



# COHA Project 8

## Enabling recirculation with hybrid treatment systems

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**March 26, 2019**

# What is a Hybrid Treatment System?

- Combination of media and hydraulic characteristics that treats water in a manner that meets the individual farm requirements
- Modified constructed wetland design
- NOT vegetated
  
- 2015-2018 study to look at nutrient and pathogen removal (HTS-1)

# Objectives & Basis of HTS-2

- Recirculating water runs the risk of unwanted crop impacts from residual PGRs
- Using existing Hybrid Treatment System (HTS) pilot systems:
  - Assess the ability of HTS media to remove plant growth regulators (PGRs) & Pesticides
  - Evaluate media sequences
  - Evaluate effect of operational parameters
  - KTT
- Existing evidence -
  - Activated carbon removal of PGRs from greenhouse water (Grant, Fisher et al., University of Florida)
  - Constructed wetlands and pesticides in ag settings
  - Denitrification bioreactor for drinking water
  - Biobeds (AAFC; woodchips etc for pesticide rinsates; aerobic)

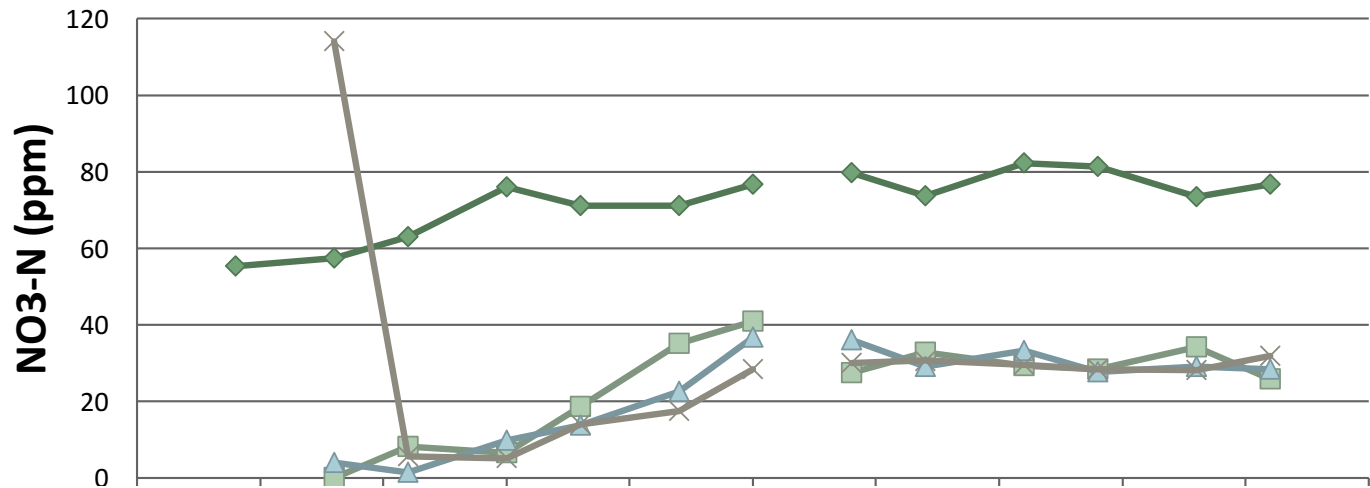
# Background: HTS-1 Portable pilot units



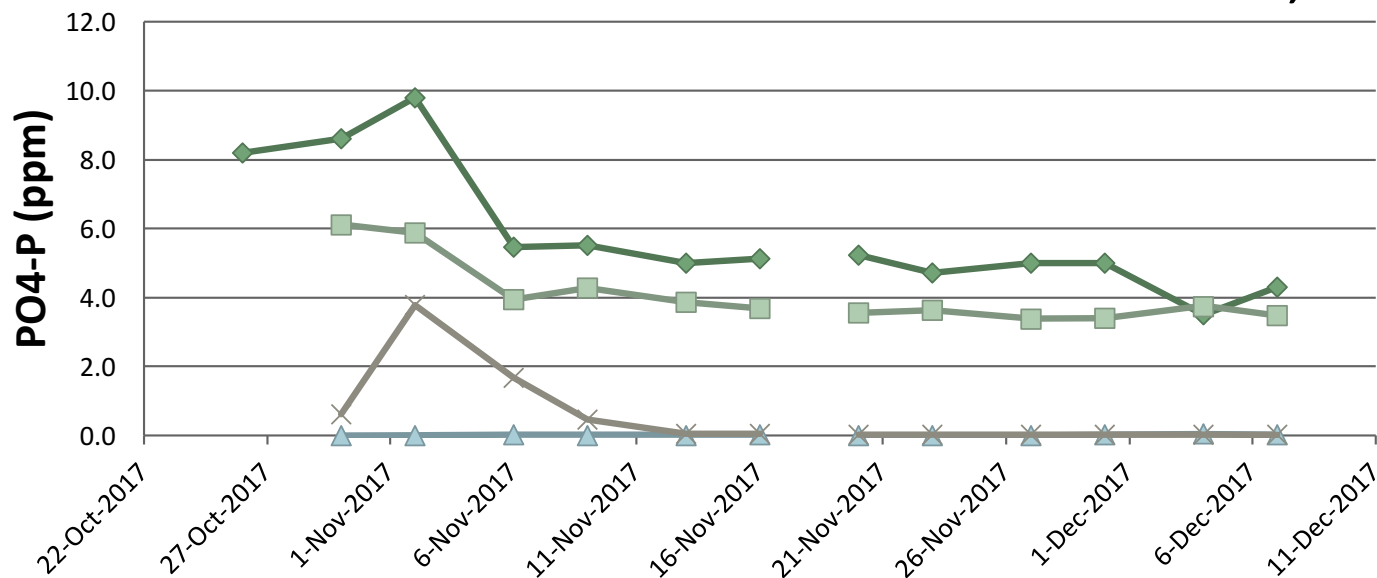
Nutrients and plant pathogens



## NO3-N Removal: Series Run Oct-Dec; Silver



## PO4-P Removal: Series Run Oct-Dec; Silver



- ◆ Silver Influent
- Silver Post Cell 1 (woodchips)
- ▲ Silver Post Cell 3 (slag/gravel)
- ✕ Silver Post Cell 4 (filter sand)

# HTS-1: Permanent Install at Site 2

## Pre- and Post- HTS construction



# Site 2 post-construction... 2017



# HTS-1: Permanent Install at Site 1

## Post- HTS construction

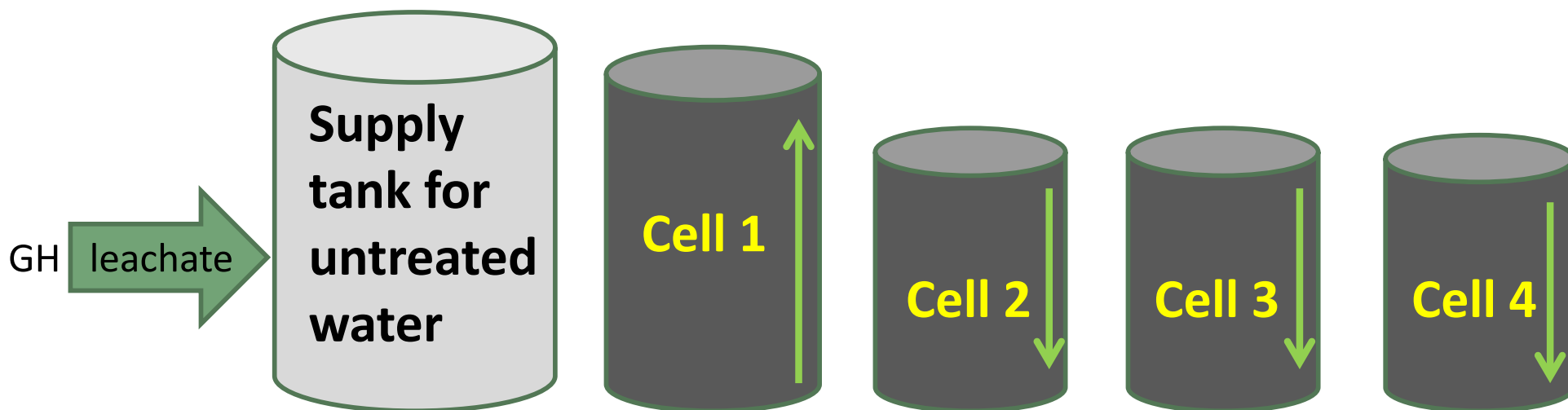




# Schedule for HTS-2

- 2019-2020 (Starts July 2019)
  - Technical Advisory Committee (TAC)
  - Pilot systems installed on site
  - Select focus PGRs & pesticides
  - Bioassay development and testing
- 2020-2021
  - Batch studies to test individual media and HRT
  - Bioassay of final effluents
  - TAC and KTT events
- 2021-2022
  - Series studies to test media sequences and key operational parameters
  - Bioassays?
  - TAC and KTT events

# Current treatment media sequences



"GOLD"	Input water supply tank	Hardwood Chips (-O <sub>2</sub> )	Pea gravel/ slag mix	Pea gravel/ slag mix	Filter sand
"SILVER"	Input water supply tank	Hardwood chips (-O <sub>2</sub> )	Pea gravel	Wollastonite	Pea gravel

**Additions or alternatives:** granular activated carbon (GAC); woodchips run aerobically; others??

# Options for Pesticides/PGR analyses

## A: Lab analysis

Groups used in GH	# measured in UofG Lab Services scans
Used as PGRs	1 of 5 in use on site (paclobutrazol*: Bonzi) (daminozide & propiconazole at A&L)
Fungicides	7 of 8 in use on site
Insecticides	8-9 of 10 in use on site

## B: Bioassay

\*MDL and MQL: 5 and 20 µg/L

# Bioassay for PGRs

- **Broccoli?** (14 days after seeding; Grant et al. Florida; paclobutrazol)
- **Rooted cuttings?** (Kalanchoe; Hwang et al.)
- Seed germination and growth? (specie(s) selection; Alberta)
- **More rapid versions?:** root bioassay (2 days), shoot bioassay (4 days); Chlorella (1 day)?
- Others??
  
- Choice may depend on the target group of chemical

# Activated carbon for removal of Paclobutrazol (U of Florida)



# AAFC– aerobic biobeds for pesticide removal from applicator rinsates



[http://publications.gc.ca/collections/collection\\_2018/aac-aafc/A42-123-2018-eng.pdf](http://publications.gc.ca/collections/collection_2018/aac-aafc/A42-123-2018-eng.pdf)