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Ecological Monitoring Plan: Impacts on Wetlands from Dewatering for *Aggregate Operations*

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Environmental Specialist for the Construction Industry

GEMS bridges the gap between the world of construction and development, and the environmental agencies that govern them.

Dewatering for Aggregate Operations

Scenario:

"I am applying for a PTTW for dewatering an aggregate pit. The aggregate operations are adjacent to a wetland and I need to conduct ecological monitoring as part of my PTTW."

"The Grey Area"

Consistency / Accountability

Quality vs Quantity of Service

Results

Costs

Standards and regulations

Challenge

Dewatering for Aggregate Operations

Before we dive in….

Removal and/or reintroduction of water

from dewatering activities

can have significant impact on wetlands

which in turn can

negatively affect the

ecological community it supports.

Dewatering for Aggregate Operations

Impacts of Dewatering: Two things to consider

1 **Dewatering:**
Removal of groundwater

2 **Discharge of Water** **(where no ECA required):**
Discharge as surface flow - infiltration
Recirculation/pumping back as groundwater

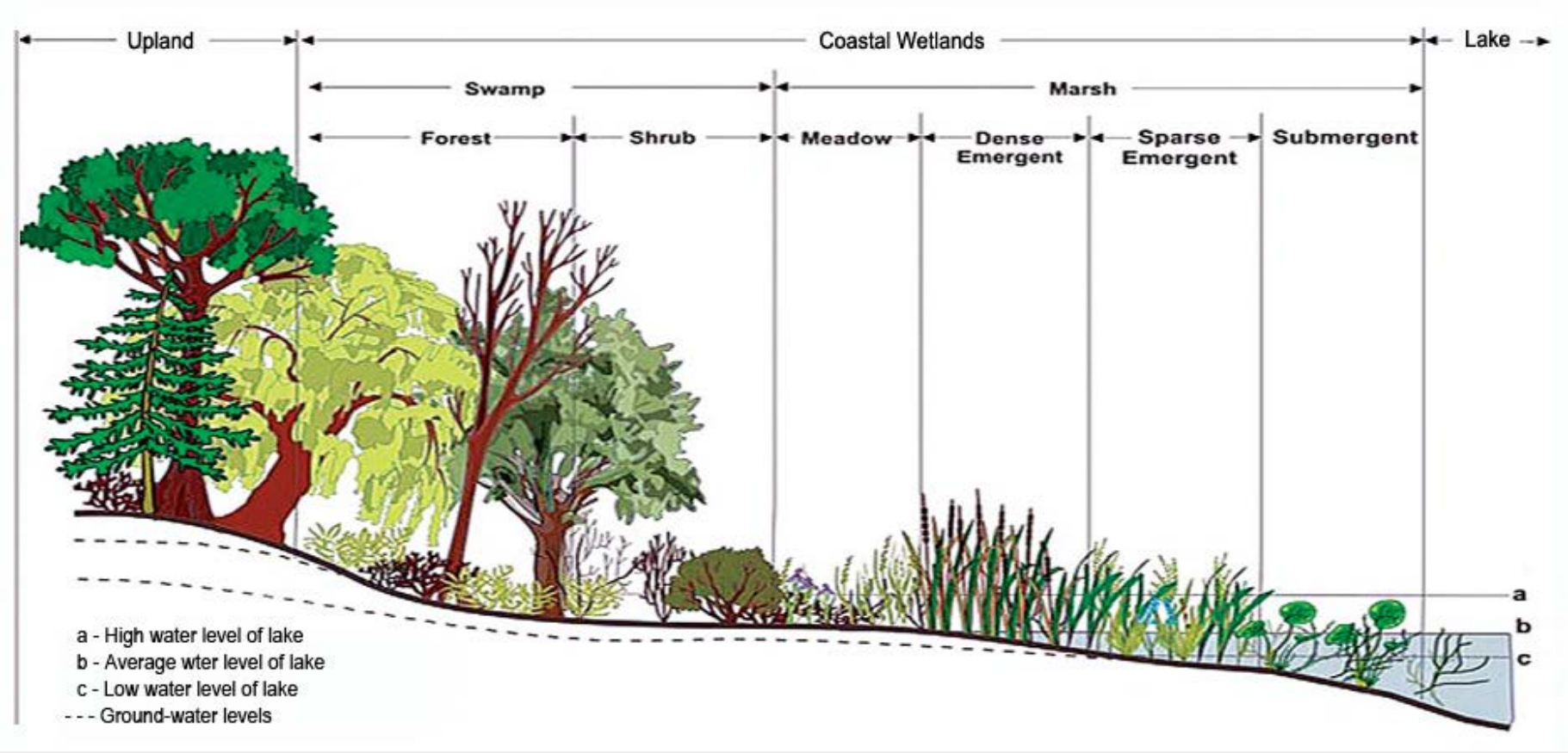
Temperature fluctuations
Quantity/source changes
Changes to quality of water

Alteration of the wetland

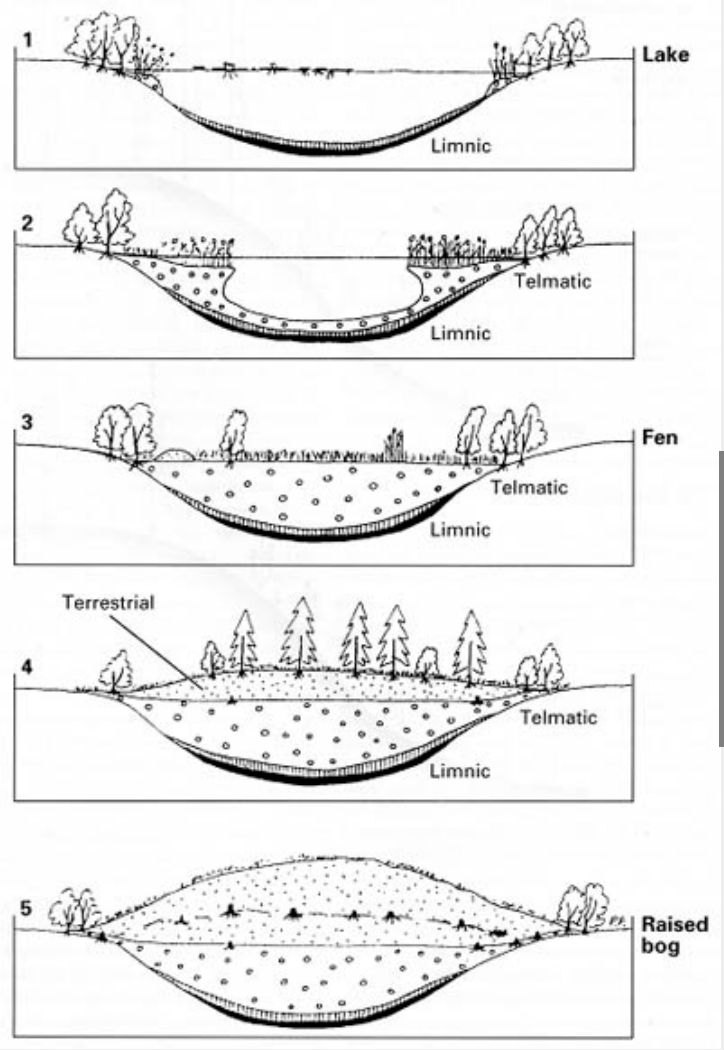
Potential negative effects on the surrounding terrestrial communities

Dewatering for Aggregate Operations

Surface Water & Groundwater Fed Systems



Hydro-seral Succession



Gradual rise of the wetland bed through decaying plant matter/sediments and eventually upland vegetation can move in (first stages usually reedbeds becoming willow scrub at the margins).

Natural Succession

Dewatering for Aggregate Operations

Water Level Fluctuations

Groundwater Fed Systems

Face risk of depletion and damage through sustained pumping of aquifers and lowering of the water table vs. Hydro-seral Succession (Natural Succession).

If this natural process happens too fast:

- Terrestrial grasses will move in
- Flow channelizing instead of lateral inundation
- Down cutting of the wetland bed and establishment of riparian grasslands/shrubs

Ideal conditions to maintain groundwater discharge wetlands is to have the wetland bed 0.1m below the local water table.

Dewatering for Aggregate Operations

Water Level Fluctuations

Overland Flow of Discharge Groundwater

Large quantities of overland flow that are in addition to natural fluctuations will increase water depths.

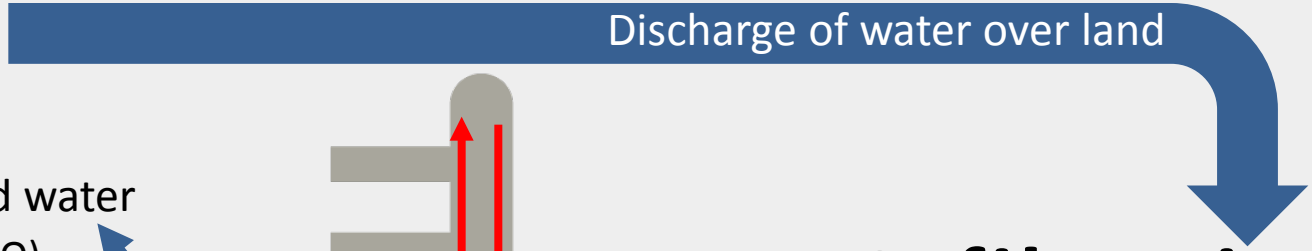
Water that is too deep:

- Increases the hydroperiod and causes oxygen deprivation
- Helophytes dominate decreasing species richness
- Increases run-off and can cause susceptibility to non-natives
- Overall water quality is impacted by a longer hydroperiod

Dewatering for Aggregate Operations

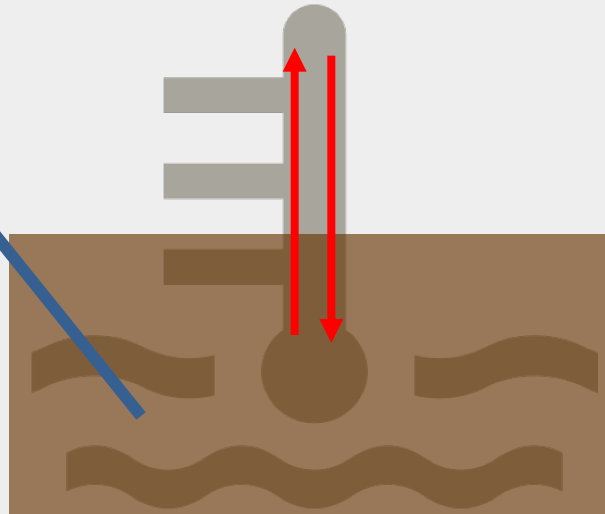
Temperature Changes

Groundwater Fed Systems + Overland Flow of Discharge Water



Removal of groundwater = removal of cold water

- Dissolved Oxygen (DO) Levels decline
  - Impacts normal rate of photosynthesis in aquatic plants
  - Affects animal metabolic rates



Infiltration

- Could increase groundwater temperatures
- If it is a warm water system, source of discharged groundwater is nearby, water temperatures could decrease
- Change in water temperature can affect flora fauna composition

Dewatering for Aggregate Operations

Water Quality

Sedimentation and Turbidity

- Can alter species composition due to reduced light
- Particles clog gills
- Affect eggs/larvae/benthic community
- Decrease DO and increase temperature

Salinity

- Groundwater containing brine or from overland flow across salted roads
- Flora and fauna species have narrow tolerance range for salinity changes

Contamination / Nutrient Loads

- Increased nutrient loads can increase emergent and floating vegetation
- Aggregate operations are less likely to increase contamination loads

Dewatering for Aggregate Operations

"The Grey Area"

Ecological Monitoring Plan

Standards and regulations

Dewatering for Aggregate Operations

Monitoring: Environmental Monitoring

The process and activities that need to take place to characterize and monitor the quality of the environment.

Used as a means and measure to determine the impacts that human activities have on the natural environment.

Why is baseline data so important?

Design of a monitoring program must take into account the final use/purpose of the data before the monitoring starts.

Dewatering for Aggregate Operations

Monitoring Using Vegetation

- Plants are sedentary and make for good long term indicators of impacts

Example:

Before Dewatering:

- Site dominated by submergent vegetation
- Natural fluctuations

During Dewatering:

- Vegetation changing to emergent or floating
- Seasonal changes

Why is baseline data so important?

Evidence that dewatering may be:

- increasing nutrient loads depending on the surroundings
- increasing sedimentation/turbidity
- simply a change in the water depth

Common Sense Technical Proof Project Success

Dewatering for Aggregate Operations

Monitoring: Qualitative vs. Quantitative

Qualitative:
"Windshield Survey"

- Species type and/or changes
- Health/condition
- Visual assessment of cover

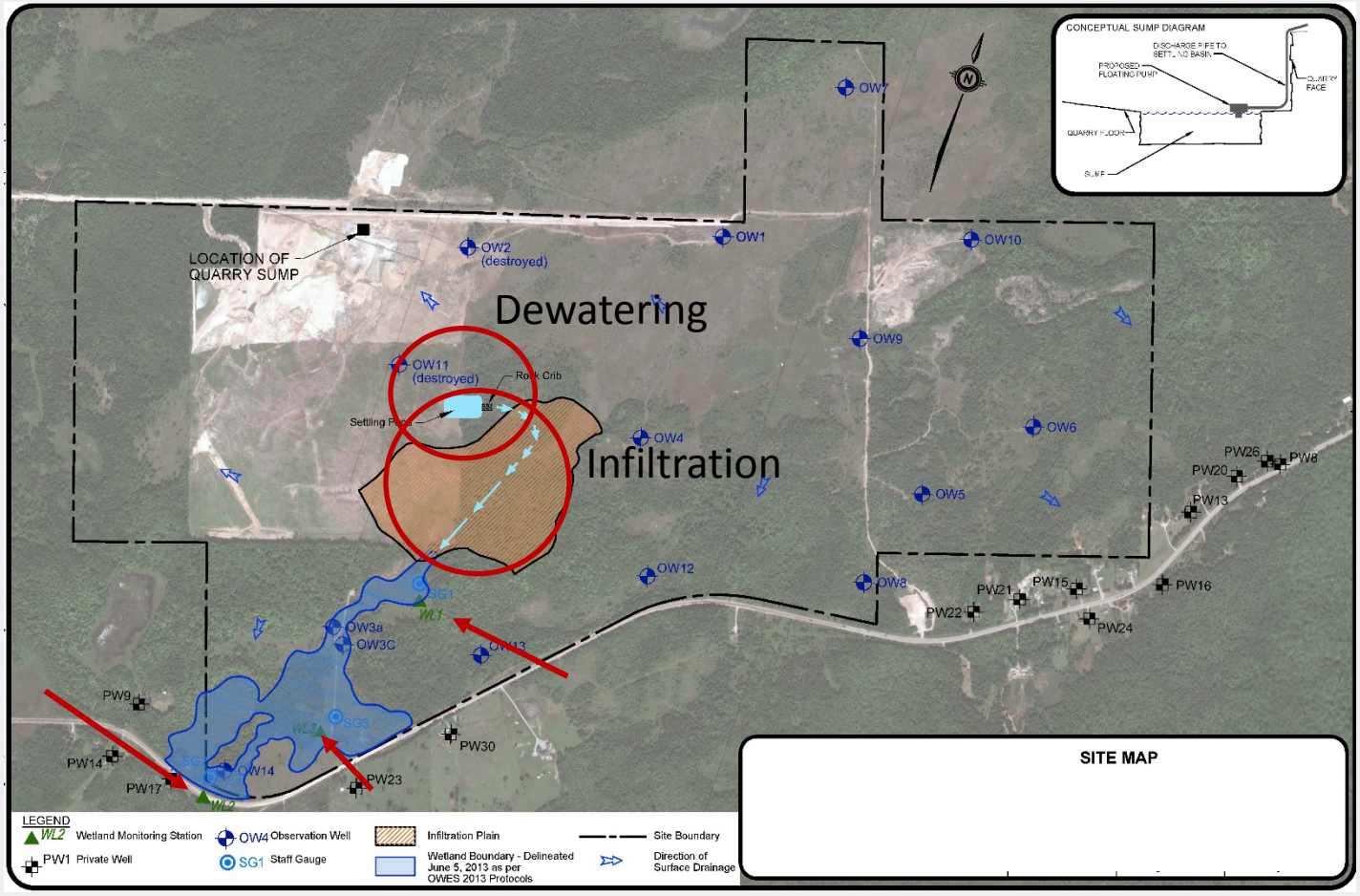
Quantitative:
Floristic Quality Assessment (FQA)

Conservation and Wetness Indices

- Conservation Index (C value)
  - 0 – 10 to indicate tolerance to habitat disturbance
- Wetness Index (W value)
  - -5 – 5 to indicate the probability of wetland occurrence

Dewatering for Aggregate Operations

Case Study:



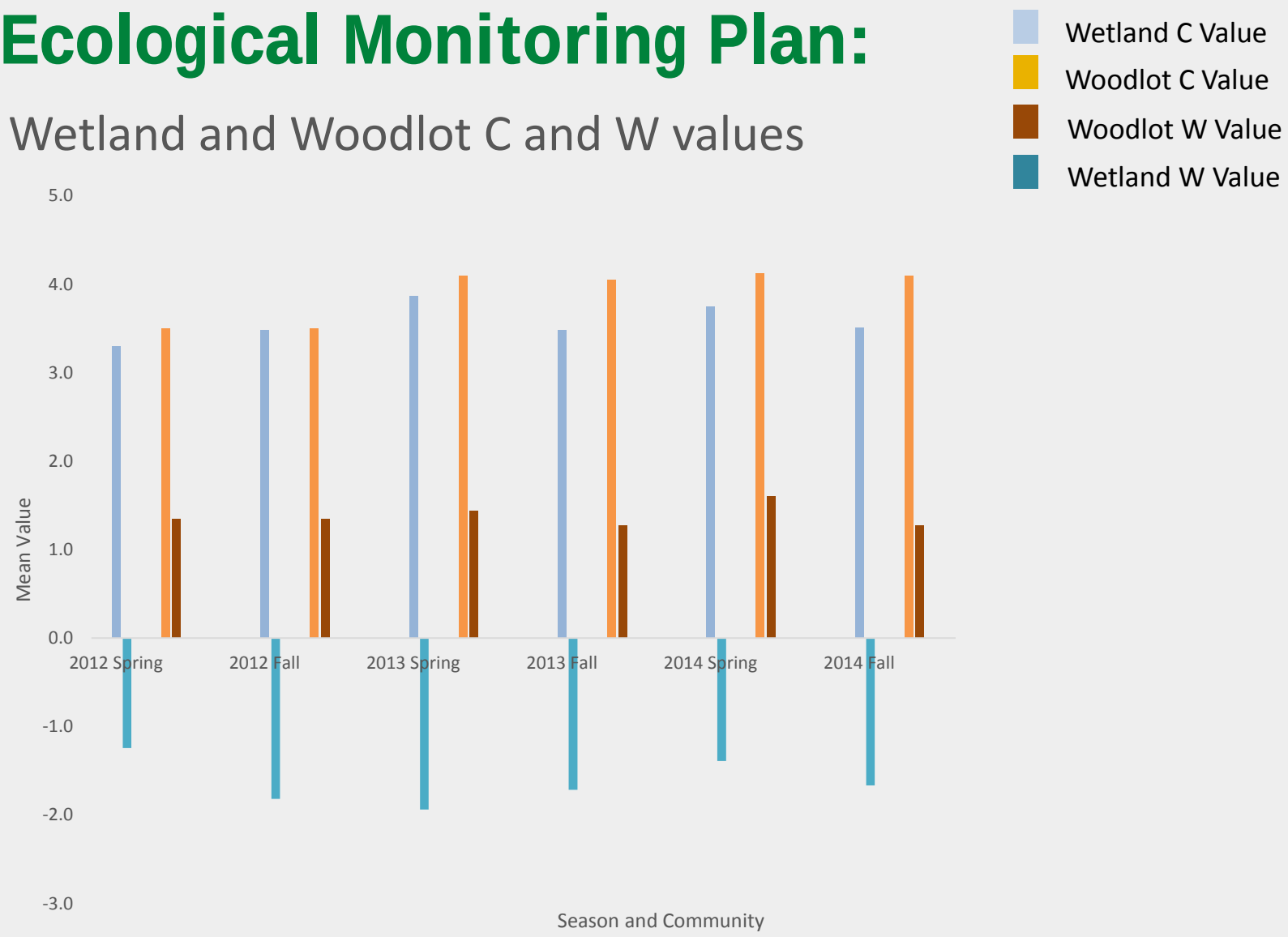
Dewatering for Aggregate Operations

Ecological Monitoring Plan:

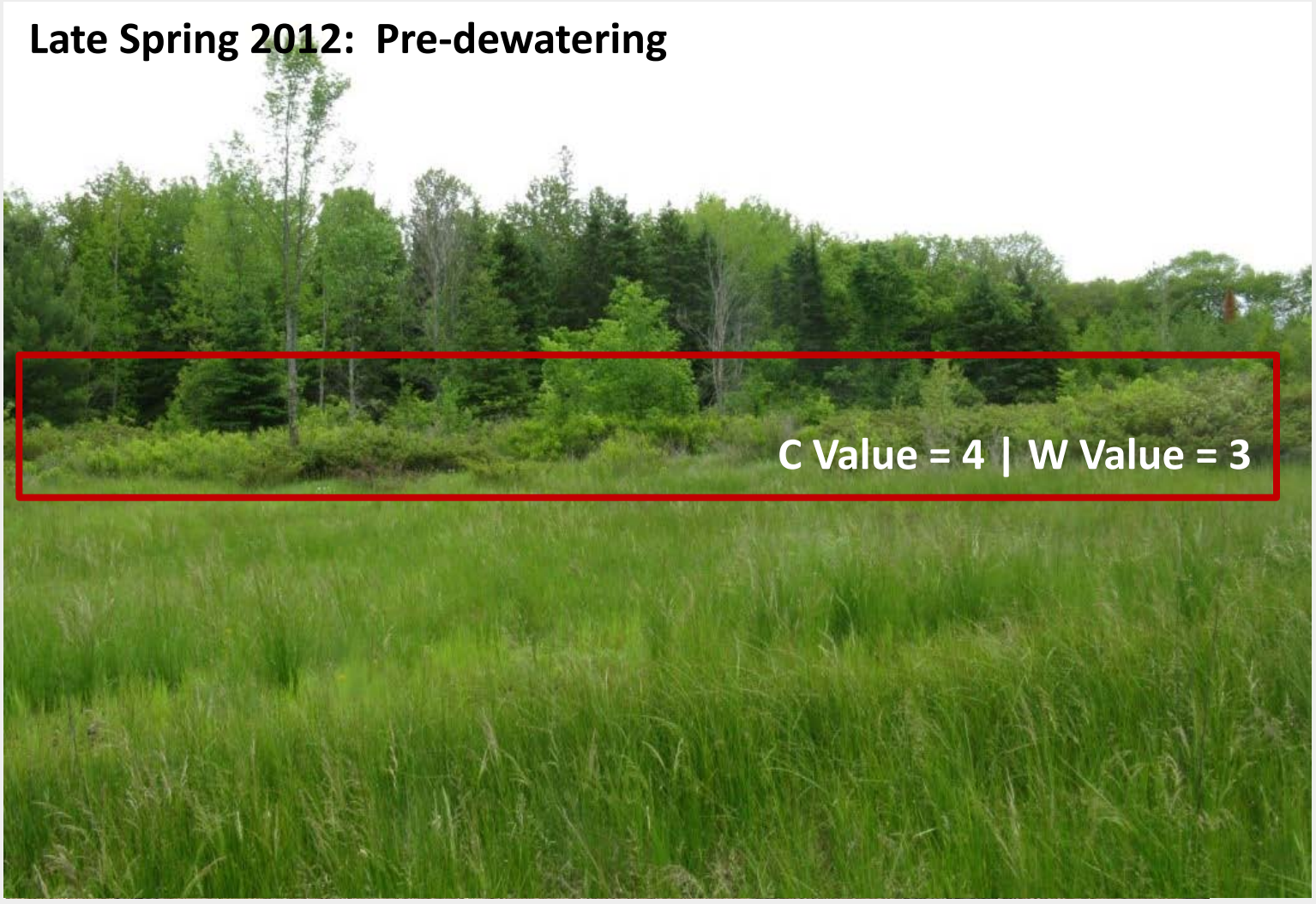
- Collect baseline data for 3 years as per PTTW
- Baseline data will be used to apply FQA for duration of dewatering to determine any impacts
- Vegetation inventories completed through walking transects with permanent stations set up for aerial extent of open water as well as water level meters
- Semi-annual vegetation monitoring (spring and fall)
- Weekly, monthly and rain event monitoring for clarity, aerial extent of open water, pH, temperature and conductivity
- Wetland has known groundwater inputs and discharge from dewatering will become excess overland flow towards the wetland

Ecological Monitoring Plan:

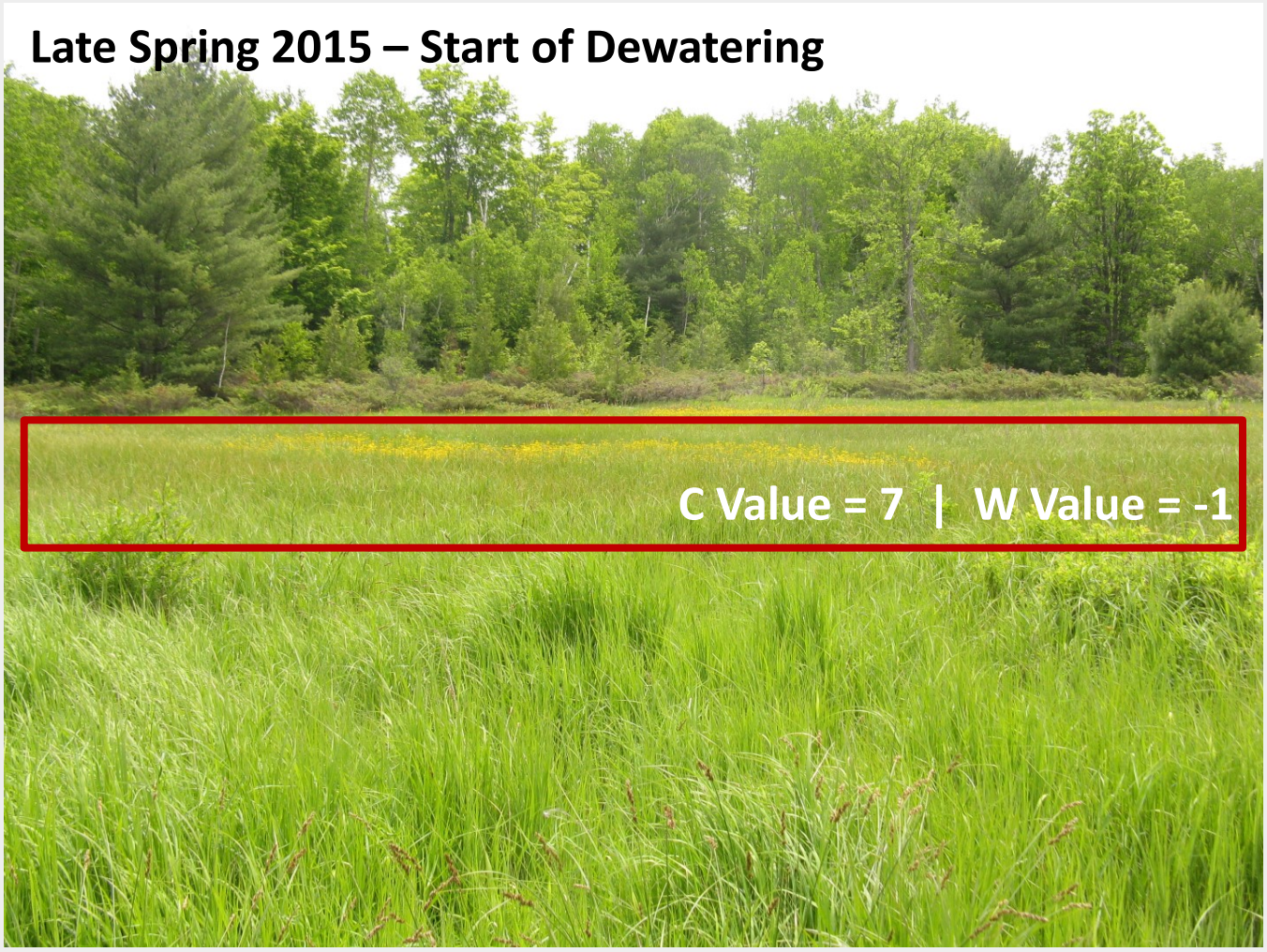
Wetland and Woodlot C and W values



Qualitative:



Qualitative:



Dewatering for Aggregate Operations and Monitoring: Qualitative vs. Quantitative

Qualitative:

"Windshield Survey"

- Species type and/or changes
- Health/condition
- Visual assessment of cover

Quantitative:

Floristic Quality Assessment (FQA)

Conservation and Wetness Indices

- Conservation Index (C value)
  - 0 – 10 to indicate tolerance to habitat disturbance
- Wetness Index (W value)
  - -5 – 5 to indicate the probability of wetland occurrence

Ecological Monitoring Plan:

Quarry Wetland Monitoring - Weekly Inspection Form

Date:	
Monitoring Station #:	
Time:	
Performed by:	

Item	Task	Observation/Measurement	Description
1	**Water Quality Measurements**		
1.1	pH	_____	
1.2	Temperature	_____	
1.3	Conductivity	_____	
2	**Visual Clarity**		
	Check option below that applies:		
	Opaque	_____	Can not see wetland bottom
	Cloudy	_____	Can not readily see wetland bottom
	Clear	_____	Can see wetland bottom
	If water is opaque/cloudy, describe:		
	Silty	_____	
	Sandy	_____	
	Organic Matter (i.e. aquatic veg.)	_____	
	Other (describe)	_____	

Ecological Monitoring Plan:

Quarry Wetland Monitoring - Monthly Inspection Form

Date:	
Time:	
Performed by:	

Item	Task	Observation/Measurement	Description
1	**Photographs** Have photographs been taken at each of the locations listed below? (circle Yes or No)		
1.1	Wetland Monitoring Station 1 (WL1)	Yes / No	North facing photograph
1.2	Wetland Monitoring Station 2 (WL2)	Yes / No	North facing photograph (towards staff gauge)
1.3	Wetland Monitoring Station 3 (WL3)	Yes / No	North facing photograph (towards staff gauge)
2	**Wetland Edge Measurements** Measurements to be taken from monitoring station to edge of standing water.		
2.1	Wetland Monitoring Station 1 (WL1)	_____ m	
2.2	Wetland Monitoring Station 2 (WL2)	_____ m	
2.3	Wetland Monitoring Station 3 (WL3)	_____ m	
3	**Water Quality Measurements**		
3.1	pH	_____	
3.2	Temperature	_____	
3.3	Conductivity	_____	
4	**Visual Clarity** Check option below that applies:		
	Opaque	_____	Can not see wetland bottom
	Cloudy	_____	Can not readily see wetland bottom
	Clear	_____	Can see wetland bottom
	If water is opaque/cloudy, describe:		
	Silty	_____	
	Sandy	_____	
	Organic Matter (i.e. aquatic veg.)	_____	
	Other (describe)	_____	

Ecological Monitoring Plan:

Quarry Wetland Monitoring – Significant Rain Event Inspection Form

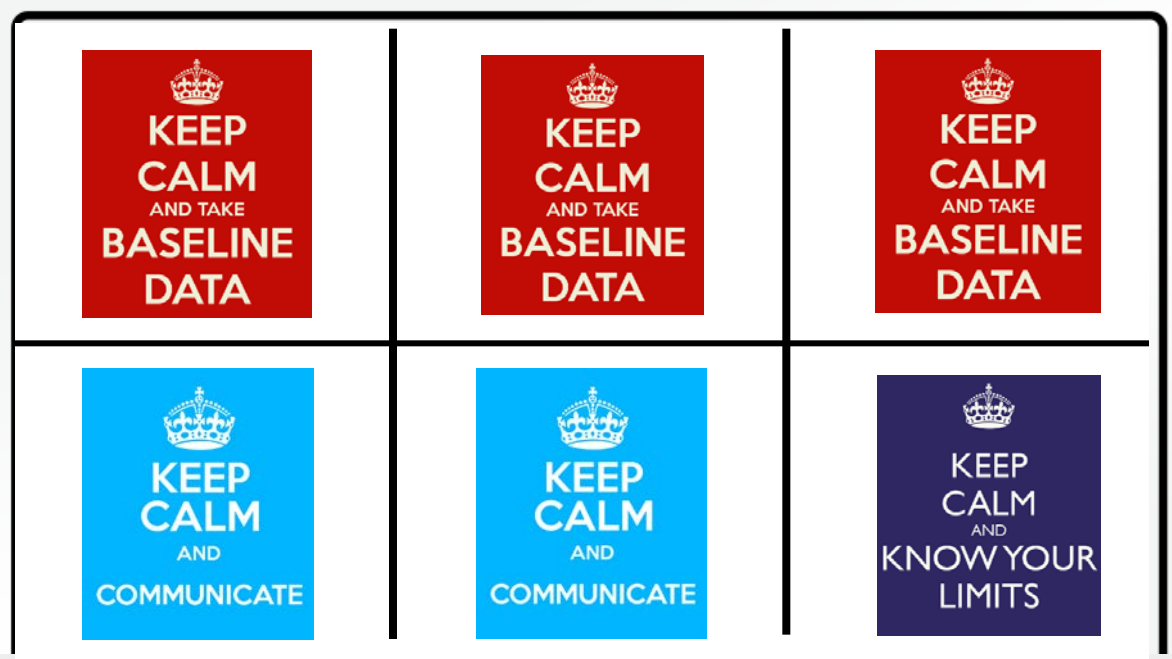
Inspection form to be completed TWICE per rain event: once DURING rain event, and once WITHIN 24 HOURS of end of rain event (at each Wetland Monitoring Station).

Date:	
Time:	
Before or After Rain Event?	
Performed by:	

Item	Task	Observation/Measurement			Description
1	**Wetland Edge Measurements** Measurements to be taken from monitoring station to edge of standing water.				
1.1	Wetland Monitoring Station 1 (WL1)	_____ m			
1.2	Wetland Monitoring Station 2 (WL2)	_____ m			
1.3	Wetland Monitoring Station 3 (WL3)	_____ m			
2	**Water Quality Measurements**	**WL1**	**WL2**	**WL3**	
2.1	pH	_____	_____	_____	
2.2	Temperature	_____	_____	_____	
2.3	Conductivity	_____	_____	_____	
3	**Photographs** Have photographs been taken at each of the locations listed below? (circle Yes or No)				
3.1	Wetland Monitoring Station 1 (WL1)	Yes / No			
3.2	Wetland Monitoring Station 2 (WL2)	Yes / No			
3.3	Wetland Monitoring Station 3 (WL3)	Yes / No			
4	**Visual Clarity** Check option below that applies:	**WL1**	**WL2**	**WL3**	
	Opaque				Can not see wetland bottom
	Cloudy				Can not readily see wetland bottom
	Clear				Can see wetland bottom
	If water is opaque/cloudy, describe:				
	Silty	_____	_____	_____	
	Sandy	_____	_____	_____	
	Organic Matter (i.e. aquatic veg.)	_____	_____	_____	
	Other (describe)	_____	_____	_____	

Dewatering for Aggregate Operations

"Rules" before you dive in….



1. Baseline studies are a valuable investment – reduces end costs and delays
2. Qualified Ecological Monitoring is important for ALL construction
3. Ecological triggers are specific to individual site conditions

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Questions?

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