

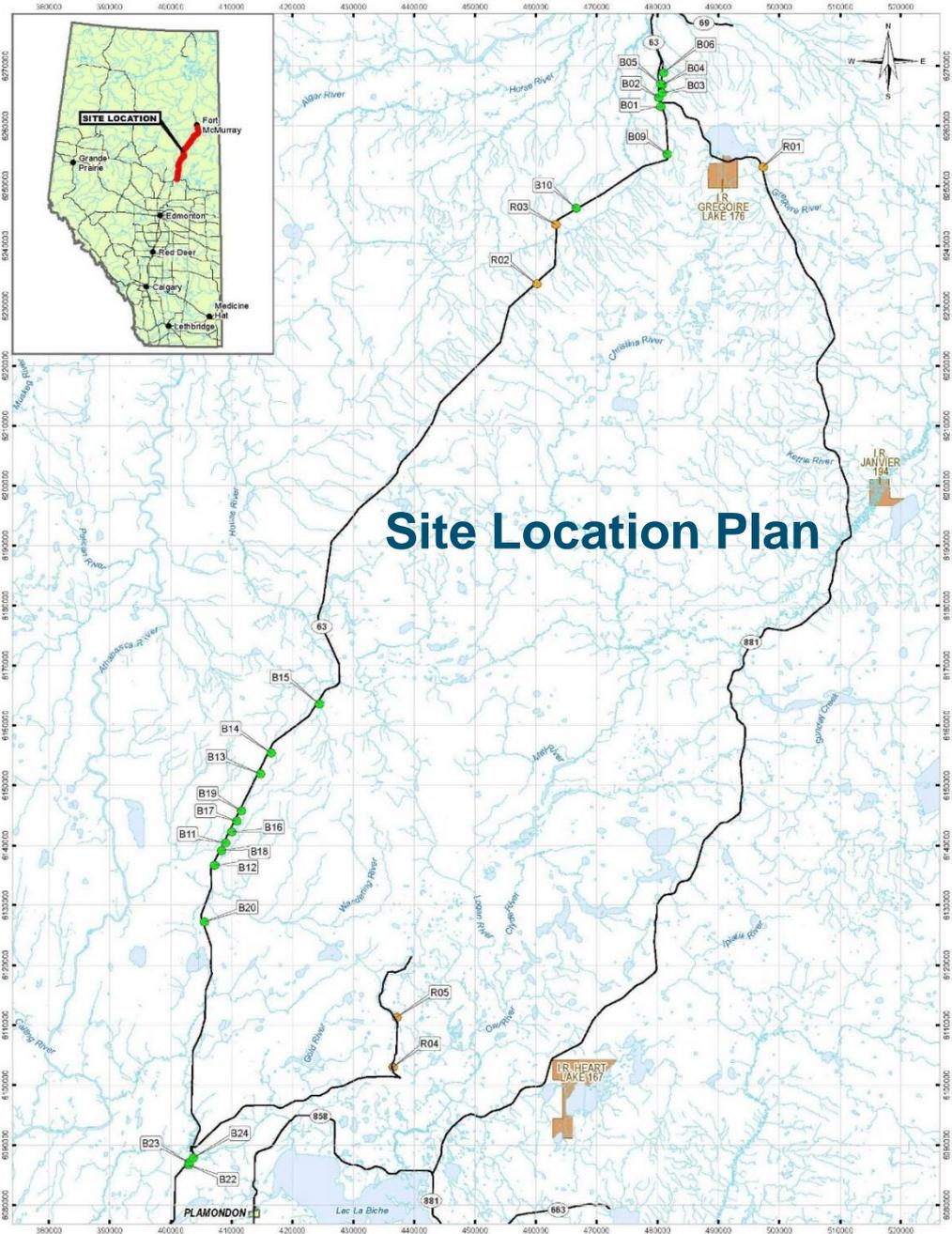


Measures of Progress – A Case Study on How to Determine Whether Constructed Wetlands Are Naturalizing Over Time

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Outline

- Project History
- Design Standards
- Measures of Progress
 - Vegetation
 - Wildlife
 - Water Quality
 - Invertebrates
- Conclusions



Site Location Plan

Project History

- 2012 Tetra Tech EBA Developed the Wetland Monitoring Plan
 - First year of monitoring (2012) develop baseline data
 - Second year of monitoring (2013) – data collection
 - Third year of monitoring (2014) – trend analysis
- Objectives:
 - Monitor wetland borrows to determine how they function in relation to nearby naturally occurring wetlands;
 - Compare the success rates of old and new wetland borrow design standards;
 - Determine whether borrow pits are naturalizing.
- Results to be utilized in continued development of AT's internal wetland policy

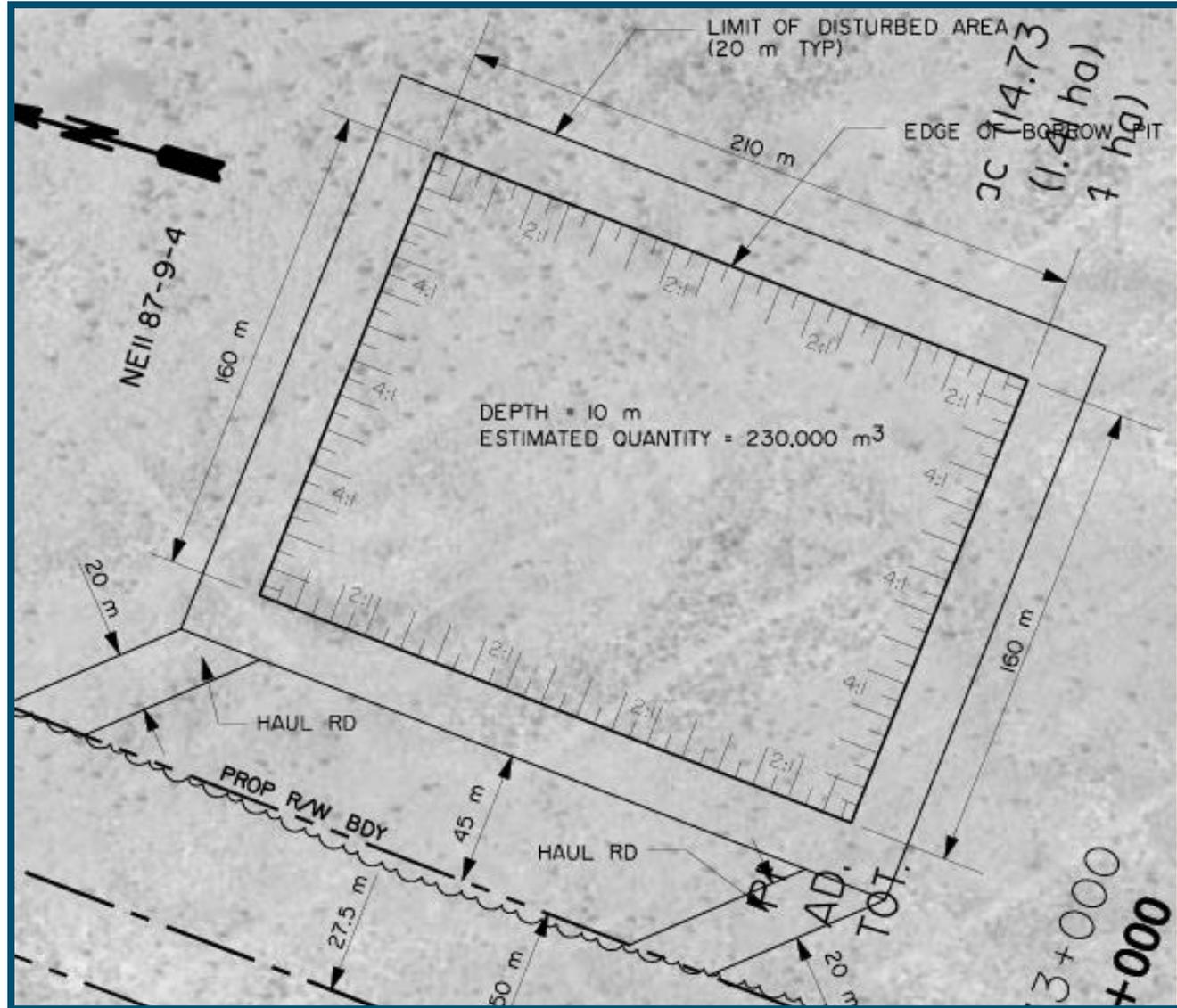
Wetland Borrow Monitoring

Four types of monitored wetlands:

1. Old borrow; old design standard
2. New borrow; old design standard
3. New borrow; new design standard
4. Reference wetlands



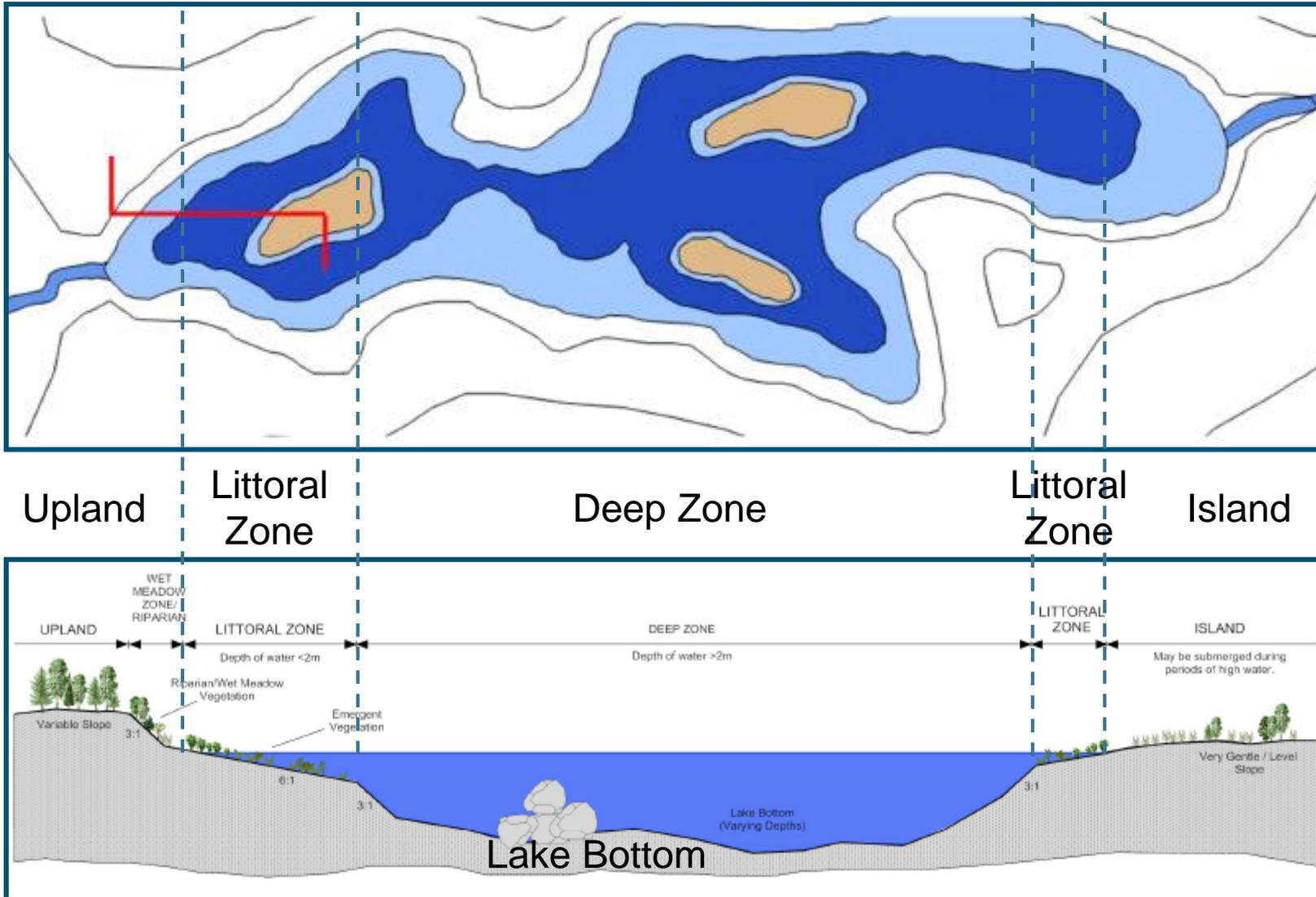
Old Design Standard



Old Design Standard



New Design Standard



New Design Standard



Monitored Parameters

- Hydrological Function
- Aquatic Invertebrates
- Vegetation
- Soils
- Wildlife
- Water Quality
- Fish



Parameters Utilized

- Water Quality
- Wildlife Usage
- Vegetation
- Aquatic Invertebrates



Water Quality

- Sampling at inlet and in middle of wetland
- Water field data
 - Temp., pH, EC, DO, and turbidity
- Laboratory analysis
 - Total metals, TOC routine chemistry, nutrients (2 events)



- Is water quality being affected by external sources?
- How does borrow pit water quality compare to that of the reference wetlands?
- Is water quality changing over time?

Water Quality

To show progression towards naturalization, water quality must conform to one of two evaluations:

- **Water quality must adhere to the Canadian Council of Ministers of the Environment (CCME) and Alberta surface water guidelines; or**
- **If there is an exceedance, it must be naturally occurring and the value must be comparable to the reference wetlands.**



Water quality for the borrow pits must fall within the 25% – 75% quartile of the reference median

Conclusions:

- Varies widely temporally and spatially;
- Most water quality parameters were within applicable guidelines, and indicate stable wetlands with some indication of eutrophication;
- All wetlands (borrow and reference) had at least one parameter that exceeded the CCME and/or ESRD guidelines;
- Departures from guidelines may be explainable by:
 - Eutrophication status of the wetland (nitrate-nitrogen and phosphorus); or
 - Mineral content of groundwater (e.g., iron, aluminum).
- Exceedances were infrequent and inconsistent. No conclusive trend towards impairment can yet be established and source(s) of the exceeded parameters cannot be conclusively determined without further study.

Vegetation

- 1 m x 1 m permanent plots in aquatic, riparian and upland
- Species richness
- Proportion of exotic species (exotic species and weeds)
- Proportion of wetland indicator species
- Floristic Quality Index (each species is given a coefficient of conservatism (cc) between 1 and 10)



- Are borrow pit vegetation communities functionally comparable to reference wetlands?
- How is vegetation changing over time?

Vegetation

To show progression towards naturalization, vegetation must conform to two evaluations:

- Floristic quality index must be comparable to the reference wetlands; and
- Species richness (the number of vegetative species present at the borrow pit) must be comparable to the reference wetlands.

The *FQI* and species richness must fall within the 25% – 75% quartile of the reference median



Vegetation

The *cc* for each species is based on an average value between 0 and 10 assigned by a group of expert botanists as follows³:

- 1–3: Species common, found in a wide variety of conditions and tolerant of disturbance.
- 4–6: Usually found within a specific plant community, but tolerant of moderate disturbance.
- 7–8: Found in advanced stages of succession that tolerate minor disturbance.
- 9–10: Species with very low tolerance of disturbance.

Each wetland vegetation species identified as having at least 1.0% cover within the aquatic and riparian plots at a borrow pit is assigned a *cc*; species with less than 1.0% cover were excluded from the calculation to help eliminate the influence of trace (only observed once) species at the wetland borrow.

Vegetation

Conclusions:

- **Need to rework sampling methodology to properly understand *FQI*;**
- **Fluctuating water levels make annual vegetation comparisons difficult;**
- **Some borrow pits have met the criteria for species richness and *FQI*, and most are close. Further monitoring?**



- Sound recorders
 - Birds
 - Bats
 - Amphibians
- Sound recorder data are analyzed after the 3rd year
- Incidental observations



Species were classified into wetland indicator statuses

- Obligate — occurs in wetlands under natural conditions approximately 99% of the time;
- Facultative Wetland — occurs in wetlands approximately 57% to 99% of the time; and
- Facultative — occurs in wetlands approximately 34% to 56% of the time.

Do the wetland borrows support wetland-dependent wildlife species?

Wildlife

To show progression towards naturalization, key wildlife species or representatives of appropriate functional wildlife groups must be present during critical times of the year.

The wildlife measure of progress will be considered achieved if one of the following conditions is met. Any observation of:

- An obligate wetland bird species;
- Amphibians or bats during critical times of the year; or
- Facultative wetland or facultative bird species in two successive years.



Conclusions:

- All borrow pits met the criteria for wildlife.
- Wildlife detection rate much higher with the use of sound recorders



Aquatic Invertebrates

- Sediment sampling to capture benthic invertebrates
- Net sweep sampling to capture invertebrates in the water column and vegetation



- Diversity is determined by: abundance, taxon richness, Simpson's Diversity, evenness, and Ephemeroptera-Plecoptera-Trichoptera index.
- Is a diverse community of aquatic invertebrates supported? Are communities comparable to the reference wetlands?

Aquatic Invertebrates

To show progression towards naturalization, the EPT Index for aquatic inverts must be comparable to that of the appropriate reference wetlands.

- A measure of progress will be met if the EPT Index value falls within the 25% – 75% quartile of the reference median



Aquatic Invertebrates

Conclusions:

- EPT values were low in general in borrows and reference wetlands (no Plecoptera);
- All but two borrow pits passed this criterion
- New borrow pits had a higher value than some of the reference wetlands



Summary

- AT and ESRD need decide how credit is determined.
 - Most wetlands failed at least one of the criteria.
- Continue to evaluate progress criteria and field data collection methods.
- Evaluate need to continue monitoring some wetlands past three years and if so, what should the monitoring intensity be?
- Work with AT towards the development of design standards.
- Share results with others to enhance understanding.

Questions?



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