# Bugs and Veggies - Optimization of Plant Based Dewatering and Deployment Technology for Fluid Tailings

Victoria Collins, Chibuike Chigbo, Christine Martineau, Amanda Schoonmaker and Paolo Mussone, NAIT

As of 2017, the Alberta oil sands has maintained a fluid tailings inventory of 1.24 $Bm^3$ (osip.alberta.ca). These tailings are composed of water, sand, silt, and clay particles, which form a stable suspension that is difficult to reclaim. The goal of this project was to develop a passive, nature based, technology to dewater fluid or flooded oil sands tailings in closure cells. The approach utilizes a combination of native wetland and flood tolerant upland plant species suspended on the surface by a floating mat and augmented with plant growth promoting microorganisms and nutrient amendments. This technology is designed to dewater in stages where the wetland species first remove the cap water and increase solids content through evapotranspiration. The woody upland species can then grow and send roots deeper into the deposit to remove water at depth. This project is executed in two phases, 1) optimization and validation of the individual components, and 2) small-scale prototype trial.

In Phase 1, plant combinations were evaluated for growth and survival, floating mat materials were tested to determine which material provided the best growth environment for plants, and microorganisms and nutrient amendments were tested in a factorial greenhouse study to identify the treatment combination which promoted the largest quantity of plant biomass. We found that wetland species western dock (*Rumex occidentalis*) and water sedge (*Carex aquatilis*), and the upland woody species, sandbar willow (*Salix interior*) persisted when grown together and grew well in fluid tailings. We also found that the thickest floating material provided a superior growth environment for sandbar willow. During the amendment trial, we found the addition of inorganic nutrients alone or in combination with hydrolyzed protein, resulted in the largest quantity of above ground biomass and increased solids content overall. The microorganism data is currently under analysis. Based on these results, the plant, floating mat, amendment combination will be combined into a scalable prototype and evaluated in Phase 2 beginning October 2021.

**Victoria Collins**

Victoria Collins is an Industrial Microbiologist with NAIT's Clean Technology research group and the resident microbiologist for the broader Industry Solutions department. Dr. Collins has a BSc in Microbiology, and both a Masters and PhD in Land Reclamation and Remediation. She has over 10 years of hands-on experience working with oil sands tailings, environmental microbiology, biogenesis of greenhouse gases, and in-situ remediation technologies. She is passionate about developing applied biotechnology and bioremediation based solutions to facilitate the reclamation of industrial disturbances and divert wastes from landfill through bio-based valoration processes. In her spare time, Victoria enjoys longsword and quarterstaff combat lessons, writing fiction, pen and paper RPGs, exploring the great outdoors, and playing with her dog Griffon.