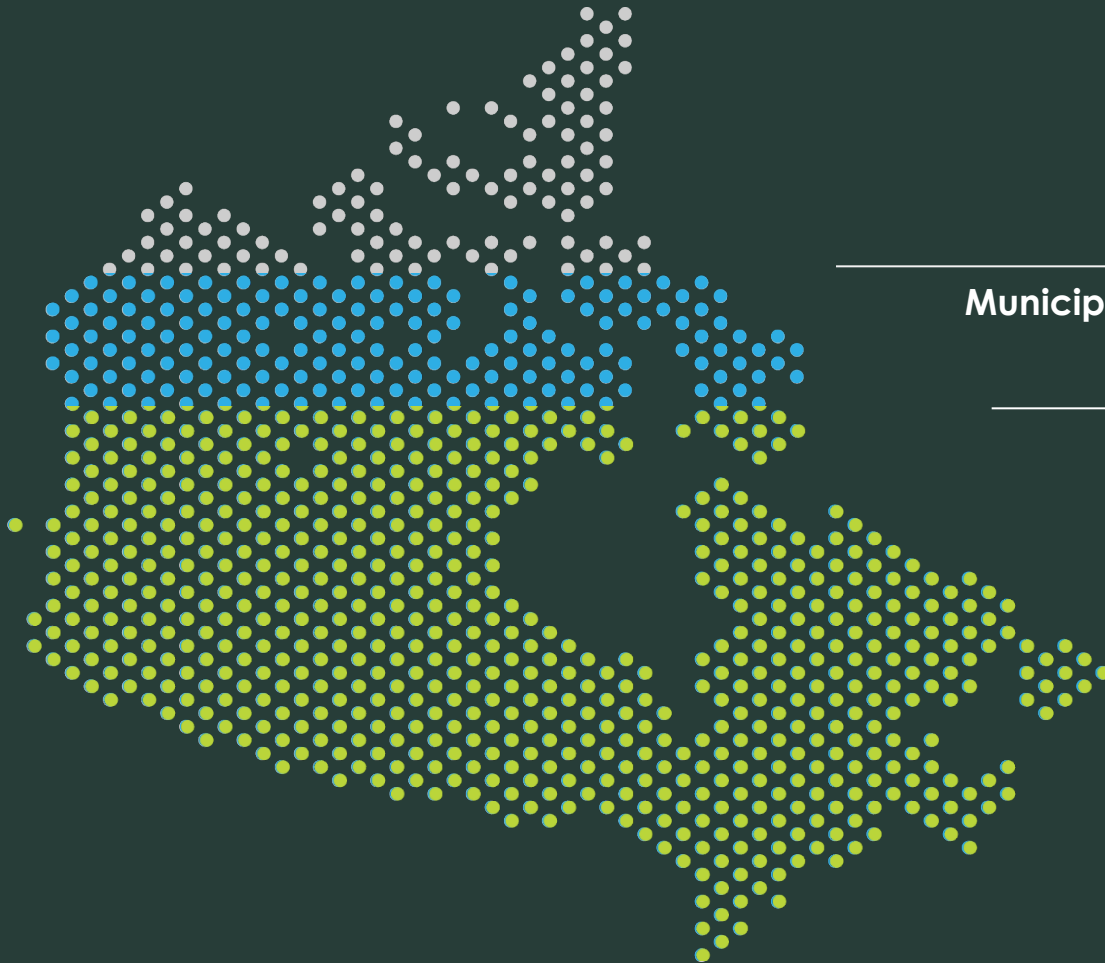


# Existing Stormwater Management Facilities



15,000

Municipal Stormwater Management Facilities

2/3

Constructed after 1999

Source



Statistics  
Canada

Statistique  
Canada

# ENHANCING YEAR-ROUND FUNCTION

in Stormwater Management Facilities  
Through Targeted Vegetation Plantings

Latonnell Conservation symposium – Nov 20, 2019

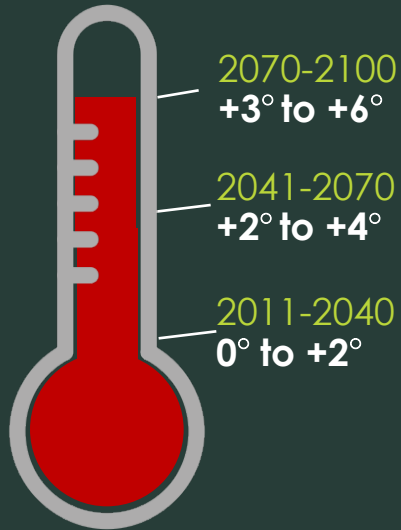
Dr. Kevin Stevens | Wilfrid Laurier University

Luke Parsons, EIT | Crozier & Associates Consulting Engineers



**CROZIER**  
CONSULTING ENGINEERS

# The Climate



## WINTER

Increased average winter temperature



## RAINFALL

increased winter runoff



## CONTAMINANTS

increased transport of water-soluble contaminants



## INVASIVE

increased northern limits of invasive species

# The Challenges

1

How well are existing SWM facilities coping with **climate change**?



3

How can we minimize incursion of **invasive species** while still having cost-effective plantings?

2

Can we **optimize year-round function** in SWM facilities?

# The Team



Dr. Kevin Stevens



Nick Mocan, M.Sc., P.Eng.



Luke Parsons, EIT



Engage Grant



# The Project



## LOCATION

- ✓ Subdivision
- ✓ Coldwater Creek
- ✓ CVC Watershed



## SAMPLING

- ✓ Wet Pond
- ✓ Vegetation Survey
- ✓ Hydraulic Monitoring
- ✓ Water Quality Sampling



## ANALYSIS

- ✓ Removal Efficiencies
- ✓ Key Observations
- ✓ Recommendations

# The Methodology

## Hydraulic Monitoring

- ✓ Water depth: Water level data logger
- ✓ Rainfall: Environment Canada & Credit Valley Conservation



## Water Quality Sampling

- ✓ Water samples collected at inlet & outlet
- ✓ pH, salinity, conductivity, K, NH<sub>3</sub>, NO<sub>3</sub>, NO<sub>2</sub>, N<sub>2</sub>, TP, OP, CI, TSS



## Vegetation Survey

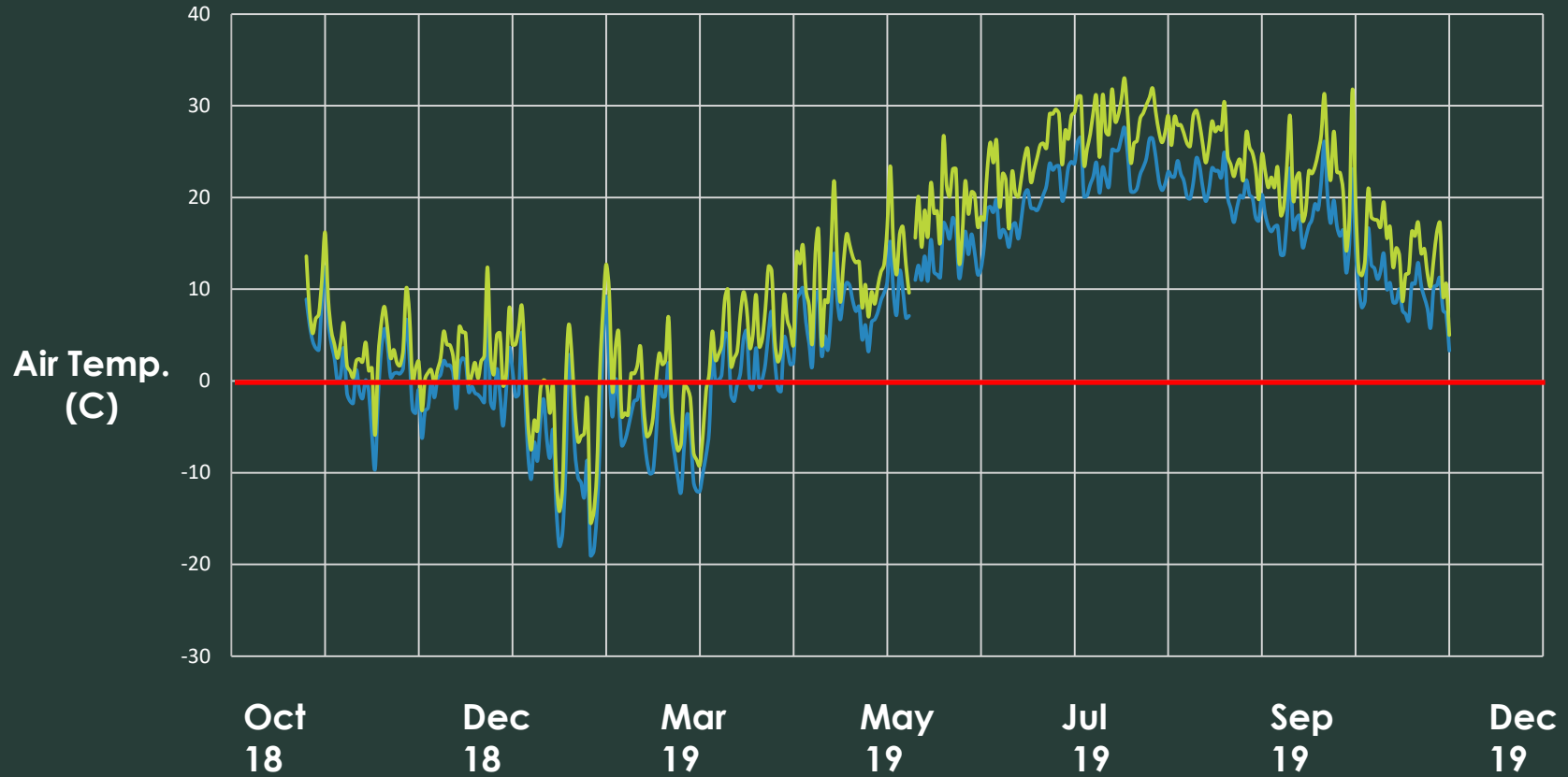
- ✓ Sampling: Fall 2018
- ✓ Identified using Michigan flora
- ✓ Survey: Spring/Summer/Fall 2019



**ANALYSES:** YSI Professional Plus Multiparameter Meter, Hach SR3900 Spectrophotometer, Gravimetric: Total Suspended Solids



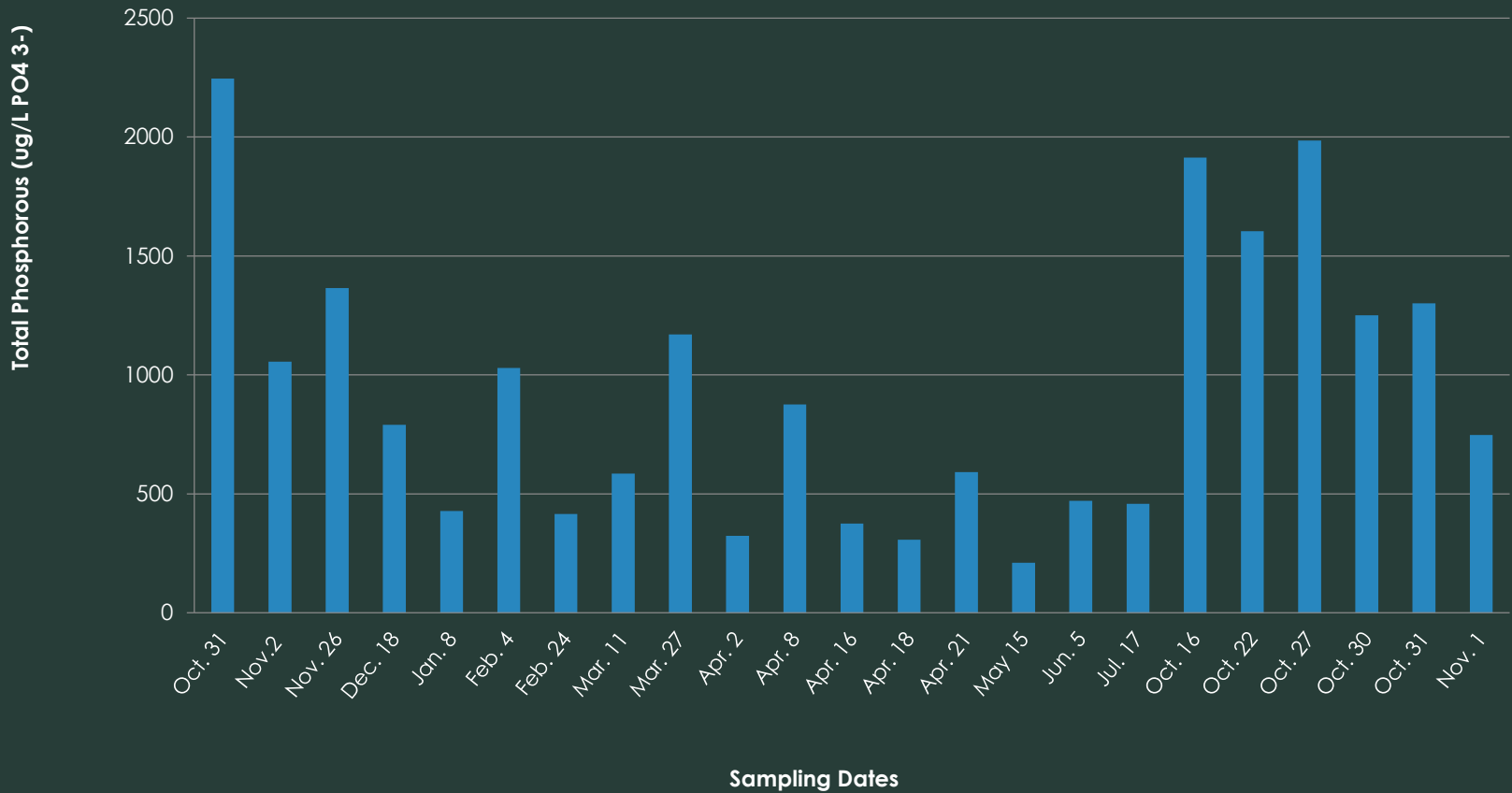
# The Monitoring



— Mean Temperature — Max Temperature

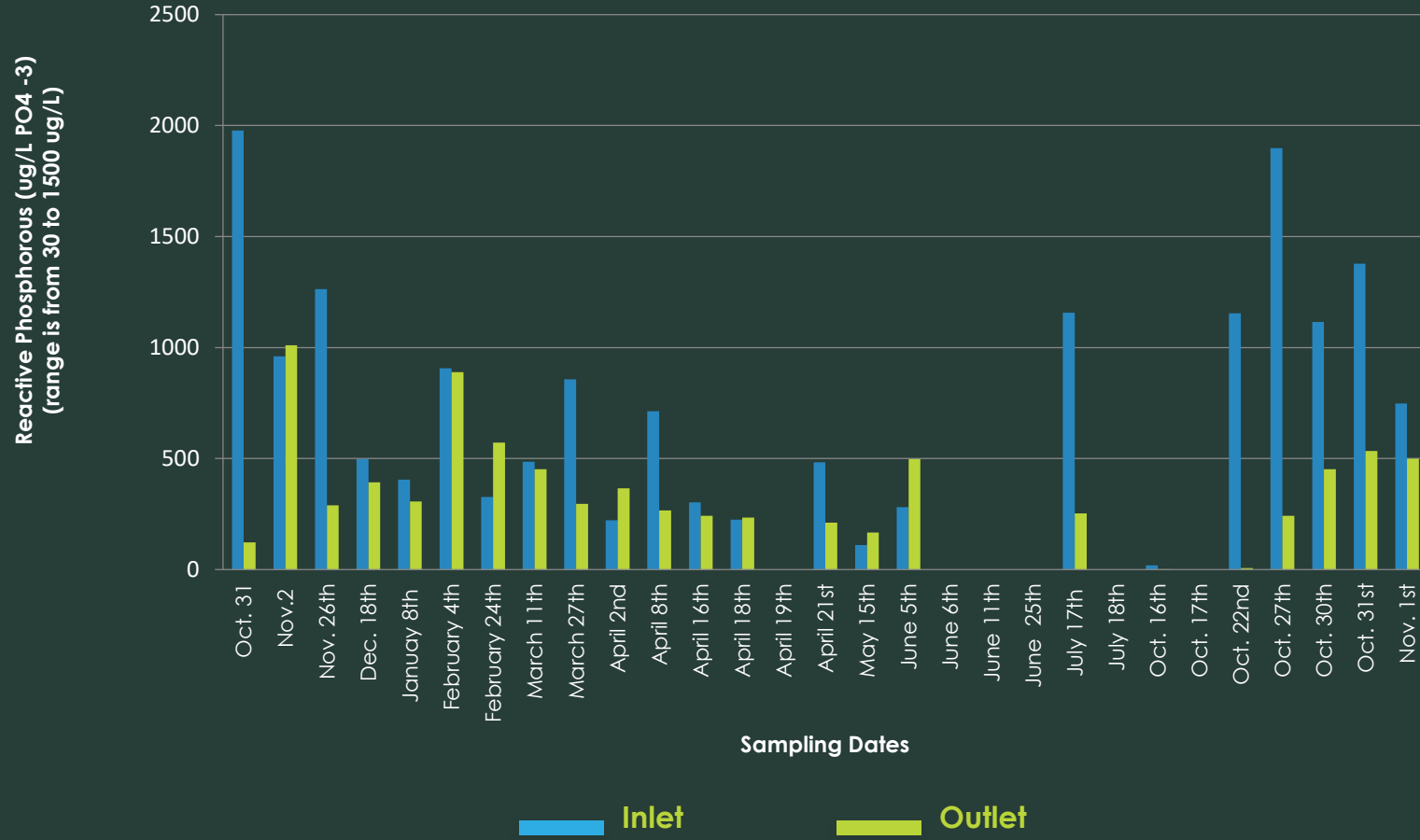
# The Monitoring

Inflow Total Phosphorous (ug/L PO4 3-)



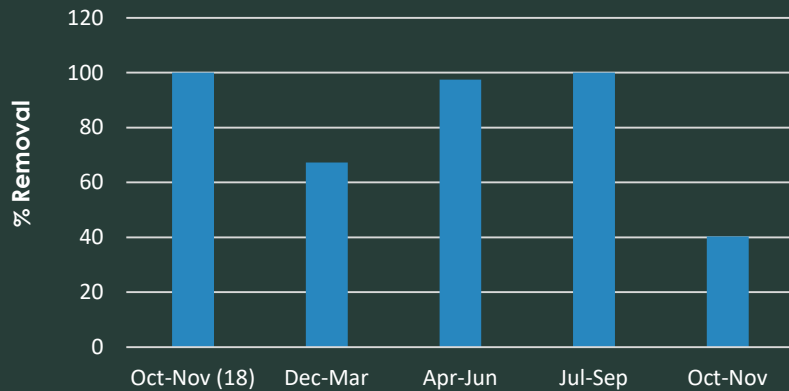
# The Monitoring

Reactive Phosphorous ( $\mu\text{g/L PO}_4^{-3}$ ) (range is from 30 to 1500  $\mu\text{g/L}$ )



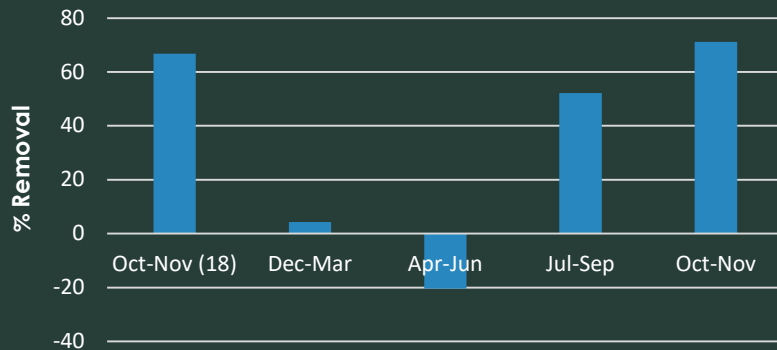
# The Monitoring

## Nitrate – % removal



>60% removal for 10 months  
40% removal for 2 months

## Total P – % removal



5-months good removal (sinks)  
7-months low or negative (sources)

# The Science: Plant Facilitation

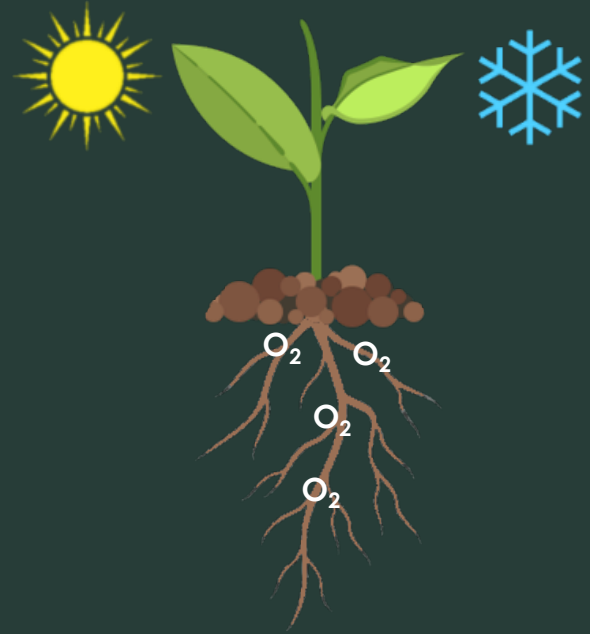
Directly uptake  
nutrients



Provide a haven  
for microbes



Re-oxygenate soils  
(all seasons)



# The Science: Species Specificity

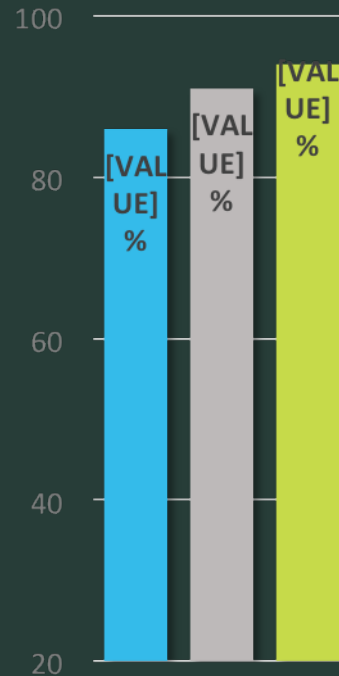
**Scirpus validus**  
(Bulrush)



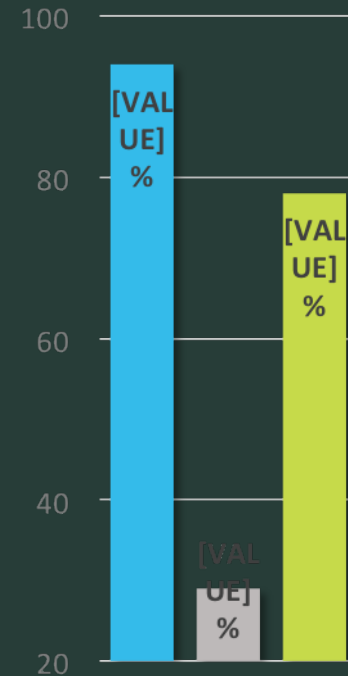
**Phragmites communis**  
(Common Reed)



**Typha latifolia**  
(Cattail)



**% Removal**  
Suspended Solids



**% Removal**  
Ammonia

Source: Gersberg et al. 1986

# The Species

## Alismataceae

*Alisma subchordatum*

## Apiaceae

*Daucus carota*

## Asteraceae

*Erigeron strigosus*  
**Euthamia graminifolia**  
*Eutrochium maculatum*  
*Lactuca* sp.  
*Solidago canadensis*  
**Symphotrichum ericoides**  
*Symphotrichum lateriflorum*  
**Symphotrichum novae-angliae**

## Cornaceae

*Cornus stolonifera*

## Cyperaceae

*Eleocharis obtusa*  
**Scirpus atrovirens**  
*Shoenoplectus tabernaemontani*

## Fabaceae

*Securigera varia*  
*Trifolium hybridum*

## Juncaceae

*Juncus tenuis*

## Lythraceae

*Lythrum salicaria*

## Poaceae

*Echinochloa muricata*  
*Leersia oryzoides*  
**Panicum capillare**  
*Setaria viridis*  
*Phragmites australis*

## Polygonaceae

*Persicaria hydropiper*  
*Polygonum tenue*

## Rosaceae

*Rumex crispus*  
**Spirea alba**

## Salicaceae Typhaceae

**Salix** sp.

**Typha latifolia**



28

Species

13

Families

7

Introduced Species

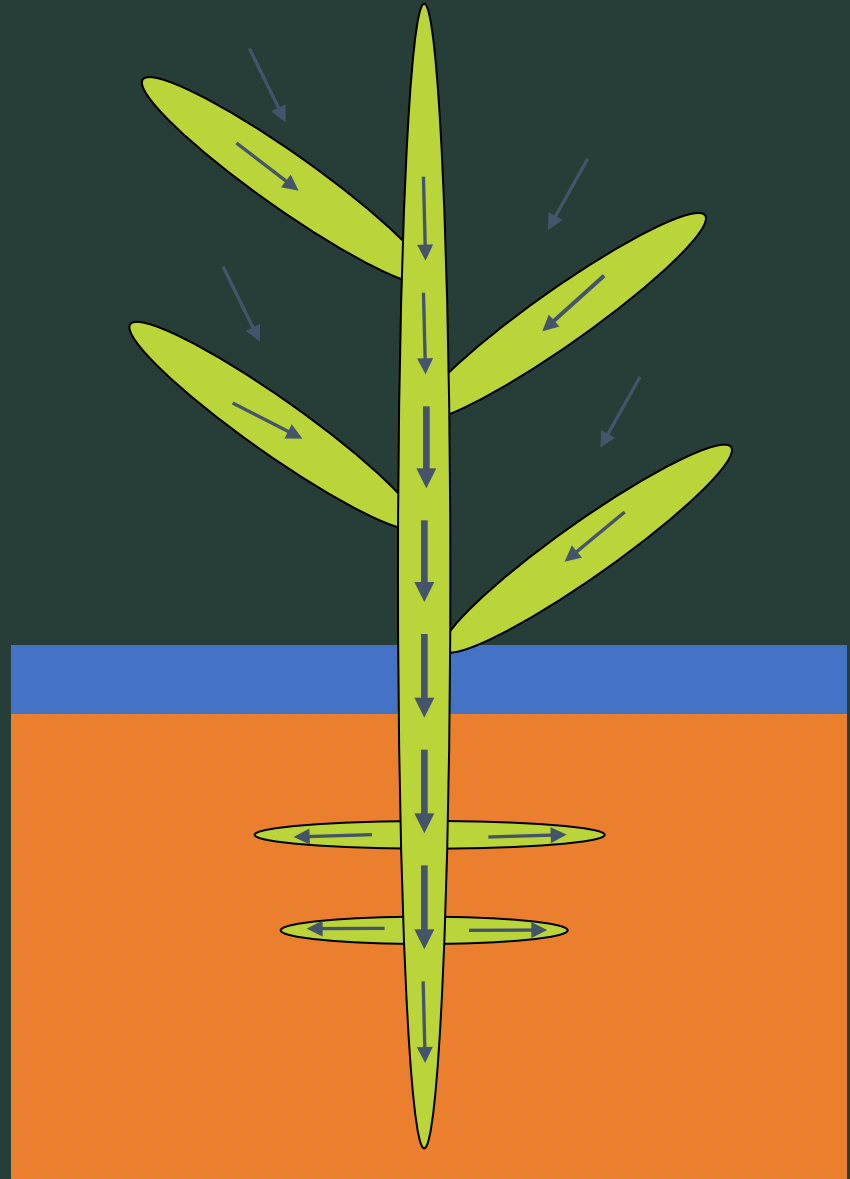
# The Enhancements

Cold  
Tolerant  
Species

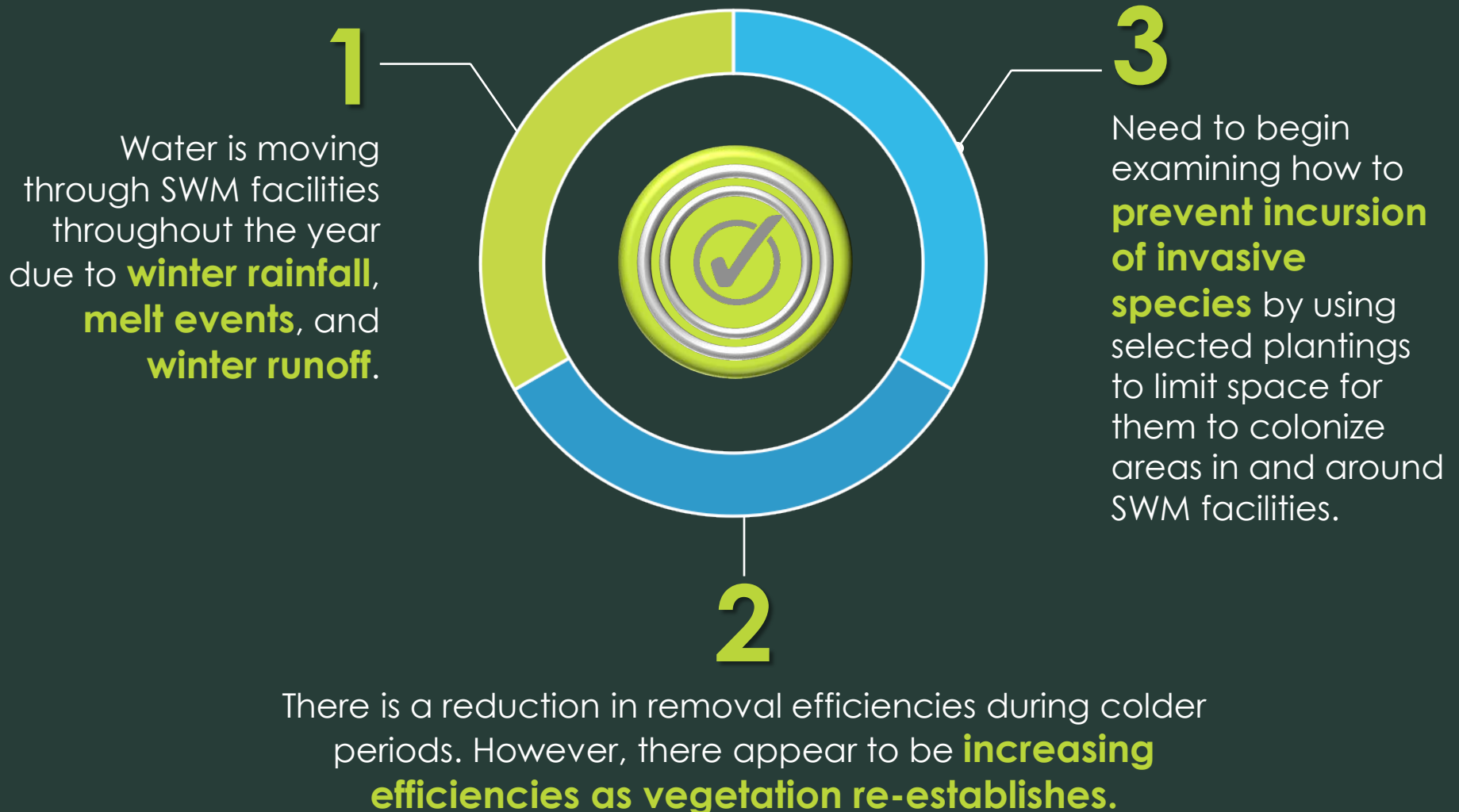


# The Enhancements: Sediment Oxygenation

Oxygen availability in water  
( $<0.1\%v$ , diff  $6-11 \times 10^3$  slower)



# Conclusions



# The Future



## RESEARCH

Climate change  
Winter rainfall  
Chloride levels  
Cold chamber  
experiments



## MONITORING

Continuous  
chemistry  
Multiple seasons



## SITES

Multiple Facilities  
Varied climates



## PARTNERS

NSERC  
Private-sector  
Municipal / Conservation

# Contact Us

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