Constructed Wetland Treatment System (CWTS)

Contango Strategies Ltd (CSL)

Ducks Unlimited Canada Operating as Native Plant Solutions (DUC)

Dr. John Rodgers and Dr. James Castle

Who We Are

- Contango Strategies Ltd
  - Saskatoon, Saskatchewan
  - Laboratories, and indoor and outdoor pilot-scale CWTS facilities
- Dr. John Rodgers and Dr. James Castle
  - University Professors with industry experience
  - Over 30 years experience building CWTS
- Ducks Unlimited Canada
  - Native Plant Solutions

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Experience

- Many CWTS across North America
  - Alaska, over a decade in operation
- Treatment experience includes: arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium and zinc
- Indoor and Outdoor facilities in Saskatoon, SK
- DUC brings over 75 years of wetlands experience across Canada, including the NWT

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What is a CWTS?
(Constructed Wetland Treatment System)

- Built on the scientific principals of natural wetlands cleaning water
- In natural wetlands, different types and areas of the wetland will have varied abilities
- Use knowledge of natural systems to design specific CWTS for specific types of water
- The CWTS at NICO will be built to site specific conditions

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How does it work?

- Water, plants, soil
- Local plants will be used in CWTS construction
- The objective is to create the right environment for chemistry and natural microbes to clean water
  - Nutrients, pH, oxidation/reduction potential
- Remove contaminants from water and put into soil

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Cold Climate

- Wetlands function to clean water
- Function during months of year when water is free flowing and during spring melt
- Pilot-scale will be performed in Saskatoon, Sk were it can be below -40°C in winter

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Examples of Wetlands in the North

Location	Constituents Treated
United Keno Hill Mines, Yukon	Zinc and metals
Northern Saskatchewan	Uranium mining waste
Near Anchorage, Alaska	Military Waste
Yellowknife, NWT	Wastewater*
Hay River, NWT	Wastewater*
Dettah, NWT	Wastewater*
Fort Providence, NWT	Wastewater*
Nahanni Butte, NWT	Wastewater*
Deline, NWT	Wastewater*
Norman Wells, NWT	Wastewater*
Fort McPherson, NWT	Wastewater*
Aklavik, NWT	Wastewater*
Behchoko, NWT	Wastewater*
Gameti, NWT	Wastewater*
Wekeweeti, NWT	Wastewater*
Whati, NWT	Wastewater*

*Reported in: “Synopsis of Municipal Wastewater Treatment and Discharge in the NWT” by Dillon Consulting (2007) for Indian and Northern Affairs Canada

Our approach

- Site specific, case-by-case
- Scientific testing and optimization
- Put contaminants into the soil
  - Metals in sediment non-reactive
  - Remove from water
  - Doesn’t go into plants
- Design to avoid toxic buildup in soil

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Key Concepts

- **Goal**: remove targeted constituents from water put into sediments in safe forms
- **Method**: replicate natural systems
- **Evaluation of performance**: measure decrease in water and perform toxicity tests

How can we be confident in performance?

- Scientific Design
- Modelling, optimizing
- Pilots, demonstration scale (early in operations)
- Testing and validation of design
  - Water
  - Sediments
  - Plants
  - Toxicology
- Contingency

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Phases

Assessment and feasibility (data gathering and review)

A. Pilot-scale Indoor

B. Pilot-scale Outdoor

C. Demonstration-scale (on site)

D. Full-scale

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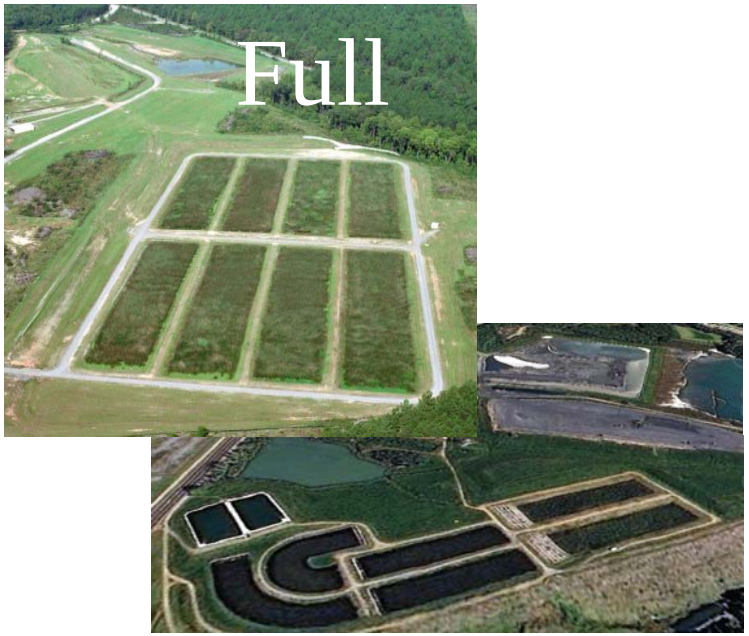
Scaling approach



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Study Plan

- Evaluate pathways to remove each constituent from the water
- Design indoor pilot-scale CWTS
  - Test 2-3 different designs, learn from each
  - Test extreme situations (e.g., drought, spike in concentrations)
- Based on preliminary information from indoors, design outdoor pilot-scale CWTS
  - Test 2-3 designs through 2 years (freeze-thaw testing)

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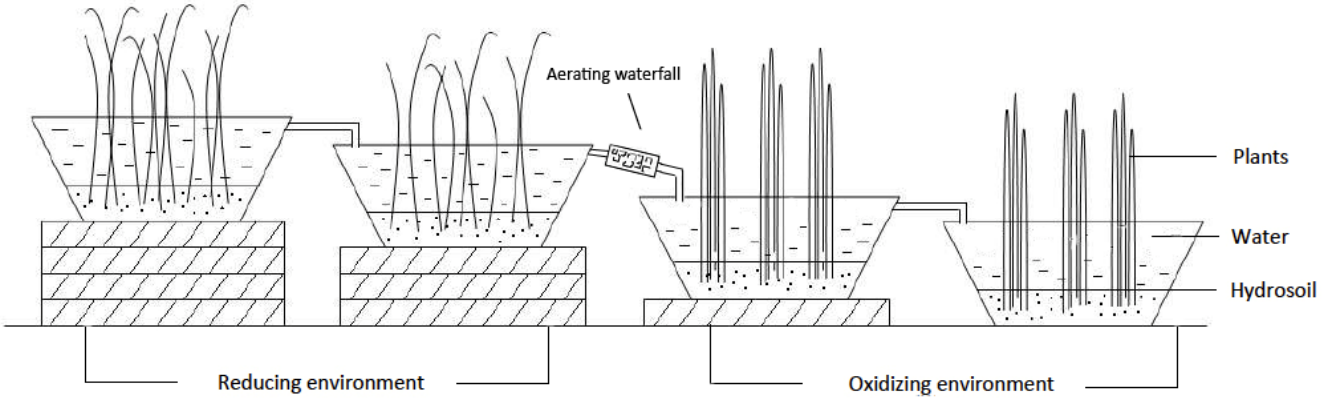
Pilot-scale CWTS



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Goals

- Determine how quickly and effectively contaminants are removed from water
- Scientifically test to find most effective and reliable design
- Gather information and data needed to design demonstration scale CWTS on site
- Walk-away system for water treatment at NICO

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