

Two Stage Ditch



Drainage ROW Opportunities

Opportunity	Hurdle
Vegetation Management • Enhanced Seed Mixtures • Work with more educational institutes with on the ground projects	Time, Money and Communication
Engineered Buffers	
Sediment Sinks or enhanced run off field locations	
Landowner education	

- Landowner's own the land that this work is being done on
- Any additional costs to a standard project are generally borne by the assessed landowners
- 1/3 grant OMAFRA pays is for agricultural lands that meet specific requirements and for works under the drainage act.
- Additional Engineering

Create a team to work with landowners and drainage superintendents

Competing Interests

- Agency Involvement and Legislation
  - DFO
  - MNRF
  - MOECC
  - OMAFRA
  - CA

- Drainage Superintendent may be responsible for 100's or 1000's of drains.
- Meetings required, more than expected take considerable time and money.

Create a team to work with landowners and drainage superintendents

Questions or Comments?