

# Reflection Lake Restoration Project

Final Report

Project No. COL-F20-W-303



*Prepared by* \*Rachel Darvill, B.Sc., M.Sc., R.P.Bio.

\*Goldeneye Ecological Services, PO Box 663, Golden, BC, V0A1H0

racheldarvill@gmail.com



*Prepared for* Fish and Wildlife Compensation Program

Prepared with financial support of the Fish and Wildlife Compensation Program on behalf of its program partners BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and public stakeholders.

April 30, 2020

## Executive Summary

Reflection Lake is important breeding marsh bird habitat for several species, including the provincially blue-listed eared grebe (*Podiceps nigricollis*). A recent marsh bird monitoring project documented Reflection Lake as having high bird species richness compared to other survey stations in the Columbia Wetlands. There has been a noticeable increase in the amount of cattail (*Typha latifolia*) growing in the lake/marsh ecosystem found here (reducing available breeding habitat), which is likely due to disruptions in hydrology that are human caused.

It is well-known that ideal marsh bird breeding habitat are wetlands with well-interspersed 50:50 vegetative cover/open water, whereas cattail monocultures are not well-used by birds. The focus of this project is on-the-ground experimental cattail manipulation that aims to return Reflection Lake to the hemi-marsh condition, increasing breeding bird habitat. Experimental cattail removal using benthic barriers (in this case, thick tarps placed on lake bottom) may be an effective way of removing patches of cattail. Through our restoration efforts, it was determined that the large cattail mat present at Reflection Lake is floating, making hand-removal efforts an ineffective approach for most of the cattail monoculture due to dangers presented to humans doing the work. It is suggested that other restoration ideas be pursued for the majority of the floating cattail mat; such as auger boring or pipe ramming used for culvert installation under the adjacent highway and railway, or mechanical removal followed by possible muskrat re-introduction.

This project provided hands-on opportunities to college students that wanted to be involved with restoration efforts. It built upon relationships with First Nations by assisting Ktunaxa communities to relearn a traditional cultural practice that had been lost, cattail weaving. Empowering educational opportunities in the form of cattail removal and a cattail weaving workshop (lead by a Ktunaxa knowledge keeper) were created for First Nations communities. A traditional skill once lost, has now been regained by some peoples in Ktunaxa communities.

This project aligned with the Fish and Wildlife Compensation Program (FWCP) habitat-based actions: (P1) restore and create wetland and riparian area habitat to address impacted, degraded or lost habitat. This project aimed to result in the restoration of Reflection Lake to re-create the hemi-marsh condition (50:50 interspersed vegetation with open water), in an area where cattails are creating mono-cultures likely due to adjacent, historic man-made alterations (railway yard, highway) that have disrupted the natural hydrologic regime. Restoring the hemi-marsh condition at Reflection Lake would benefit marsh birds by increasing breeding bird habitat and feeding/resting (stopover) habitat. Direct benefits would be made to the provincially blue-listed eared grebe and several FWCP priority species for wetland/riparian ecosystems [e.g., sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), pied-billed grebe (*Podilymbus podiceps*), wood duck (*Aix sponsa*), hooded merganser (*Lophodytes cucullatus*).

## Table of Contents

Executive Summary.....	1
1.0 Introduction .....	3
1.1 Goals and Objectives.....	4
2.0 Study Area.....	4
3.0 Methods.....	5
3.1 Bird surveys.....	5
3.2 Coordination and communication efforts .....	5
3.3 Vegetation surveys and cattail removal.....	6
4.0 Results and Outcomes .....	10
5.0 Acknowledgements.....	12
6.0 References .....	13
7.0 Appendix .....	14
Appendix 1. Data from the bird surveys at Reflection lake. ....	14
Appendix 2. Poser for the cattail weaving workshop. ....	16
Appendix 3. Data from the vegetation surveys at four test plots. ....	17

## List of Figures

Figure 1. Cattails removed for Ktunaxa cattail weaving workshop .....	7
Figure 2. Removing cattail for the Ktunaxa cattail weaving workshop. ....	7
Figure 3. Volunteers on the experimental cattail manipulation.....	8
Figure 4. Cattail removal at a test plot. ....	8
Figure 5. Placing down the benthic barrier and edging. ....	9
Figure 6. Rocks holding down the benthic barriers at a test plot.....	9

## 1.0 Introduction

Through the 2016-2019 Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP), Reflection Lake was shown to provide important breeding marsh bird habitat for several species, including the provincially blue-listed eared grebe (*Podiceps nigricollis*) (Darvill & Westphal, 2020). Reflection Lake was also documented to have high species richness compared to over 60 other marsh bird survey stations in the contiguous Columbia Wetlands (Darvill & Westphal, 2020). Cattail (*Typha latifolia*) monocultures at Reflection Lake are growing aggressively and the thick cattail areas are not well-used by birds.

Breeding-bird communities inhabiting prairie wetlands in the north have higher densities and diversities in wetlands with a well-interspersed 50:50 vegetative cover to water ratio, than in those wetlands with a higher or lower proportion of vegetative cover (Weller & Spatcher, 1965; Kaminski & Prince, 1981; Murkin et al., 1982). The 50:50 ratio of interspersed emergent herbaceous vegetation and open water has been termed the 'hemi-marsh' condition, and has been used globally for the management of wetlands for waterfowl and other birds. Potential reasons for the greater avian abundance and diversity in hemi-marsh conditions include increased abundance and availability of food, and visual isolation or pair-spacing of breeding birds (Smith, Haukos & Prather, 2004). Since there are far fewer wetlands now than have occurred historically, it is important to target conservation efforts on increasing the carrying capacity and use of remaining wetland habitats.

Cattail reduction at Reflection Lake to restore the hemi-marsh condition is desirable, as substantial increases in cattail are threatening breeding bird habitat, natural plant diversity and habitat heterogeneity (Apfelbaum, 1985). The accumulation of cattail removes open water needed by birds to move around and it creates anaerobic zones where there is little oxygen or invertebrate (bird food) productivity (Apfelbaum, 1985). If cattail growth is left untreated it will continue to grow aggressively, eventually taking over remaining breeding, feeding, and migration stopover habitat at Reflection Lake that is currently well-used by birds.

At Reflection Lake, the natural flood pulse of the Columbia River (which controls cattail growth) has been altered through the creation of the adjacent highway, railyard, and railway. The natural spring freshet scours away rooted vegetation like cattail, and without this flood pulse the vegetation continues to grow. There is no silver bullet for cattail management, but a variety of methods have been tested in other areas.

Benthic barriers have been tested on cattail and the results were that actively growing cattails were killed when completely covered for at least 60 days, but "there were problems holding down tarps confounding the investigation" (Apfelbaum, 1985). Recently, Dr. Catherine Tarasoff (Thompson Rivers University) used benthic barriers (tarps) as an effective long-term control agent on yellow-flag iris (*Iris pseudacorus*), an aquatic invasive plant that threatens native wetland plant and animal diversity. These benthic barrier treatment methods have not been tested on cattail (Streichert & Tarasoff, 2015), and it is not known whether the barrier treatment method could work on cattails. "It is critical that other scientists go through the process of testing the barrier methods [on other plant species] rather than assuming the barriers will or won't work. [This] proposal is a logical step towards understanding if benthic barriers are an effective control option for cattails (pers. comm., C. Tarasoff, May 2019).

increases bird use at test sites.

## 1.1 Goals and Objectives

The Reflection Lake Restoration Project hand-remove patches of cattail and placed benthic barriers at test sites located at the south end of Reflection Lake. Removed cattails were used by Akisqnuq First Nations for traditional cultural purposes. Vegetation and bird surveys were conducted at test sites before benthic barrier treatments, to collect baseline information to be used for effectiveness monitoring. The project goals of the Reflection Lake Restoration Project were as follows: 1) determine if cattail removal followed by benthic barrier treatment is an effective long-term control mechanism; 2) determine if cattail reduction increases bird use (subsequent years); 3) build opportunities by involving students; and 4) build relationships with First Nations to support FWCP sustainable use objectives. This project meets FWCP objectives in that it works to improve habitat integrity, it provides First Nations opportunities for sustainable use, and builds on relationships with indigenous communities.

Habitat restoration efforts are for one FWCP Focal Species for wetland/riparian ecosystems (American bittern) and 12 Priority 1 FWCP Inventory Species priority species for wetland/riparian ecosystems, i.e. pied-billed grebe, horned grebe, blue-winged teal, American coot, canvasback, cinnamon teal, lesser scaup, northern pintail, redhead, red-necked grebe, wood duck, hooded merganser, ring-necked duck, bufflehead, and common goldeneye.

## 2.0 Study Area

At the north end, Reflection Lake (51.281808; -116.944923) is located within the Town of Golden boundaries, whereas the southern end is within Columbia Shuswap Regional District Area A jurisdiction. Reflection Lake lies just outside of the Columbia Wetlands Wildlife Management Area (WMA), which is managed by the provincial Ministry of Forests, Lands, Natural Resources Operations and Rural Development (MFLNRORD). Test plots for this project were located at the southwestern end of the lake, where cattails have grown aggressively to create monocultures likely due to adjacent man-made alterations (e.g., railway yard, highway), that have disrupted the natural hydrologic flow regime.

## 3.0 Methods

### 3.1 Bird surveys

Three marsh bird surveys were conducted at the each of the north and south ends of Reflection Lake in order to document species diversity and collect baseline bird data ahead of experimental cattail manipulation efforts. Bird survey dates were May 20, June 10 and June 29, 2019. The marsh bird surveys were point counts utilizing the North American Marsh Bird Monitoring Protocol to detect birds aurally and visually at the two survey stations (Conway, 2011). This employed a combination of both call-broadcast and passive listening to detect marsh birds, to enhance marsh bird detection probability (Conway & Nadeau, 2010).

An additional single day visual/aural bird survey was conducted above Reflection Lake test plots on June 10, 2019, to collect baseline data on bird occupancy at the specific cattail monoculture test sites prior to cattail removal and benthic barrier treatments. In order to limit the disturbance response from birds and since broadcast equipment was used at the two other survey stations earlier on that day, a broadcasting unit was not used at this third site. The bird survey results were recorded and entered into an excel datasheet (Appendix 1).

### 3.2 Coordination and communication efforts

On July 2, 2019, a Section 11 [application for change approval and notification (changes in and about a stream)] was applied for through MFLNRORD, in order to have permission to removal cattail. On July 16, 2019, notification was received and stated that the described works in the application were considered a 'Notification.' Therefore, no Section 11 Water Sustainability Act Approval was required, since the work was done in accordance with the Water Sustainability Regulation (Part3/Section39).

Dates for College of the Rockies (COTR) student involvement with hands-on restoration efforts (cattail removal, benthic barrier installation) were coordinated with Don Webster (COTR Instructor). All volunteers signed 'volunteer release and liability forms.' Liaison with Akisqnuq Lands Manager occurred to determine the most appropriate Ktunaxa knowledge keeper to teach other Akisqnuq/Ktunaxa members how to utilize cattails for culturally traditional practices, i.e., weaving mats, baskets. Subsequent coordination efforts were completed with the Akisqnuq First Nations knowledge keeper and Lands Manager to organize the cattail removal, processing, and weaving workshop. A poster communicating the cattail weaving workshop was developed, printed, and distributed throughout the Metis and Ktunaxa communities (Appendix 2). Volunteer opportunities to participate in hands-on restoration efforts was promoted to the Metis Nation Columbia River Society. A request was made to appear as Delegation at a Town of Golden Council meeting to communicate on restoration efforts, and a presentation as delivered to Town Council on June 18, 2019.

### 3.3 Vegetation surveys and cattail removal

At four test plots, vegetation surveys were conducted ahead of cattail removal and treatment efforts; survey results were entered into an excel datasheet (Appendix 3). On July 19, 2019, the principal consultant with two volunteers went to Reflection lake to stake out the test plots where cattail removal would take place. The original plan was to set them out in the middle of the cattail mat, working towards a hemi-marsh state. However, walking on the cattail mat proved very unsafe; it seemed highly possible that someone could have fallen through the thick mat of floating vegetation. Prior to restoration efforts, it was not known that the large areas of cattail growth posed a danger. It was decided that all four test plots had to be set up around the perimeter of the cattail monoculture area. Each test plot was staked out to be 12 feet x 10 feet in size.

On July 21, 2019, some cattail leaves were removed by the principal consultant and six volunteers (including three Metis members, one Aqisqnuq member) from established plots because leaves needed to be cured and processes for 6-8 weeks ahead of the cattail weaving workshop (Figure 1 and 2). Apfelbaum (1985) states that physical control methods for cattail are best if plants are cut in late summer or early fall. On October 23, 2019 when water levels were low, the principal consultant, 16 COTR students, their instructor, and an additional volunteer (Figure 1), conducted the cattail removal with benthic barrier installation at the four test plots. Large rocks were obtained from the gravel pit north of Reflection Lake, and brought over to the test plots. The four 10ftx12ft patches of dense cattail leaf growth were hand-removed using loppers/hand clippers. The plan was to also dig out rhizome/root structures from all test plots, but this proved very challenging and impossible at two of the test plots due to water hazards. Once some of the vegetation was removed, two of the plots behaved like sink holes. Therefore, several roots/rhizomes were left at those two test plots. We also planned to use spikes to hold down the benthic barriers, but this did not work as planned since the ground was too soft to hold the spikes in place. Garden edging was put around the perimeter of each test plot to try and sever the rhizome mat, and benthic barriers (industrial black vinyl panel, 10ft x 12ft) were set down at all four treatment locations, held down by the large rocks (Figure 2 and 3). Rocks were used to hold down the tarps from wind and from meltwater (and possibly groundwater) expected during spring 2020. In order to try and suppress the growth of the cattail and to kill the root structure, the benthic barriers will be left on the test plots for one year. They will be removed in the fall of 2020.



*Figure 1. Cattails removed for Ktunaxa cattail weaving workshop*



*Figure 2. Removing cattail for the Ktunaxa cattail weaving workshop.*

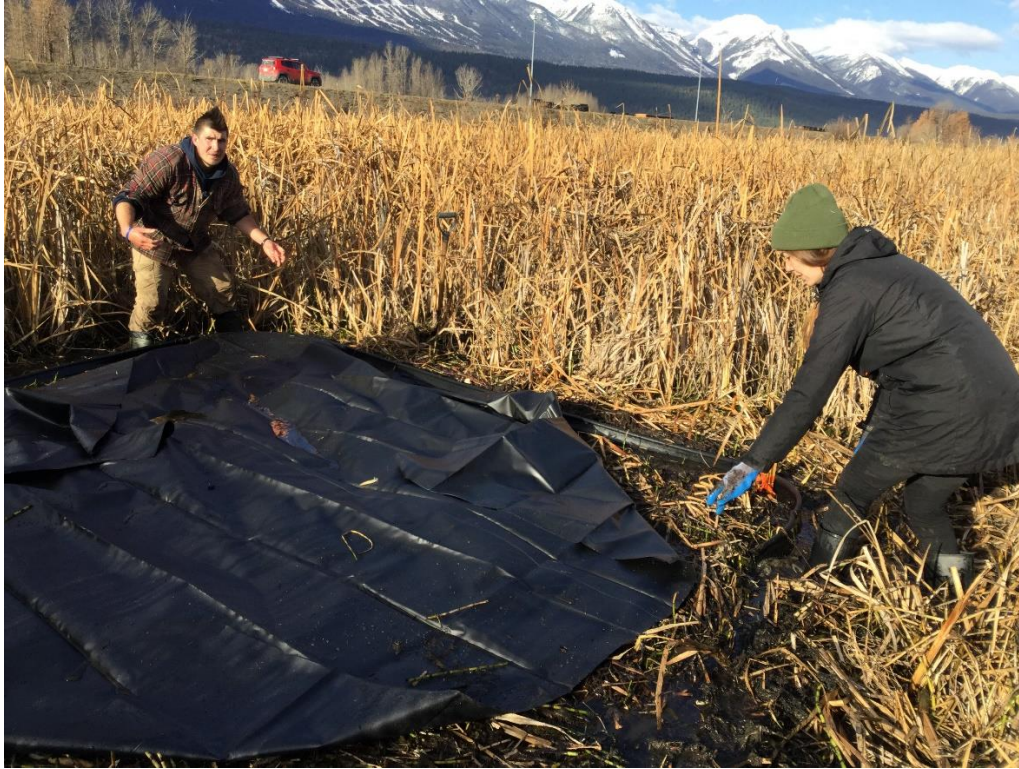




*Figure 3. Volunteers on the experimental cattail manipulation.*



*Figure 4. Cattail removal at a test plot.*



*Figure 5. Placing down the benthic barrier and edging.*



*Figure 6. Rocks holding down the benthic barriers at a test plot.*

## 4.0 Results and Outcomes

Bird use was high at the two marsh bird survey areas located just outside of test plots (survey stations called Reflection Lake and Reflection Lake 2 in Appendix 1), but bird use was very low at the location of the test plots in the cattail monoculture area (survey station called Reflection Lake 3 in Appendix 1).

Restoring the hemi-marsh condition at places of Reflection Lake where cattails are thick and excessive would benefit marsh birds by increasing available habitat. It is a challenging endeavour to remove cattail in the long-term, with no silver bullet technique. An experimental approach to reducing excessive cattail growth occurred during this project by removing vegetation from four test plots and subsequently installing benthic barriers. Even if this experimental cattail manipulation project is successful at reducing the cattail structure at the test plots, due to the hazardous condition at the site, the larger overall area of cattail needs to be removed using other methodology. In fall 2020, the benthic barriers and liners will be removed from the four test plots.

Since cattail accumulation is likely a result of the hydrologic flow being cut off from the Columbia River (due to placement of the adjacent railway, railyard, and highway), a potential way to move forward with this initiative could be to further investigate the potential of installing a culvert under the railway and highway. This may work to restore water flow to Reflection Lake, which could help naturally reduce the stature of the cattail. Auger boring or pipe ramming could be considered for flow restoration. There are companies based out of Calgary (e.g., The Tunneling Company) that specialize in culvert installation under highway and railways. The Tunnelling Company was contacted during this project and advised that before they can assess costs and the constructability, they need key details including pipe diameter and information from a soils report. For the pipe diameter, one would need to work with a hydraulic engineer to determine what pipe size would be required. For the soils information, a full geotechnical investigation would need to be completed to determine the tunneling methodology required, in addition to what risk mitigation would be needed. The next steps for investigating the potential of installing a culvert under a railway and highway, would be to work with an engineering firm that has experience in this type of work. This will not be explored further at this time due to the large scope and high costs of this initiative. Given the projected large expense associated with re-establishing hydrological connection under the highway and railway, further research should occur that could guarantee this initiative would reduce the amount of cattail present into the long term.

In 2014, Voyageurs National Park in Minnesota, USA, initiated a cattail removal project that uses an amphibious barge with two rotating chopper blades that cuts and removes thick mats of cattail mats (Beager, 2017). The cattail removal is followed by re-establishment of other native vegetation to prevent cattails from growing back; they are also planning to re-establish a muskrat population, which can help control cattail (Beager, 2017). In 2019, the project in Voyageurs National Park received \$1.27 million USD to work on the invasive cattail project (Beager, 2019). Project details and plans are not clear for this site; it would be worth following up on the work done in this park and determine if this would be a feasible way to move forward at Reflection Lake and other areas of excessive cattail growth in the Columbia Basin.

Traditionally, cattail heads and seeds were eaten by First Nations, cattail leaves and stalks were used for weaving mats and baskets, cattail roots and pollen were used as medicine herbs, and cattail down was used as moccasin lining, pillow stuffing, and diaper material. Additionally, cattails have symbolic meaning with some First Nations bands. During a presentation that the principal consultant provided to Akisqnuq Chief and Council in 2018, the Council stated that their knowledge of traditional cultural practices utilizing cattails had been lost in the Akisqnuq culture. This project organized and hosted a workshop with a Ktunaxa knowledge keeper whom taught skills to eight indigenous peoples; these skills are needed to harvest and use cattails for lost cultural traditional purposes. By coordinating the cattail weaving workshop for the Akisqnuq, some indigenous community members become re-engaged and empowered in their community. Educational benefits were provided to the Akisqnuq First Nations (Ktunaxa Nation) in the Windermere area, and to the Metis Nation Columbia River Society that were involved with hand removal efforts at Reflection Lake.

Additionally, 16 students at the College of the Rockies became involved with the experimental cattail manipulation through hands-on involvement, which can help students consider future career choices in either habitat restoration or in an alternative environmental field that works to conserve wildlife habitat. This project worked to restore habitat, engage communities, improve opportunities for sustainable use, and improve science and knowledge. If methods used in this project are successful at reducing the cattail stature and subsequently increasing bird use at test sites, this methodology could be used in other areas all over the Province and beyond, as long as cattail mats are not very large and floating.

## 5.0 Acknowledgements

I would like to acknowledge the financial support of the Fish and Wildlife Compensation Program in supporting this project. My gratitude goes to Dr. Catherine Tarasoff for providing her guidance and advice based on experience in terms of using the benthic barrier treatment methodology. I would also like to thank the 16 College of the Rockies students who were in their second year Adventure Tourism Business Operation students in the Sustainable Tourism and Environmental Stewardship Class. They, along with their instructor Don Webster, greatly assisted in the benthic barrier treatment efforts at Reflection Lake. I would also like to thank the Aqisqnuq First Nation, a vibrant Ktunaxa Nation community located near Windermere, specifically knowledge keeper Lillian Rose. Lillian graciously provided her time and assisted with the cattail removal efforts at Reflection Lake, and she processed and dried cattail leaves at her home for two months. She subsequently led the workshop at the Aqisqnuq Recreation Centre, where she taught cultural traditional practices (i.e., basket/mat weaving using cattail leaves) to indigenous community members. This was a powerful experience. The Metis Nation Columbia River Society, in addition to Tesia Hackett and Jeff Jackson, are also acknowledged for their participation and volunteerism in removing cattails in preparation for the cattail weaving workshop. I would also like to thank the following individuals and organizations for their verbal support on this project: Town of Golden, Columbia Shuswap Regional District Area A Director Karen Cathcart, Dr. Bruce Harrison of Ducks Unlimited Canada, and Ariana McKay (Habitat Biologist, Ministry of Forests, Lands, Natural Resource Operations and Rural Development).

## 6.0 References

- Apfelbaum, S. I. (1985). Cattail (*Typha* spp.) management. *Natural Areas Journal*, 9-17.
- Conway, C. J. (2011). Standardized North American marsh bird monitoring protocol. *Waterbirds* 34(3), 319-346.
- Conway, C. J., & Nadeau, C.P. (2010). Effects of broadcasting conspecific and heterospecific calls on detection of marsh birds in North America. *Wetlands*, 30(2):358-368.
- Darvill, R., & Westphalm, A. (2020). Columbia wetlands marsh bird monitoring project (CWMBMP). Final Report. Project No. COL-F19-W-2677. Prepared for Fish & Wildlife Compensation Program.
- Beager, L. (2017). VNP launches cattail removal project. *International Falls Journal*. Available: [https://www.ifallsjournal.com/news/outdoors/vnp-launches-cattail-removal-project/article\\_60f99716-e986-59ab-96ab-957c5004b46f.html](https://www.ifallsjournal.com/news/outdoors/vnp-launches-cattail-removal-project/article_60f99716-e986-59ab-96ab-957c5004b46f.html)
- Beager, L. (2019). Voyageurs National Park invasive cattail project awarded \$1.2 million. *International Falls Journal*. Available: [https://www.ifallsjournal.com/news/outdoors/voyageurs-national-park-invasive-cattail-project-awarded-million/article\\_2ef18fa4-22e2-52f4-9aa2-970ee9111d81.html](https://www.ifallsjournal.com/news/outdoors/voyageurs-national-park-invasive-cattail-project-awarded-million/article_2ef18fa4-22e2-52f4-9aa2-970ee9111d81.html)
- Kaminski, R. M., & Prince, H. H. (1981). Dabbling duck and aquatic macroinvertebrate responses to manipulated wetland habitat. *The Journal of Wildlife Management*, 1-15.
- Murkin, H. R., Kaminski, R. M., & Titman, R. D. (1982). Responses by dabbling ducks and aquatic invertebrates to an experimentally manipulated cattail marsh. *Canadian Journal of Zoology*, 60(10), 2324-2332.
- Smith, L. M., Haukos, D. A., & Prather, R. M. (2004). Avian response to vegetative pattern in playa wetlands during winter. *Wildlife Society Bulletin*, 32(2), 474-480.
- Weller, M. W., & Spatcher, C. S. (1965). Role of habitat in the distribution and abundance of marsh birds. Special Report. 42. Retrieved from: <http://lib.dr.iastate.edu/specialreports/42>







Appendix 2. Poser for the cattail weaving workshop.



## CATTAIL WEAVING WORKSHOP

Weaving with Lillian Rose using Indigenous plant materials using seasoned Cattail that was removed as part of a restoration effort at Reflection Lake. We will use traditional weaving practices and explore the basics of weaving, warp, twinning and tying, as we construct a small mat. These basic skills will allow weavers to make any size mat. We will learn about habitat, mellowing and curing processes, and other valuable insights about cattails.

**WEDNESDAY, SEPTEMBER 18, 1-4PM**

LOCATION: IN THE LOBBY OF THE AKISQNUK RECREATION CENTRE



GOLDENEYE ECOLOGICAL SERVICES GRATEFULLY ACKNOWLEDGES THE FINANCIAL SUPPORT OF THE FISH AND WILDLIFE COMPENSATION PROGRAM FOR THEIR CONTRIBUTIONS TO THE REFLECTION LAKE RESTORATION PROJECT.

Appendix 3. Data from the vegetation surveys at four test plots.

<b>Test Plot</b>	<b>Latitude</b>	<b>Longitude</b>	<b><i>Typha latifolia</i> (%)</b>	<b><i>Equisitum spp.</i> (%)</b>	<b><i>Carex spp.</i> (%)</b>	<b>Moss sp. (%)</b>	<b>Grass sp. (%)</b>
1	51.28097	-116.94393	55	35	0	10	0
2	51.28115	-116.94392	85	10	1	4	0
3	51.28124	-116.94393	95	1	0	4	0
4	51.28102	-116.94388	55	33	1	9	2