**Alberta Conservation Association**
**2018/19 Project Summary Report**

**Project Name:** ACA Fish Stocking Pond Rehabilitation

**Fisheries Program Manager:** Peter Aku

**Project Leader:** Scott Seward

**Primary ACA Staff on Project:** Kevin Fitzsimmons, Troy Furukawa, Brendan Ganton, John Hallett, Joe Hopkins, Andy Murphy, Diana Rung, Britt Schmidt, and Scott Seward

**Partnerships**

Alberta Fish & Game Association, Viking
Alberta Environment and Parks

**Key Findings**

- Determined that 31 of 65 AFS Ponds have sufficient mean water depth (>3m) to reliably maintain water quality for trout. However, despite sufficient water depth, 11 ponds have dissolved oxygen (<4 mg/L) concentrations that may not sustain fish throughout the summer.
- Planted trees and shrubs at Castaway Fish Pond in Viking, to improve nutrient interception and promote riparian health.
- Low mid column dissolved oxygen concentration (<1 mg/L) in Rainbow Park Pond suggest the pond may not sustain fish throughout the summer.
- Rainbow Park Pond is hyper eutrophic, with high total phosphorus, and a good candidate for alum treatment to inactivate phosphorus to reduce primary productivity.

## Introduction

ACA stocks ponds throughout the province of Alberta as part of our fish stocking project. Several of ACA's Fish Stocking (AFS) ponds are very popular angling destinations receiving >2,000 angler h/ha. However, our recent data suggest that some of these ponds may not be capable of supporting trout survival beyond mid-summer due to poor water quality, particularly low dissolved oxygen (DO), and temperature (Fitzsimmons and Keeling 2015). This is not surprising since most AFS ponds tend to be shallow and enriched with nutrients. Beyond dredging these waterbodies, not much can be done to reduce water temperature for trout survival, but low DO can be improved through limiting nutrient availability and subsequent primary productivity and biological oxygen demand (BOD). Best management practices suggest that functioning aquatic ecosystems require healthy riparian areas and that riparian enhancements can be used to intercept nutrients from entering waterbodies. In instances where high nutrient concentrations are already present in-situ, nutrient recycling within waterbodies can be limited through adsorbing phosphorus to alum. Reducing nutrient availability will limit primary productivity and BOD, improving DO and summer-long survival of fish in these ponds.

## Methods

A three-part process was developed to address poor water quality in select AFS ponds:

- Identification of ponds with water quality issues amenable to riparian enhancements and alum treatment.
- Rehabilitation of riparian areas of selected ponds.
- Determination of alum concentration suitable to safely chemically inactivate the internal phosphorus load of a selected pond.

To determine ponds amenable to riparian enhancements and alum treatment, we reviewed historic water quality data from AFS ponds for low DO concentrations (<4 mg/L) during the open water season. We chose 4 mg/L DO as the cutoff for trout survival since the incipient lethal level for trout is 3 mg/L for durations >3.5 days (Chapman 1986). Ponds that have a mean water depth <3 m were not included in the analysis because of the inherent water quality issues common in shallow waterbodies (such as excessive weed growth and high-water temperature) that cannot be significantly improved by means other than dredging. Based on our results, we selected Castaway Pond for riparian rehabilitation and Rainbow Park Pond (formerly Westlock Pond) for further investigation for alum treatment.

As part of the investigation for alum treatment, we installed an oxygen datalogger, midwater column, in Rainbow Park Pond, from June – September 2018 to establish baseline DO. We collected bi-weekly composite water quality samples that were analyzed by a lab for nutrient concentration, chlorophyll *a*, pH, and water hardness to evaluate the candidacy of the pond for alum treatment. We added eight varying concentrations of alum (ranging from 10-400 mg/L) to composite water samples taken from Rainbow Park Pond, collected in August, following the alkalinity method (Kennedy and Cooke 1983). Briefly, varying quantities of alum were added to pond water to determine what concentration of alum achieved maximum phosphorus precipitation while maintaining a pH >6, and a residual alkalinity ≥25%.

**Results**

More than half of AFS Ponds have a mean water depth <3 m and fish survival may be limited by the lack of sufficient water depth in these ponds. Of the ponds with >3 m average water depth, one-third are susceptible to low DO (<4 mg/L) that is the result of poor water quality. We planted 100 willow cuttings and 39 shrubs in the riparian area of Castaway Pond to improve riparian health and nutrient interception. Rainbow Park Pond exhibits high phosphorus concentrations (TP 110 ± 53 µg/L) and primary productivity (chlorophyll *a* 28.9 ±18.7 µg/L). We also measured prolonged (≥1 week) <1.0 mg/L DO concentrations in Rainbow Park Pond during July and August (Figure 1). The sudden reduction in DO in July and August may be the result of algal bloom collapses and is likely negatively impacting trout survival. Jar tests indicate that the effective alum dose necessary to address the excessive nutrient load in Rainbow Park Pond is 200mg/L.

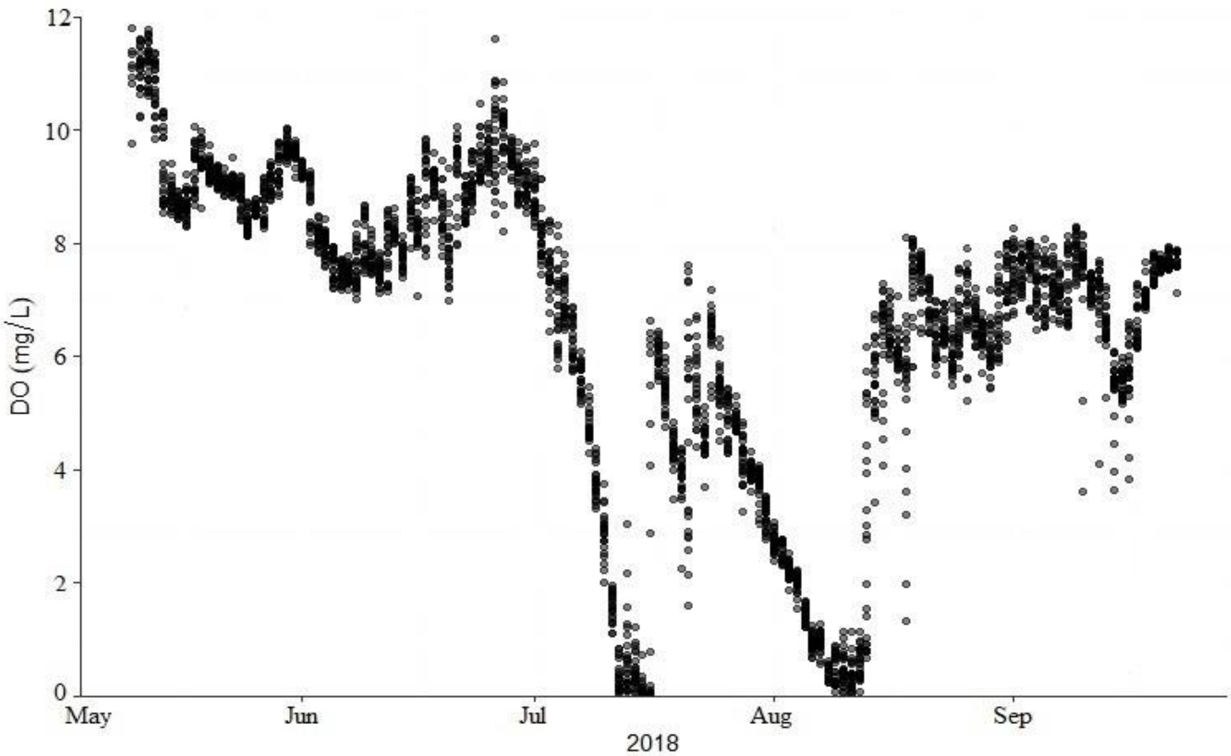



Figure 1. Hourly dissolved oxygen (mg/L) in Rainbow Park Pond taken from 2.1 m water depth and recorded May – September 2018.

**Conclusions**

Functioning aquatic ecosystems require a healthy riparian that is capable of intercepting nutrients entering waterbodies. Trees and shrubs planted at Castaway Pond will help to improve the riparian health and nutrient interception potential of the pond. In the case of Rainbow Park Pond where TP is high, nutrient inactivation may be necessary to maintain water quality for trout survival. Rainbow Park Pond is a good candidate for alum treatment because the water chemistry of Rainbow Park Pond can accommodate a high concentration of alum without having an adverse effect on pH or alkalinity. This will make for effective nutrient inactivation that will not harm the fishery. We will be working with Alberta Environment and Parks to secure permits to apply alum to Rainbow Park Pond.

## Communications

N/A

## Literature Cited

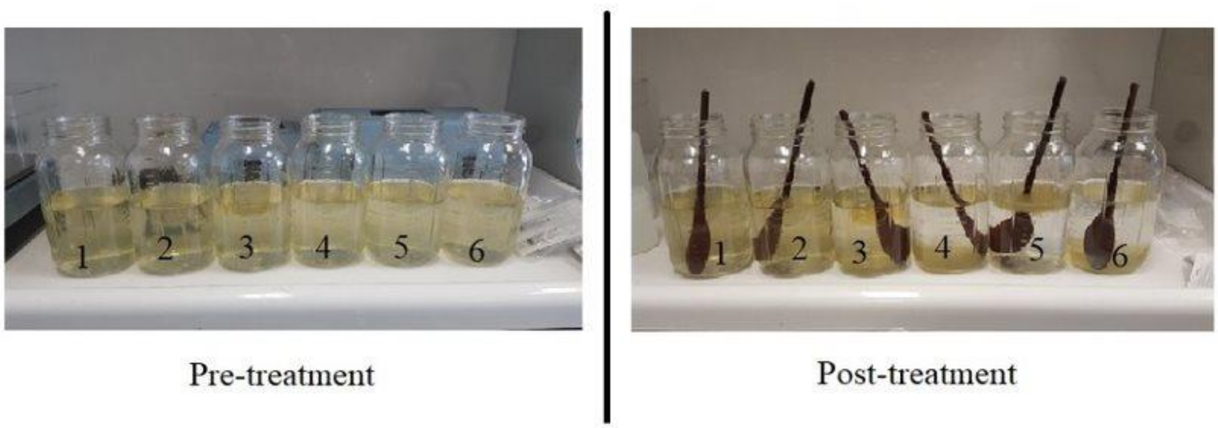

Chapman, G. 1986. Ambient water quality criteria for dissolved oxygen. U.S. E.P.A. EPA 440/5-86-003. 46pp.

Fitzsimmons, K., and B. Keeling. 2015. Survival of stocked trout and a creel based sport fishery assessment of 12 Alberta Conservation Association stocked ponds. Data Report, produced by the Alberta Conservation Association, Sherwood Park, Alberta, Canada. 25 pp + App.

Kennedy, R., and D. Cook. 1982. Control of lake phosphorus with aluminum sulfate: dose determination and application techniques. Journal of American Water Resources. 18(3): 389-395.

**Photos**

ACA staff member, Joe Hopkins, waters a shrub planted to improve riparian health and nutrient interception at Castaway Pond. Photo: Diana Rung.




Rainbow Park Pond alum jar test pre- and post-treatment. Alum concentrations ranged from 10 – 400 mg/L (left to right). Photo: Brendan Ganton


Algal bloom in Rainbow Park Pond. Photo: ACA