



Treating Milking Centre Washwaters Using Horizontal Subsurface Flow Constructed Wetlands

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Outline

- Introduction
- Twin Hills Farm Constructed Wetland
- Phosphorus Management
 - LawrenceHolmes Constructed Wetland
- Alfred Campus Constructed Wetland Design
- Conclusion

Introduction

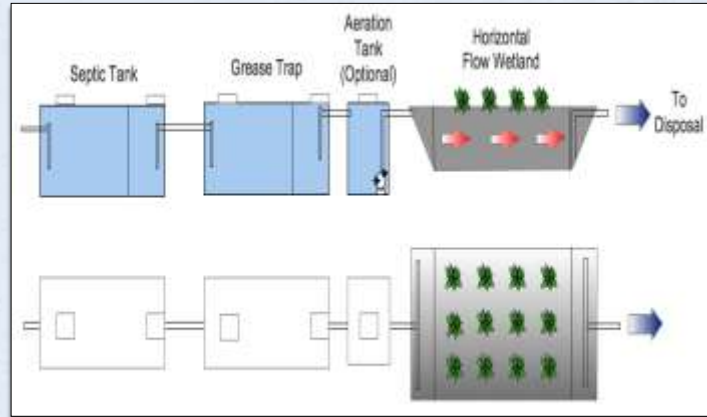
- During a typical milking session equipment must be rinsed with:
 - Water, acid, sanitizer, water
 - Milking center wash water is exposed to high concentrations of acidified water, detergents and chlorinated alkaline solutions
- Problem:
 - How to deal with the large quantity of water that is generated from cleaning milking pipeline and equipment?

Introduction



- Farmers across Canada are interested in implementing a low cost, effective treatment system for agricultural effluents.
- Recently, the use of constructed wetlands to enhance pollutant reductions has become increasingly popular.
- Constructed wetlands can provide an effective low cost option to dairy farmers.

Twin Hills Constructed Wetland



Twin Hills:
Wetland Technology Schematic

Twin Hills Constructed Wetland

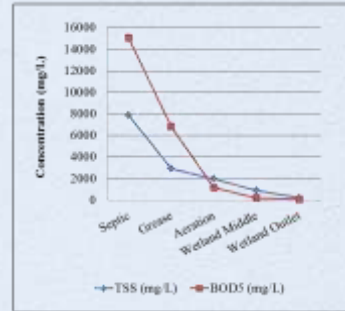


Twin Hills:
Wetland Technology Schematic

Twin Hills Constructed Wetland

Organic Matter and Solids Removal Results:

- Wetland technology is effective at reducing pollutant loading rates.
- BOD₅ reduced by 99 %.
- TSS reduced by 98 %.

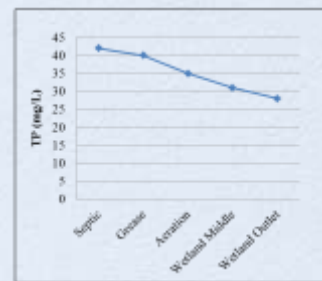


Organic Matter and Solids Removal at the Twin Hills Farm.

Twin Hills Constructed Wetland

Total Phosphorus Management Results:

- Organic phosphorus can be removed in the pre-treatment tanks through sedimentation.
- However most of the phosphorus is in dissolved form.
- Dominant process for phosphorus removal is through adsorption to a substrate media.
 - 33 % total phosphorus removal at the Twin Hills Farm with no passive filter.
- A passive phosphorus filter after the constructed wetland can help reduce phosphorus load.



Total Phosphorus Removal at the Twin Hills Farm.

Phosphorus Management

- Phosphorus is an important nutrient for crop production.
 - The release of phosphorus has significantly increased over the years through agricultural practices.
 - An increase in phosphorus can cause a direct increase in aquatic plant growth and algae growth.
 - A passive phosphorus filter after the constructed wetland can help reduce phosphorus load.
 - Research is needed to determine type of material and filter lifespan.

Phosphorus Management

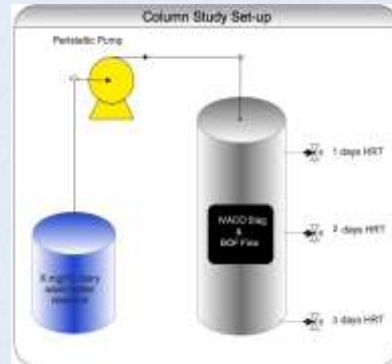
- Goal:
 - Narrow down substrate material to top two.
- Preliminary Jar Test Results:
 - Therefore, IVACO Slag and BOF (GORP) are selected for further research.



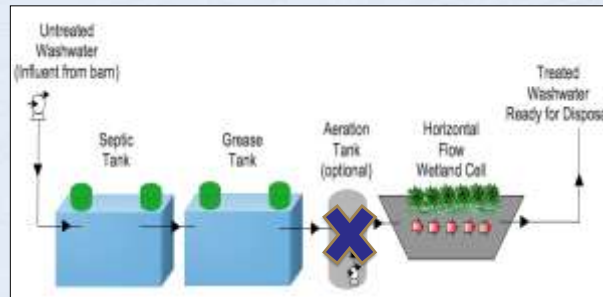
Type	P retained (mg P/kg material)	Material Selection
IVACO Slag	347	✓
LMF Slag	181	✗
Basic Oxygen Furnace (GORP)	618	✓
Air Cooled Blast Furnace Slag	207	✗
Granulated Blast Furnace Slag	110	✗
Basic Oxygen Furnace (+1/2)	63	✗
Basic Oxygen Furnace Fine Blend	450	✗
Steel Wool (Grade #0 small)	1297	✗
Steel Wool (Grade #0/4 small)	1328	✗
Steel Wool (Grade #3 large)	2561	✗
Steel Wool (Grade #3 small)	580	✗

Phosphorus Management

- Current Work:
 - Set up column studies to find filter life span.



LawrenceHolmes Constructed Wetland



LawrenceHolmes:
Wetland Technology Schematic

LawrenceHolmes Constructed Wetland

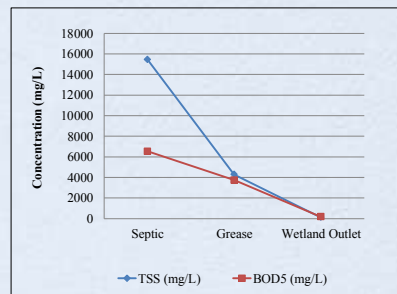


LawrenceHolmes
Wetland Technology

LawrenceHolmes Constructed Wetland

Organic Matter and Solids Removal Results:

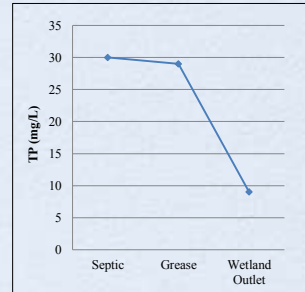
- Wetland technology is effective at reducing pollutant loading rates.
- BOD₅ reduced by 97 %.
- TSS reduced by 98 %.



Organic Matter and Solids Removal
at the LawrenceHolmes Farm.

LawrenceHolmes Constructed Wetland

- **Total Phosphorus Management Results:**
 - 70 % total phosphorus removal
 - A passive phosphorus filter after the constructed wetland does help reduce phosphorus load



Total Phosphorus Removal at the LawrenceHolmes Farm.

Alfred Campus Dairy Wetland

- Alfred wetland provides treatment to:
 - Dairy milk line washings
 - 35 cows, twice a day
 - Parlor washings
 - Bulk tank washings

Design Parameters	Values
Flow (m ³ day ⁻¹)	1.1
Depth (m)	0.5
[BOD ₅] _{in} (mg L ⁻¹)	580
[BOD ₅] _{out} (mg L ⁻¹)	10
Vegetation	Cattails
Total Wetland Area	48 m ²
Inlet/Outlet Material	¾ to 1.5 inch gravel
Wetland Material	0.5 inch gravel
Length to Width Ratio	3:1 (12:4 m)
Wetland Liner	3 mm PVC liner

Alfred Campus Dairy Wetland



Alfred Campus Dairy Wetland

Conclusion

- Dairy farm wash water contains high concentrations of phosphorus, *E.coli*, BOD₅, TSS, etc.
 - If not managed and treated properly, it can cause harm to our health and our environment.
- Farmers across Canada are interested in implementing a low cost and potentially effective treatment system to treat and manage the effluents.
- The construction and implementation of a constructed wetland technology will provide an effective solution to dairy producers, who are required to properly treat and dispose of their wash water.