# Peace Project Water Use Plan

## Reservoir Wetland Habitat Monitoring

### Implementation Year 2

### Reference: GMSMON-15

### Study Period: April 2012 to February 2013

**Cooper Beauchesne and Associates Ltd.**
**Northern Interior Office**
**Suite 1, 1257 4th Avenue**
**Prince George, BC**

**February 2013**

# GMSMON-15: Reservoir Wetland Habitat Monitoring
# Year 2 - Final Report

**Report submitted to:**

**BC Hydro**

**Attn: Mike McArthur**

**Submitted by:**


**Cooper Beauchesne and Associates Ltd.**
**Northern Interior Office**
**Suite 1, 1257 4th Avenue**
**Prince George, BC**
**Tel: 250 954-1822**
**Contact: John Cooper**
**jcooper@cooperbeauchesne.com**


**February 2013**

**Suggested Citation:**

**MacInnis, A.J., K. Bachmann, A. Carson and V. Prigmore. 2013.** GMSMON-15: Reservoir Wetland Habitat Monitoring, Year 2 – Final Report. Unpublished report by Cooper Beauchesne and Associates Ltd., Prince George, BC, for BC Hydro Generation, Water Licence Requirements, Burnaby, BC. viii + 42 pp. + Appendices.

**Keywords:** Peace Water Use Plan, Riparian and Wetland Habitat Enhancement Management Plan, Williston Lake, amphibians, waterfowl, songbirds, riparian vegetation, wetland vegetation, fish, wetland demonstration sites

**Cover photo**: Long-toed salamander, WDS 6-2 (Airport Lagoon), Williston Reservoir. Photo © A. Carson, Cooper Beauchesne and Associates Ltd.

## EXECUTIVE SUMMARY

Reservoir operations have created large unproductive areas within the drawdown zone of Williston Lake resulting in limited aquatic and riparian habitats that limit the area's capacity to support fish and wildlife and potentially increase the risk of predation for terrestrial wildlife using the drawdown zone. To address these impacts, the Riparian and Wetland Habitat Management Plan was developed under the Peace Water Use Plan to investigate the possibility of creating or enhancing perched wetland areas to increase riparian and wetland habitat. An inventory of potential enhancement sites was completed under GMSWORKS-16 *Williston Reservoir Wetlands Inventory* and detailed designs for two locations were completed under GMSWORKS-17 *Williston Reservoir Trial Wetlands*.

The GMSMON-15 project is a 10-year program to monitor the effectiveness of the two demonstration wetland enhancement projects at improving wildlife habitat and maintaining the habitat over the life of the projects. Waterfowl, songbirds, amphibians, and vegetation were identified as the indicator groups for determining the effectiveness of the wetland projects. Fish populations are also being monitored, although improving fish habitat is not one of the goals of the wetland projects. This report presents the results from the second year of monitoring under GMSMON-15. The results provide the second year of baseline information on the two selected wetland demonstration sites prior to the construction of the projects.

In Year 2, habitat class descriptions and spatial distributions were reviewed. Two groups of habitat classes were merged, reducing the total number of classes from 19 to 17 and, the boundary of a single habitat class polygon was revised. Fewer plant species and lower cover on the sampling transects was observed in Year 2. The change in vegetation was attributed to the different reservoir conditions between the two years. The species still present were considered to be those that were tolerant of extended periods of flooding. Plant species identified at lower elevations typically were adapted to wet soils and are considered to be more tolerant of periods of inundation. Plant species identified from higher elevations in the drawdown zone were considered to be less tolerant of inundation.

A total of 367 individuals representing 24 species of waterfowl and shorebirds were observed during the spring surveys. The majority of species and individuals were observed at the Airport Lagoon site with only three species and four individuals observed at the Beaver Pond site. Limited waterfowl habitat was present at the Beaver Pond site at the time of the surveys. Canada Goose was the most common species detected, followed by Ring-necked Duck, American Wigeon, Green-winged Teal, and Lesser Yellowlegs.

Songbird point counts detected a total of 59 species and 611 individuals. Species richness was higher at the Airport Lagoon site with 56 species compared to 24 species at the Beaver Pond site. An average of 14.5 (n=17) species were detected per point count station at the Airport Lagoon site compared to an average of 12.0 (n=3) per station at the Beaver Pond site. The larger number of habitats in and adjacent to the Airport Lagoon site contributed to the higher diversity observed.

Western toad, wood frog, and long-toed salamander were observed during the amphibian surveys with western toad accounting for the majority of the observations. Three long-toed salamander adults were also observed at the Beaver Pond site but were located just outside of the survey area. The numbers of amphibians observed may have been affected by cool dry conditions in May and the different reservoir conditions.

Fish population sampling was completed by backpack electrofishing, minnow traps, and fyke nets and confirmed fish presence at both sites. A total of 620 fish were captured representing 11 of the 22 species potentially present in Williston Reservoir. The fish collected were primarily non-sportfish including lake chub, redside shiner, northern pike minnow, brassy minnow, and three species of sucker. A single bull trout from the Beaver Pond site and 47 burbot from the Airport Lagoon site were sportfish species collected in Year 2.

The data collected in Years 1 and 2 of the GMSMON-15 project appear to support the preliminary predictions for the wetland demonstration projects but collected in years with different reservoir conditions. Reservoir conditions are considered to be the primary reason for the observed differences in results for vegetation, amphibians, and fish while the differences in results for waterfowl and songbirds were attributed primarily to natural vegetation. The stabilisation of water levels the wetland enhancement projects is expected to improve wildlife habitat and increase wildlife use of these areas. All recommendations from Year 1 were implemented in Year 2 and will be continued in Year 3. Data collected in Year 3 prior to construction of the wetland enhancement projects will provide additional baseline data following a period of high reservoir levels. Recommendations for refining the data collection in Year 3 are provided.

## ACKNOWLEDGEMENTS

A number of people have contributed to completion of Year 2 of the GMSMON-15 project. BC Hydro WLR sponsored the project. Ongoing guidance and support was provided by Mike McArthur.

Field work was completed by CBA staff Karl Bachmann and Andrew MacInnis with assistance from CBA staff Allan Carson (vegetation), Ryan Gill (songbirds and waterfowl), and Vicki Smith (amphibians, fish and waterfowl). Andrew MacInnis (CBA Senior Fisheries Biologist) was Project Manager with assistance from John Cooper the Project Advisor.

The report was written by Andrew MacInnis and Karl Bachmann with assistance from Allan Carson and Vicki Prigmore. Ryan Gill conducted the GIS analyses and prepared maps for the report. John Cooper provided a review of the draft report.

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# 1 INTRODUCTION

## 1.1 Background

During consultations under the Peace Water Use Plan, the Consultative Committee recognized that reservoir operations created large unproductive areas within the drawdown zone of Williston Lake (Anon. 2003). The resulting limited aquatic and riparian habitats were hypothesized to have two primary impacts: they limit the area's capacity to support fish and wildlife and they potentially increase the risk of predation for terrestrial wildlife utilizing the drawdown zone. The large area (~450 $km^2$) of the drawdown zone between the low and high water levels, provides little wildlife habitat when exposed during low water levels and little habitat for fish when inundated (Anon. 2003). The fluctuating water levels were also identified as affecting riparian productivity around the reservoir.

It was noted that when water levels recede during drawdown, pools and isolated backwater areas formed in some locations around the reservoir. The contribution of these pools and backwaters to wildlife and fish productivity is variable, depending on the location. The Riparian and Wetland Habitat Management Plan was developed to investigate the possibility of creating or enhancing additional perched wetland areas to increase riparian and wetland habitat (Anon. 2003). The components of the plan were an inventory of sites that were potentially suitable for enhancement, selection of sites for implementation of demonstration wetland enhancement projects, and a monitoring program to test their effectiveness in improving riparian and foreshore habitat for fish and wildlife over the life of the project. If the projects were considered to be successful, then the potential for creating additional wetlands would be assessed during the mid-term review of the project (BC Hydro 2007).

The inventory of potential enhancement sites was completed under GMSWORKS-16 *Williston Reservoir Wetlands Inventory*. A total of 42 sites in the Parsnip Arm were reviewed as potential wetland enhancement sites by Golder (2010). Of the 42 sites reviewed, five candidate sites were identified for demonstration projects on the basis of a combination of factors including (but not limited to) cost, feasibility, and potential benefit to wildlife (Golder Associates Ltd 2010). The second phase was completed under GMSWORKS-17 *Williston Reservoir Trial Wetland*. Two of the five candidate sites were selected as demonstration sites and detailed designs developed (Golder Associates Ltd 2011). Monitoring of the effectiveness of the wetland demonstration projects in improving wildlife habitat on the reservoir will be completed under GMSMON-15 *Reservoir Wetland Habitat*.

## 1.2 Monitoring Plan Overview

The GMSMON-15 project is a 10-year monitoring program to assess the effectiveness of the demonstration wetland enhancement projects at improving wildlife habitat and maintaining the habitat over the life of the two projects (BC Hydro 2010). This effectiveness monitoring program is designed to determine the response of selected indicator groups to the wetland enhancements and to increase knowledge of wildlife use of the drawdown zone for the selected groups, particularly birds and amphibians. Monitoring the responses of all species is not feasible; therefore, BC Hydro (2010) identified waterfowl, songbirds, amphibians, and vegetation as the wildlife indicator groups to be used for monitoring in GMSMON-15. Fish populations were also identified for monitoring as fish were observed at both of the selected demonstration sites (Golder Associates Ltd 2010, 2011). While improving fish habitat is not one of the goals of the wetland enhancement projects, little is know about the fish species composition and distribution at the selected locations (BC Hydro 2010).

This report presents the results from the second year of the GMSMON-15 monitoring program. The results provide the second year of baseline information on the two selected wetland demonstration sites prior to the construction of the projects. Recommendations for improving the data collection in Year 3 are provided along with considerations for the final design and construction phases of the demonstration projects.

# 2 MANAGEMENT QUESTIONS AND HYPOTHESES

The monitoring objectives and hypotheses for GMSMON-15 were stated in the Terms of Reference for the project (BC Hydro 2010). These are restated below along with a brief summary of how the testing of each hypothesis is approached in the study design.

Three key management questions regarding the effectiveness of the wetland enhancements were identified for the Reservoir Wetland Habitat monitoring program:

1. Are the enhanced (or newly created) wetlands used by waterfowl and other wildlife?
2. Is there a change in the abundance, diversity and extent of vegetation in the enhancement area?
3. Is the area and quality of wildlife habitat created by the wetland enhancement maintained over time?

Based on these management questions, the study was designed to test the following hypotheses stated in the Terms of Reference:

$H_{01}$: The density, diversity and spatial extent of riparian and aquatic vegetation does not change following enhancement;
$H_{02}$: The species composition and density of waterfowl and songbirds does not change following enhancement;
$H_{03}$: Amphibian abundance and diversity in the wetland does not change following wetland enhancement.

The monitoring program will collect annual data on riparian and aquatic vegetation density, diversity, and spatial extent, waterfowl and songbird abundance and diversity, and amphibian abundance and diversity. Annual monitoring of fish diversity and abundance will also be completed. There are no specific management questions or hypotheses for fish to be tested as the focus of the projects is on enhancing wildlife habitat rather than fish habitat.

The general approach is to sample each of the indicator groups at locations within the core area of the enhancement treatments and in peripheral riparian areas at both sites. Riparian vegetation will be monitored using annual quadrat sampling and aerial photo analysis. Songbirds will be surveyed using breeding bird point counts and nest searches. Waterfowl and shorebirds will be surveyed by land-based observations. Amphibians will be inventoried using systematic surveys to determine relative abundance. Fish will be sampled with minnow traps, fyke nets and by electrofishing.

## 3 STUDY AREA

Williston Reservoir is located in northeastern British Columbia and was created by construction of the W.A.C. Bennett Dam at the head of the Peace River Canyon, about 20 km west of Hudson's Hope, B.C (BC Hydro 2007). The reservoir extends for about 260 km along the Rocky Mountain Trench from the Finlay River in the north to the Parsnip River in the south. The reservoir is generally divided into three geographic regions (from north to south): Finlay Reach, Peace Reach and Parsnip Reach (BC Hydro 2007).

The reservoir is located within the Sub-Boreal Spruce and Boreal White and Black Spruce biogeoclimatic zones (Meidinger and Pojar 1991). The Sub-Boreal Spruce zone is the dominant zone and occurs as two subzones and variants at lower elevations along most of the reservoir (Meidinger and Pojar 1991). The Boreal White and Black Spruce zone occurs only at the northern end of the reservoir in the Finlay Arm (Meidinger and Pojar 1991). The drawdown zone consists of large areas of mud, sand and gravel flats with stranded large woody debris. Limited amounts of vegetation occur even following extended periods of drawdown.

The water level in the reservoir varies annually with reservoir filling and drafting. The spring and summer reservoir levels (April – August, low to full pool) for 2010, 2011, and 2012 along with the mean level are shown in Figure 1. In 2012, the reservoir reached its lowest level of 660.5 on April 25 with levels gradually increasing until late May (BC Hydro CRO database). Water levels began rising rapidly in late May and the reservoir reached a maximum of 671.97 on July 30 (BC Hydro CRO database). This is similar to 2011, with reservoir levels reaching a maximum of 671.4 m in late August 2011 (BC Hydro CRO database). Both years are in contrast to 2010 when reservoir levels had only reached a level of 664.7 m in mid August and only reached a maximum of 665.54 m on November 8, 2010 (BC Hydro CRO database).

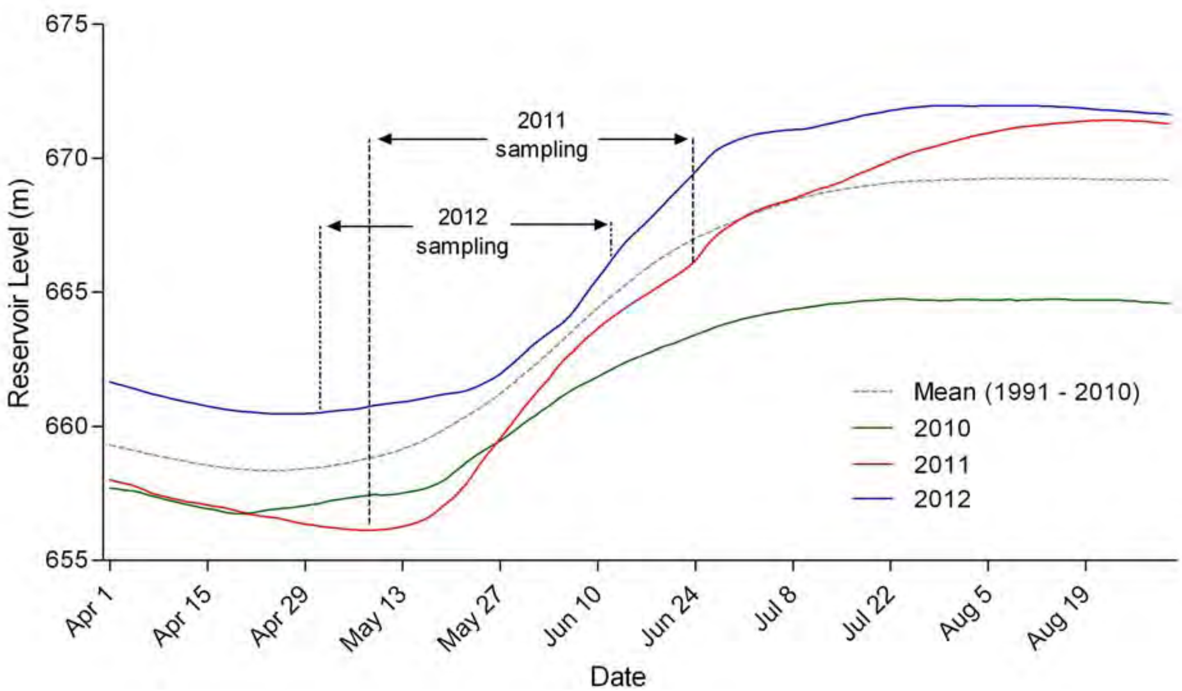


**Figure 1. Spring and summer Williston reservoir levels for 2010, 2011, and 2012.**

The two locations identified for the wetland demonstration projects are both located on the east side of the Parsnip Reach of the reservoir (Figure 2). The Airport Lagoon site (WDS 6-2) is located approximately six kilometres south of Mackenzie and is an approximately 75 ha site on the upstream side of a forest service road causeway. Except for two culverts at the base of the causeway the area is isolated from the main reservoir. Water supply to the lagoon is primarily from two unnamed streams located at the north end of the lagoon. At reservoir elevations >664.5 m, the reservoir becomes connected to the lagoon and water levels in the lagoon correspond to reservoir levels. The proposed treatment for this site is the installation of new culverts at an elevation of 667.5 m to create a larger area of permanently flooded habitat and reduce water level changes (Golder 2011). The stable water level is anticipated to allow for colonization by submergent and emergent vegetation as well as enhance the riparian zone to benefit waterfowl, wading birds and amphibians (Golder 2011).

The Beaver Pond site (WDS 34) is located approximately 22 km northwest of Mackenzie at the end of a narrow inlet on Heather Point. There are two beaver ponds located at the head of the inlet with a small stream draining the ponds. The stream also appears to be partially supplied by an area of ground water seepage. The proposed treatment for this site is the installation of a berm to create a wetland of approximately 2 ha in area (Golder 2011). The top of the berm will be at 669 m resulting in the wetland being directly connected to the reservoir during periods when it exceeds this elevation. With the exception of the stream, this area is currently dry when water levels are below 666 m. The creation of an area with stable water levels will allow for colonization by submergent and emergent vegetation and enhance the riparian zone to benefit wading birds and amphibians (Golder 2011).

The uniqueness of both sites, along with the specific physical works proposed for each, means there are no associated control sites in this project.

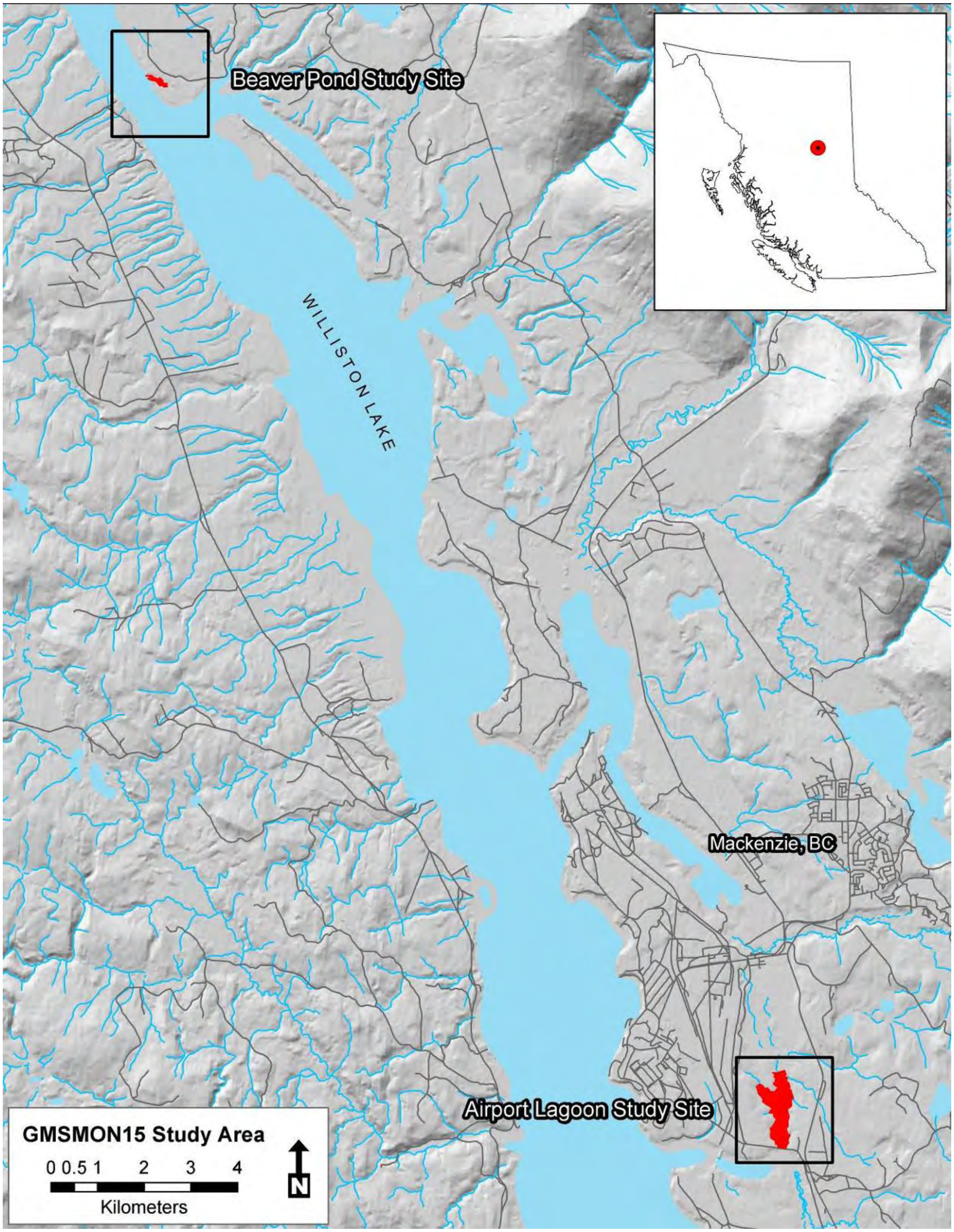


**Figure 2. Location of the two wetland demonstration sites on the Parsnip Reach of Williston Reservoir.**

# 4 METHODS

## 4.1 Vegetation Surveys

A combination of air photo interpretation and terrestrial ecosystem ground sampling was used to describe vegetation communities at both sites (Province of British Columbia 2010, RISC 2010). TEM standards (Province of British Columbia 2010) for sampling were used as the plant species assemblages and soil profiles identified within the project sites were not consistent with the wetland classes described by Mackenzie and Moran (2004). Mackenzie and Moran (2004) describe naturally recurring wetlands within British Columbia that are relatively stable in terms of their hydrologic cycle and plant species composition and have established over long periods of time. Due to variability of flood events in the drawdown zone from dam operations, the plant species assemblages identified in this project are in constant transition to a stable state. Therefore, habitat classes were created based on information collected during initial site investigations and air photo interpretation instead of the Mackenzie and Moran (2004) wetland classes.

All photo interpretation was completed in 2-D softcopy using ArcGIS (version 9.3, ESRI 2008). Digital ortho-rectified 1:5000 air photos provided by BC Hydro were used as the background layer for delineating polygons. A habitat classification scheme based on RISC (2010) was developed to capture all the habitat classes in the study area visible at the resolution available. Habitat classes were first determined from an overview of the study area to identify the larger vegetation features. As the study area was viewed at finer scales during photo interpretation more vegetation features were identified. As new vegetation features were encountered, additional habitat classes were created to accommodate them.

Field notes on vegetation composition and structure from informal inspections of the study sites prior to the air photo interpretation assisted with establishing the initial habitat classes. Each habitat class was identified based on a common plant species assemblage and elevation position within the drawdown zone. The spatial arrangement of habitat classes often followed a similar pattern. For example, at the Airport Lagoon, a band of coarse woody debris parallel to the edge of the reservoir at full pool usually transitioned into a band of sparsely vegetated sand followed by an area of sparsely vegetated mud adjacent to the water's edge.

Due to the relatively small area of both of the study sites, a map scale of 1:1000 was used as the initial resolution for polygon typing. Where required, a larger scale was used to differentiate similar or small area polygons. Overall, the scale varied roughly between 1:2000 and 1:200 throughout the interpretation process depending on the size of the habitat polygon.

Following the air photo interpretation, Year 1 (2011) ground sampling was conducted to confirm the habitat classes and to complete the descriptions. Vegetation ground sampling was completed at both sites on June 17-23, 2011. The timing of the surveys in June was to assist in identification of plant species by observing species when they were fully flushed and flower inflorescences were present to assist in identification; and prior to the sites being flooded by rising reservoir levels. Prior to commencing sampling, lists of common plant species as well as red- and blue-listed species occurring in the area were reviewed. Ten transects were completed at the Airport Lagoon site and five transects were completed at the Beaver Pond site. Coordinates for the transects are included in Appendix 1.

In Year 2 (2012), ground sampling at each of the vegetation transects established in 2011 (10 transects at the Airport Lagoon site and five transects at the Beaver Pond site) was completed between June 2-4, 2012. Sampling was completed earlier than in Year 1 due higher forecasted reservoir levels in 2012 than in 2011. Based on forecasted reservoir levels the majority of sites would have been underwater if sampled at the same time as in 2011. Prior to sampling, the list of species detected at the two study sites in Year One, along with an up-to-date list of red and blue-listed plant species from the Conservation Data Centre (CDC; May 2012) was reviewed.

As the habitats being surveyed were often linear in shape, a transect-based method for vegetation sampling was selected over a grid-based method (using design components from LGL (2007) and US EPA (2002)). A 20 m long belt-line quadrat transect consisting of ten 2m x 0.5m rectangles was laid out (Figure 3) using a 30 m tape and 2 m measuring rod. UTM coordinates were recorded for the transect start and endpoints, and a spray-painted piece of re-bar was driven in the ground at both points. A photograph was taken at the start point and end point of the transect, each looking along the transect.

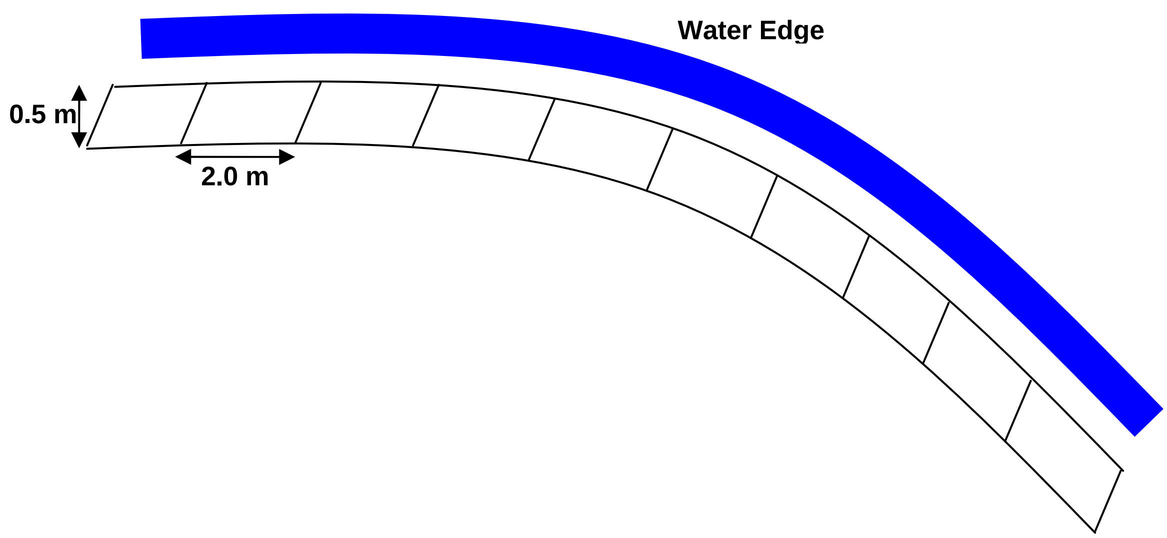


**Figure 3. Belt-line quadrat transect for a sample site laid out adjacent to the riparian area.**

Site and soil characteristics for the entire transect were recorded on provincial ecosystem field forms (Province of British Columbia 2010), including seral and structural stage characteristics (Appendix 2). Site characteristics representative of the whole site were recorded and a representative location was chosen for the soil pit. Within each quadrat, vegetation was identified to species and the percent cover of each species recorded. The terrestrial ecosystem keys (Province of British Columbia 2010) were used to describe soil characteristics and plant species were identified using MacKinnon et al. (1999). Where identification of species was not possible or uncertain, samples were taken and identified in the botany laboratory of the University of Northern British Columbia (UNBC) using Hitchcock and Cronquist (1973). Where species identification was still problematic or where correct identification was particularly important (i.e., with a potential red-listed species), a plant taxonomy expert from UNBC was asked to confirm the initial result. Plants listed as rare or endangered at the provincial or federal level were recorded on a Rare Plant Observation Form and submitted to the BC Conservation Data Centre.

Based on information collected during ground sampling in Year 2, a re-assessment of habitat classes identified in Year 1 of the study was completed to determine whether refinements to the description (i.e., vegetation and soil characteristics) of the existing habitat classes were required. Where two habitat classes were found to be very similar, they were merged into a single habitat class.

## 4.2 Waterfowl Surveys

Land-based surveys following the protocols for absolute abundance inventories of waterfowl species (Resources Inventory Committee 1999a) were used to record waterfowl and shorebird occurrence at the study sites. Shorebirds were not included in 2011 but were added in 2012 to provide additional detail on bird use of the sites. Surveys began in early spring to capture migrating waterfowl and continued through to late spring. Waterfowl surveys were completed on May 1, 9, 16, and 31 at the Airport Lagoon site and on May 18 and June 1 and 8 at the Beaver Pond site. The surveys occurred later at the Beaver Pond site due to access issues (late spring ice on Williston Lake). In addition to the three survey stations established at the Airport Lagoon site in 2011, a fourth station (WSP-06) was added to provide coverage of the northern end of the site (Figure 4). The Beaver Pond site surveyed in 2011 was again used in 2012 (Figure 5). Coordinates for the survey stations are provided in Appendix 3.

Survey stations were chosen prior to commencing field surveys. Locations with unobstructed views of a portion or all of a study site as well as efficient access were selected. Where possible, locations were selected to minimize disturbance to waterfowl when approaching the survey station (e.g., reducing sightlines from pond to approach trail). A combination of a modified RIC data form (1999a) and a form with an orthophoto background of each site was used to record waterfowl observations (Appendix 4).

Survey conditions (temperature, wind direction, wind speed, precipitation, cloud cover, and ceiling height) were noted at the beginning and end of each survey, and any unusual events (if any) in the wetland area that may have affected survey results. Upon arrival at a station, the observer scanned the area with binoculars to obtain an overview of birds present, but also to take note of any bird or group of birds that may have taken flight upon arrival. Observers ensured that groups of birds were not double counted if they could be seen from more than one observation station. To avoid double counting birds, observers noted a suitable landmark to set the limit of the observations taken from that station. The location of such a boundary changed from survey to survey depending on water levels and the distribution of groups of waterfowl.

From a survey station the respective survey area was slowly and systematically scanned at low magnification with binoculars. A spotting scope was used to identify birds or groups of birds that could not be identified with binoculars due to small size or distance from the observer. Observers drew a polygon with a unique ID number for every group of birds on field data maps created for this purpose (Appendix 4). Care was taken to draw the polygon as accurately as possible by matching up landmarks with their corresponding location on the orthophoto background. On the observation form, a new data line was recorded for all groups that could be defined by species and number of individuals, with associated information such as number of broods present, sex, behavioural activity, and habitat within each polygon. Behaviour was recorded as one of several categories as were habitat descriptors for the polygon. Species codes followed RIC (2008).

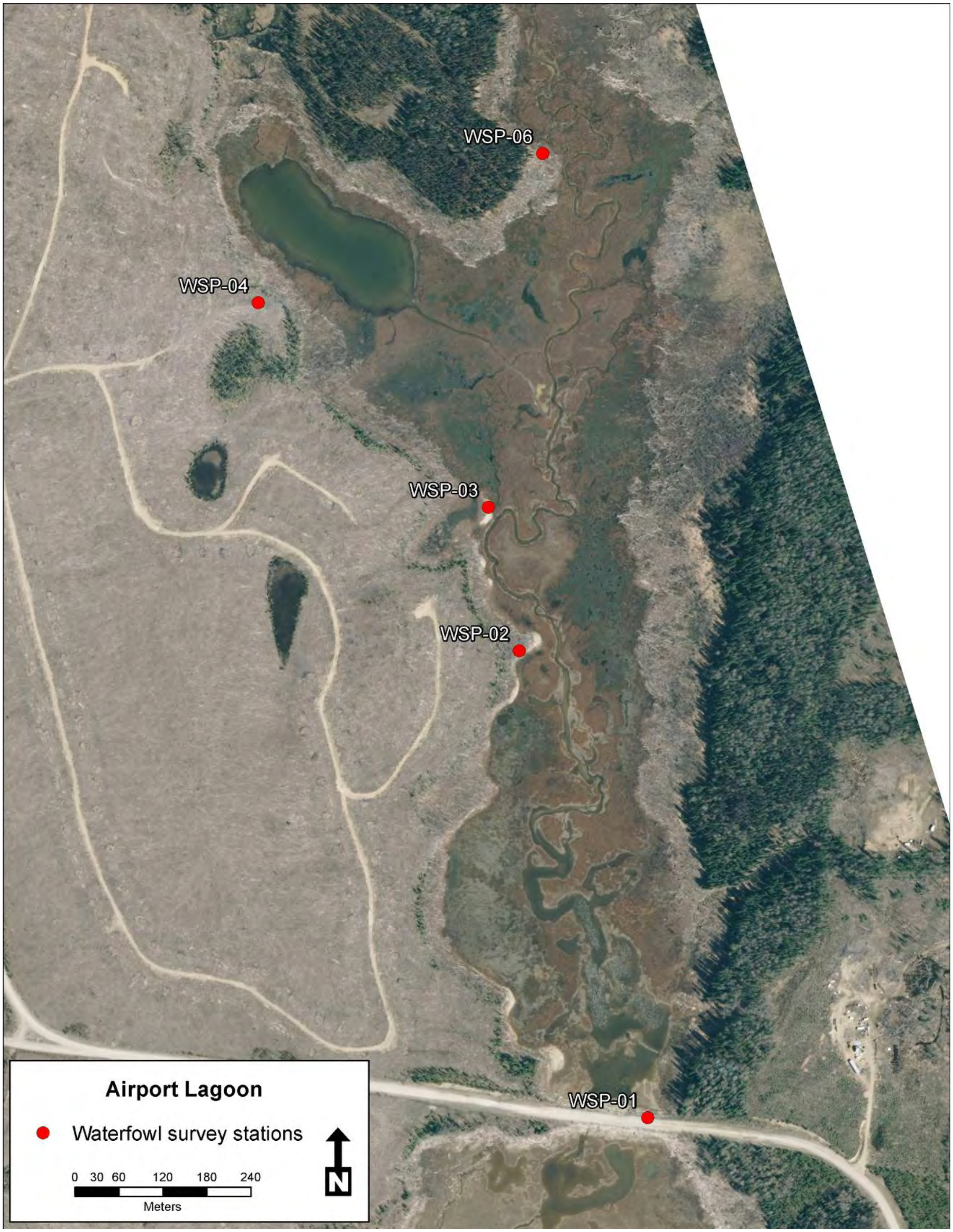


**Figure 4. Waterfowl survey station locations at the Airport Lagoon site.**


**Figure 5.** **Waterfowl survey station locations at the Beaver Pond site.**

### 4.3 Songbird Surveys

Variable radius point counts and nest searches following Bird Studies Canada and RIC methods (Resources Inventory Committee 1999b, Bird Studies Canada 2009) were used to record breeding bird communities in the study sites. Point count surveys were conducted from June 7-12, 2012 at the Airport Lagoon and Beaver Pond sites. All surveys were conducted during the breeding season (May 28 – July 10) (Bird Studies Canada 2009) within a four hour period commencing at sunrise. Previous work in the area (Hentz and Cooper 2006, CBA 2008) suggested that mid-June is the peak of the breeding season. Three replicates were completed at each site to give a 'snapshot' of the breeding bird community (Resources Inventory Committee 1999b).

Point count stations were distributed throughout the study sites to ensure maximum coverage of the areas. In Year 1, seventeen point count stations were established at the Airport Lagoon site (Figure 6) and three point count stations were established at the Beaver Pond site (Figure 7). The same locations were surveyed in Year 2. Point count station centres were spaced a minimum of 200 m apart to prevent overlap of the 100 m radius survey areas. The UTM coordinates for the centre of each point count station were recorded to ensure subsequent survey replicates were repeated in the same location. Coordinates for the point count stations are provided in Appendix 5.

Breeding bird surveys were conducted by performing five minute point count surveys and recording all species heard or seen. Upon arriving at a point count station, the observer waited one minute to allow any disturbance effects on resident birds to dissipate. The point count form was oriented north for each survey. During point counts, each bird detection (a detection can include more than one individual; e.g., one detection of a flock of ten Pine Siskins) within 100 m was spatially mapped on a data sheet with concentric radii of 25, 50, 75, and 100 m from the point count station (Appendix 6). Birds beyond 100 m were noted but not spatially located, as distance estimation at further distances is problematic (Alldredge et al. 2007). Time was broken down into intervals of 0-3 and 3-5 minutes and detections were assigned to the time interval they were initially detected in.

In 2012, more detailed data were also collected on the location of the bird detections. Bird detections were categorised as in the drawdown zone, in the shrub fringe at the upper edge of the drawdown zone, in forested habitat bordering the shrub fringe, as ‘flying-over’ and not associated with any vegetation type, or unknown. These data will allow separation of bird detections into those occurring within the drawdown zone and those occurring above the drawdown zone in terrestrial habitats. Species detected in the drawdown zone are considered more likely to have a response to the proposed wetland enhancements than those using terrestrial habitats above the drawdown zone.

Environmental variables (ceiling, cloud cover, wind, precipitation) (Appendix 7) and time of day were also recorded. Birds detected flying over the point count station were recorded but were noted as “fly-overs” rather than detections associated with habitat sampled by the point count survey. Based on previous experience conducting point count surveys in the cool, wet northern BC spring (Hentz and Cooper 2006, CBA 2008), surveys were conducted according to ‘modified’ RISC standards for environmental conditions (Resources Inventory Committee 1999b). These standards are as follows: wind speed ≤ Beaufort 3 (gentle breeze, leaves and twigs constantly move), precipitation = ‘very’ light rain, temperature > 3˚C. Species codes followed RIC (2008).

Nest searches were conducted opportunistically after morning point count surveys. Areas where breeding behaviour (e.g., carrying nest-building material) was observed during the point counts were the focal areas for conducting subsequent nest searches. Searches were focused on the drawdown zone and adjacent areas (within 50 m the drawdown zone). The UTM coordinates, type, height off the ground, and species using the nest were recorded for each nest. In 2012, coarse resolution vegetation composition data were also collected around nests to better describe nest sites.

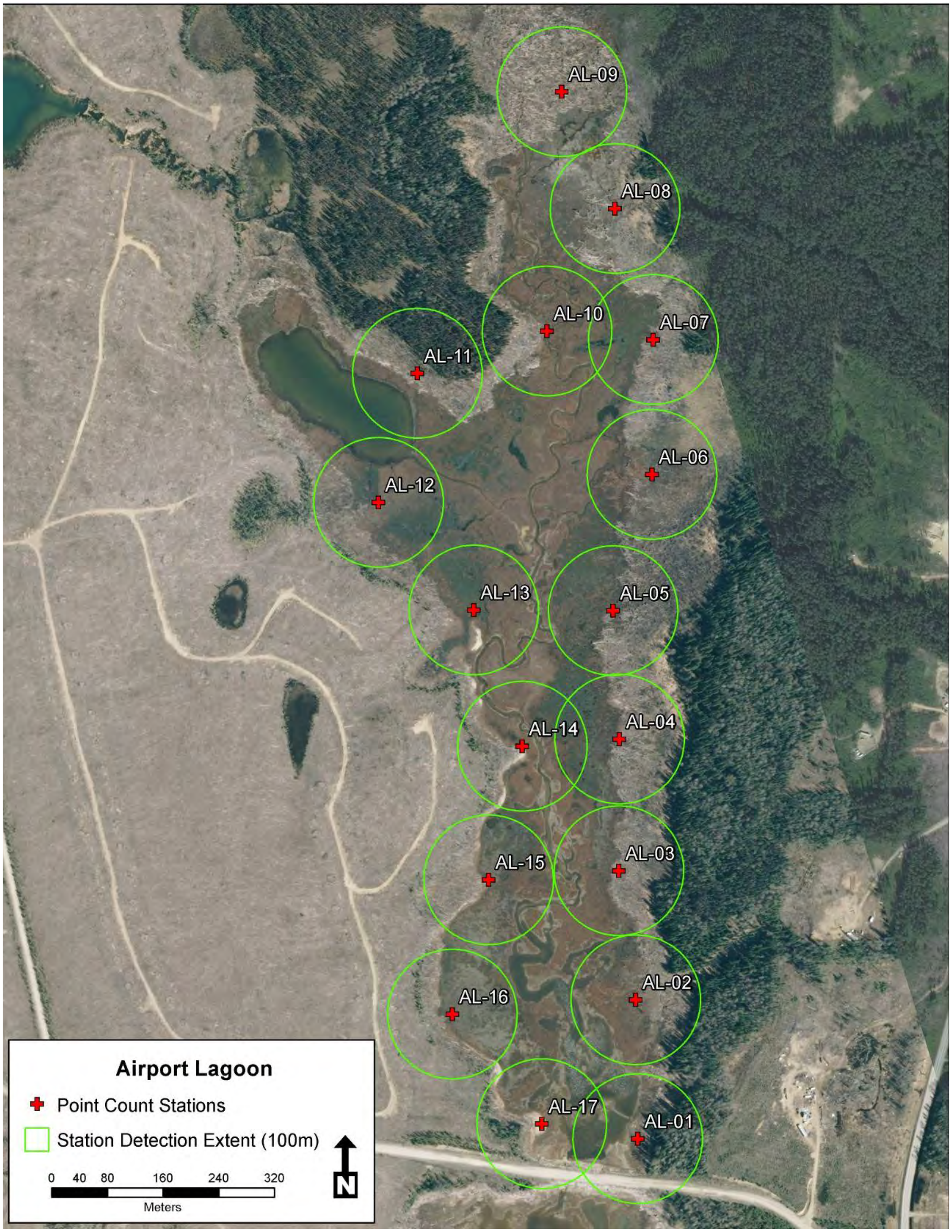


**Figure 6. Point count station locations at the Airport Lagoon site.**

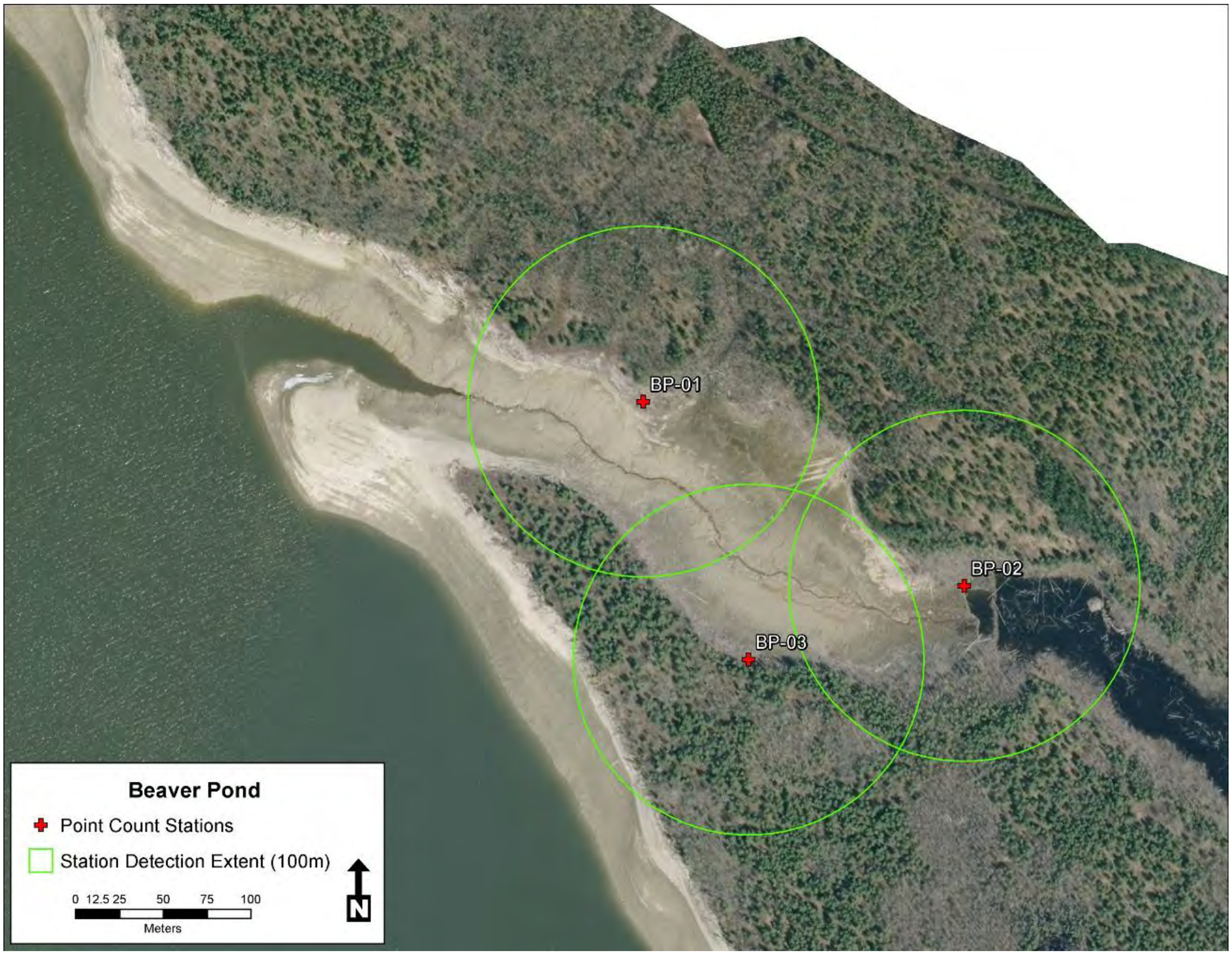


**Figure 7. Point count station locations at the Beaver Pond site.**

### 4.4 Amphibian Surveys

In 2012, systematic surveys following RIC (1998) were used to record amphibian species on four occasions at each study site. Consistent with the Year 1 effort, surveys involved systematic searches of the same 11 randomly distributed transects on the peripheries of the inundated area of the Airport Lagoon site (Figure 8) and the entire Beaver Pond site (Figure 9). There were no obvious strata, so both sites were treated as a single stratum for sampling (Resources Inventory Committee 1998). Replicates were completed at the Airport Lagoon site on May 1, 9, 17, and 31; and at the Beaver Pond site on May 18, and June 1, 8, and 12.

The shallow water (<1m deep), shoreline, and shore (within 3 m of shoreline) zones of ponds, streams and riparian areas were searched in a zigzag pattern (except the shoreline which was followed in a linear pattern) to ensure complete coverage of the area. A dip-net sweep was used in the shallow water zone in a standardized fashion and at regular intervals. Smaller areas were completely surveyed using straight-line transects. Searchers on the shore and shoreline flipped up pieces of woody debris and other potential cover objects to find amphibians sheltering underneath. All pieces of woody debris and cover were returned to their original position after determining if amphibians were present.

Prior to the field surveys, Hengeveld (2000) and the results for Year 1 (MacInnis et al. 2012) were reviewed to compile a list of species likely to be encountered during surveys. Amphibians were only captured if identification was not possible during the initial sighting; all individuals were released immediately upon identification. Species, developmental stage, and approximate size were recorded for each observation. Transect start and end points along with survey tracks were recorded using hand-held Garmin 76CSx GPS units to allow for repeat surveys and for calculations of detections per unit distance. A photograph was taken at each transect start point, oriented towards the end point. All adults, larvae, and egg masses were recorded on RISC Animal Observation forms for amphibians (Appendix 8). At locations with large numbers of tadpoles (>100) the observation was recorded as 'tadpoles' if it was not possible to count an exact number. Species identifications were confirmed using Matsuda et al. (2006) for adults, and an unpublished tadpole key from the Ministry of Environment in Fort St. John, BC. Species codes followed RIC (2008).

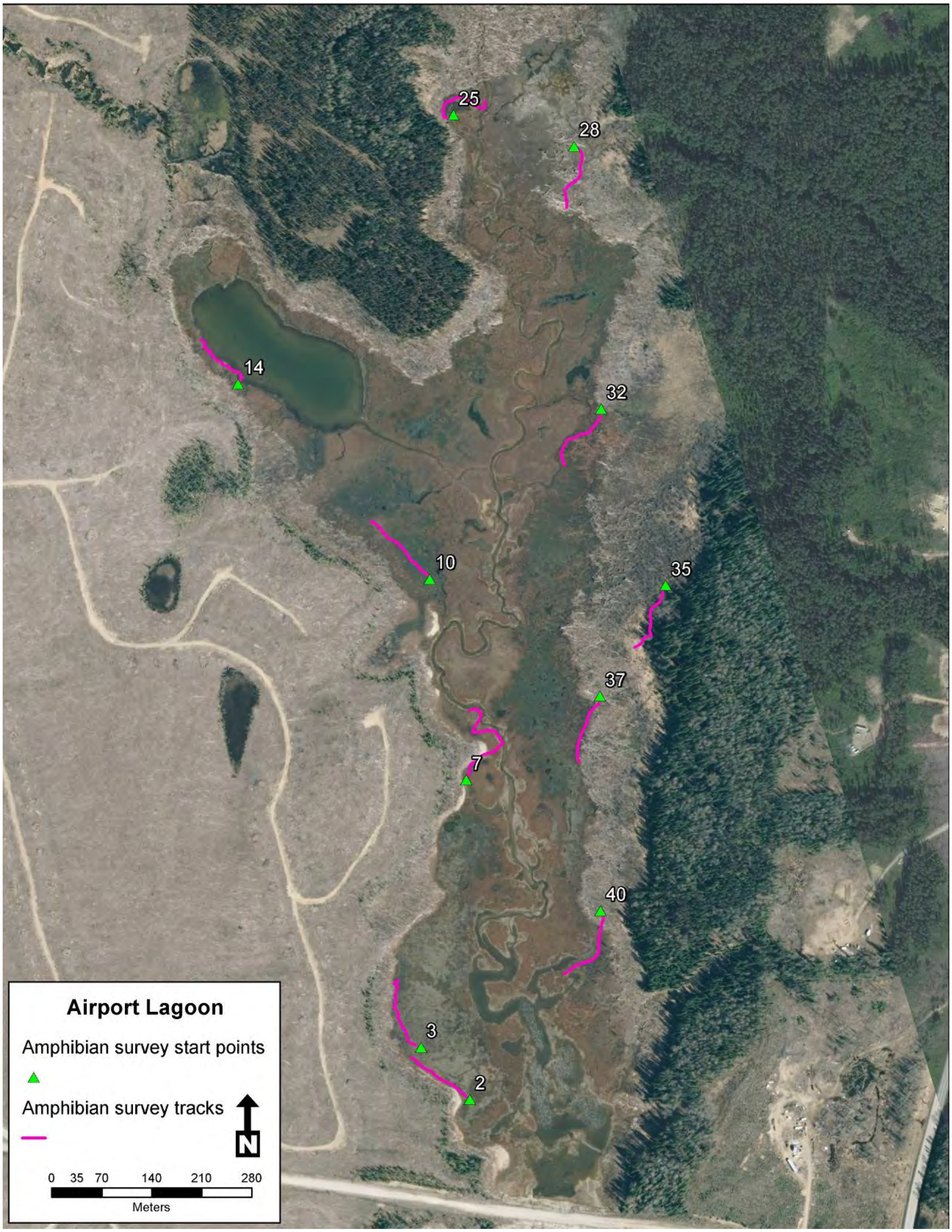


**Figure 8. Amphibian survey transect locations at the Airport Lagoon site.**


**Figure 9. Amphibian survey tracks locations at the Beaver Pond site.**

## 4.5 Fish Surveys

Fish populations were sampled at both sites using a combination of methods following RIC (2001) guidelines. Fish sampling was conducted under Fish Collection Permit PG12-78173 issued by the Ministry of Forests, Lands and Natural Resource Operations. A combination of methods was used to ensure sampling of both large and small fish at each site and the different habitats available at low and high reservoir levels. Fish sampling at the Beaver Pond and Airport Lagoon sites was completed using minnow traps, backpack electrofishing, and fyke nets.

Fish sampling was completed at the Airport Lagoon site on May 16 and 17, June 1, and July 19-20, 2012 and at the Beaver Pond site on May 18 and July 21-22, 2012. The sampling locations are shown in Figure 10 and Figure 11 for the Airport Lagoon and Beaver Pond sites, respectively. The methods used on each date are summarized in Table 1. The June 1 electrofishing at the Airport Lagoon was to sample the reach at the upstream end of the lagoon that was not sampled on May 17. As recommended in Year 1 (MacInnis et al. 2012), further investigation of the Airport Lagoon site during the May fish sampling identified an area near the causeway with sufficient area and water depth for setting a fyke net. It was not possible to use a fyke net in the upper pond in the northwest arm of the lagoon due to lack of boat access for setting the net. The first fish sampling at the Beaver Pond site was completed prior to this area being inundated.

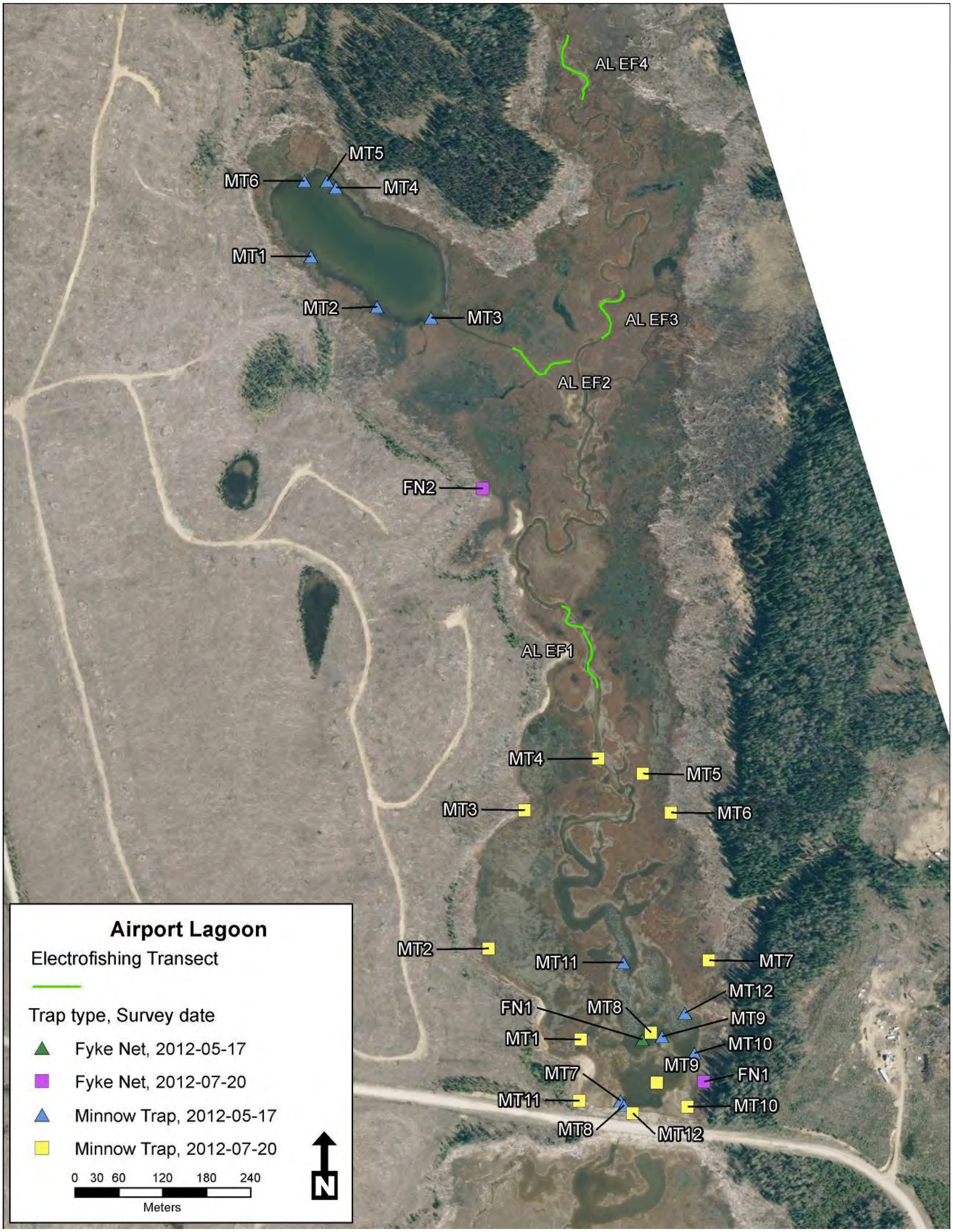


**Figure 10.** **Fish sampling locations by date and method at the Airport Lagoon site.**


**Figure 11. Fish sampling locations by date and method at the Beaver Pond site.**

**Table 1. Fish sampling methods in 2012 at the Airport Lagoon and Beaver Pond sites.**

| Site | Date | Method | Number of Samples |
|---|---|---|---|
| Airport Lagoon | May 16 -17 | Minnow traps<br>Fyke net | 12 traps<br>1 net |
| | May 26 | Electrofishing | 3 reaches |
| | June 1 | Electrofishing | 1 reach |
| | July 19-20 | Minnow traps<br>Fyke nets | 12 traps<br>2 nets |
| Beaver Pond | May 18 | Electrofishing | 2 reaches |
| | July 22-22 | Minnow traps<br>Fyke net | 6 traps<br>1 net |

Two minnow trap sampling sessions were completed at the Airport Lagoon and one at the Beaver Pond. At the Airport Lagoon one of the sampling sessions was completed prior to inundation and the second session was completed after inundation. Minnow trapping at the Beaver Pond site was completed after inundation. Minnow traps were baited with cat food and set for a minimum of 12 hours at random locations at each site. At the Beaver Pond site, six minnow traps were deployed during the single sampling session. At the Airport Lagoon, 12 minnow traps were used for each sampling session. During the first sampling session (prior to inundation) the minnow traps were evenly divided between random locations around the pond in the northwest arm of the lagoon and the pond located just upstream of the causeway. For the second session (after inundation) the minnow traps were deployed at random locations throughout the flooded area of the lagoon. Minnow trap locations will be standardized following completion of the wetland enhancement projects.

Backpack electrofishing (Smith-Root LR-20B) was used to sample the stream habitat that is present at both sites prior to inundation. Four reaches were sampled at the Airport Lagoon site (Figure 10) and two stream reaches were sampled by electrofishing at the Beaver Pond site (Figure 11). The reaches sampled at both sites in 2012 were the same reaches as sampled in 2011.

Fyke net construction was based on the design in Bonar et al. (2000). A single net was deployed at the Airport Lagoon during the May sampling and two nets were used during the July sampling. A single net used to sample the Beaver Pond site in July. Fyke nets were randomly deployed at each site with the lead anchored to the shore and the net set perpendicular to the shoreline. All sets were overnight for a minimum of 12 hours. Net locations will be standardized following completion of the wetland enhancements and stabilization of water levels.

All collected fish were held in live wells after capture and processed as soon as the electrofishing pass, or net/trap haul was complete. Captured fish were anaesthetized using $CO_2$ to ease handling and reduce the potential for handling injury. Captured fish were identified to species, enumerated, and the fork length recorded to the nearest millimetre. All anaesthetized fish were allowed to fully recover prior to release. All fish data were recorded on the RIC Fish Collection and Individual Fish Forms (Appendix 9Appendix 9).

Environmental data were also collected during field visits to record the sampling conditions during each site visit. Additional data included water temperature, water depth, water clarity (relative turbidity or Secchi depth), pH, dissolved oxygen (DO), and conductivity. Water temperature, pH, DO and conductivity were recorded at the surface using a calibrated YSI 556 multi-parameter meter (YSI Inc., Ohio). Relative turbidity was recorded for each electrofishing reach according to RIC (2001) standards. Secchi depth (20 cm diameter disk) was used as a measure of turbidity for the sampling completed after inundation. The fish data collected was standardized to CPUE for each gear type (electrofishing = fish/minute, minnow traps and fyke nets = fish/hour) to allow for future interannual comparison of fish diversity and abundance to identify changes related to the wetland treatments.

## 4.6 Data Entry and Analysis

Immediately after a field survey was completed, data sheets were scanned into .pdf documents and stored in a redundant file storage system. Similarly, photographs taken during field surveys were labelled and filed by survey type. All data were entered into a customized database designed to minimize data entry errors by restricting the permissible range of values for a field or by using selections from ‘drop-down’ lists.

Data were exported from the database to MS Excel to provide data summaries for each component of the monitoring project. Data from each vegetation transect were summarized to provide an overview of the vegetation community at each site. The vegetation % cover data from each of the ten quadrats in a belt-transect were pooled to provide an average % cover for each species. Waterfowl and amphibian survey results were summarized by survey date and site. As the intent of the breeding bird survey was to provide a snapshot of the breeding bird community at a site, data from all three replicates were pooled to provide summaries on species richness and relative abundance.

With only two years of baseline data available, data analyses are limited to qualitative comparisons between the two years. More detailed analyses are planned once additional years of data become available.

# 5 RESULTS

## 5.1 Vegetation Surveys

In Year 1 of the study, a total of 19 habitat classes describing vegetation communities at the Airport Lagoon and Beaver Pond sites were identified and mapped. A total of 13 habitat classes were identified at the Airport Lagoon site and eight habitat classes were identified at the Beaver Pond site. The plant species assemblages identified within habitat classes consisted mostly of herbaceous perennials (grasses and herbs) and bryophytes with minimal woody shrubs and no live tree cover (with the exception of occasional paper birch trembling aspen [*Populus tremuloides*] seedling). A few classes had a high percentage (≥50%) of coarse woody debris from driftwood accumulation.

In Year 2, a re-assessment of habitat class descriptions and their spatial distribution was completed. As a result of the re-assessment, two pairs of habitat classes were merged, reducing the total number of classes from 19 to 17. In addition, the boundary of a single habitat class polygon was revised. Changes to Year 1 habitat classifications were based on information collected during of Year 2 ground sampling and include:

- *Habitat classes 1 and 2 were merged.*
    - The main water source (i.e., precipitation) and dominant vegetation cover (grasses; e.g., bluejoint [*Calamagrostis canadensis*]) for both habitat classes are equivalent. The main water source for habitat class 2 was revised in Year 2 from groundwater (surface and subsurface seepage) to precipitation. Based on these similarities, the two habitat classes were merged into a single class.

- *Habitat classes 15 and 16 were merged.*
    - The amount of vegetation observed in polygons of these two classes (sparse to no vegetation cover) did not differ considerably in Year 2 and both experience annual to frequent flooding. Based on these similarities, the two habitat classes were merged into a single class.

- *Boundary of habitat class 12 was extended.*
    - During vegetation surveys during Year 2, It was determined that the vegetation cover for habitat class 12 extended further down the drawdown zone and was therefore extended into habitat class 15 in order to reflect this observation.

In addition, the numeric values identifying habitat classes (i.e., 1-17) in Year 1 were replaced with a two letter code and descriptive name for Year 2. An overview of habitat classes is provided in Table 2; detailed descriptions of each class are provided in Appendix 10.

**Table 2. An overview of habitat classes located at the Airport Lagoon and Beaver Pond site for Year 1 and Year 2.**

| Site | Year 1 Habitat Class | Year 2 Habitat Class | Habitat Class Description |
|---|---|---|---|
| Airport Lagoon | 1 | SD | Shoreline Driftwood |
| | 2 | SD | Shoreline Driftwood |
| | 3 | SS | Shoreline Sand |
| | 4 | CT | Cattail Thread Rush |
| | 5 | CM | Cinquefoil Moss |
| | 6 | SM | Smartweed Moss |
| | 7 | CF | Cinquefoil Fireweed |
| | 8 | WS | Wetland Sedge |
| | 9 | WW | Wetland Willow |
| | 10 | WD | Wetland Dead Trees |
| | 11 | WH | Wetland Horsetail |
| | 12 | SW | Shoreline Willow |
| | 19 | WB | Water Body |
| Beaver Pond | 12 | SW | Shoreline Willow |
| | 13 | CS | Cryptantha Speedwell |
| | 14 | CB | Cinquefoil Bluegrass |
| | 15 | SC | Shoreline Cinquefoil |
| | 16 | SC | Shoreline Cinquefoil |
| | 17 | SB | Stream Bluejoint |
| | 18 | SG | Shoreline Gravel |
| | 19 | WB | Water Body |

At the Airport Lagoon site, a total of 12 habitat classes were identified and mapped (Figure 12), while at the Beaver Pond site seven habitat classes were identified and mapped (Figure 13). Of the 17 habitat classes identified only classes SW and WB were common to both sites (Figure 12 and Figure 13, Table 3). The 17 habitat classes identified within the two study sites covered a total of 141 polygons encompassing 66.19 ha at the Airport Lagoon site and 4.40 ha at the Beaver Pond site (Table 3). The number of polygons for each habitat class ranged from one (classes WD, WH, WW, CB, CS, SB and SG) to 47 (class WB; Table 3). The percentage of total area covered by habitat classes ranged from 0.68 (class WD) to 20.63 (class CT) at the Airport Lagoon and 0.68 (class WB) to 24.66 (class SC) at the Beaver Pond site.

The most abundant habitat classes at the Airport Lagoon by number of polygons were WB (46 polygons), and CT (46 polygons). All other classes had eight or fewer polygons. By area, habitat classes CT, CM, and SD accounted for more than 55% of the total area at the Airport Lagoon site. The next largest habitat class by area was class WB, accounting for 11% of the total area at this site. All other classes at this site had a cover of ≤8%.

At the Beaver Pond site, the most abundant habitat class by number of polygons was SW (4 polygons) with SC represented by two polygons all other classes represented by one polygon each. By area, habitat classes SC, SW, and CB accounted for more than 63% of the total area at the Beaver Pond site. The next largest habitat classes were CS and SC, each accounting for 12.56% of the total area. The remaining three habitat classes each represented less than 8% of the total area (Table 3).

Vegetation transects at the Airport Lagoon site were generally located on moist, organic rich soils, with slight to gentle slopes and frequent to annual flooding (Table 4). All transects were in a graminoid-dominated structural stage (with the exception of habitat class SW); no mature tree cover was observed on any of the survey transects (however, dead standing trees were present within habitat class WD). The surface substrate at the site was dominated by organic matter or decayed wood, with a subset having a large percentage of exposed mineral soil (Table 4).

Vegetation transects at the Beaver Pond site were located on clay rich soils with gentle to moderate slopes and frequent to annual flooding (Table 4). All transects were in a graminoid-dominated structural stage (with the exception of habitat class SW); no mature tree cover was observed on any of the survey transects. The surface substrate at the site was dominated by exposed mineral soil with minimal woody debris and little to no organic matter (Table 4).

In Year 2, total of 28 herb species were recorded across all 15 transects. Average percent herb cover by transect ranged from 0.27% to 22.01% (Table 5). Four species of moss were recorded during ground sampling on seven of the 15 transects. No moss species occurred on eight of the 15 transects. On transects where moss species did occur, the percent cover ranged from 1.20% to 99.80% (Table 5). Shrub species only occurred on four of the 15 transects, and only in the B2 (30-200 cm) layer. A total of two different shrub species were identified; however, with the exception of Bebb's willow (*Salix bebbiana*), willow species were only identified to genus (i.e., *Salix* spp.). A summary of the plant species and percent cover for each transect is provided in Appendix 11.

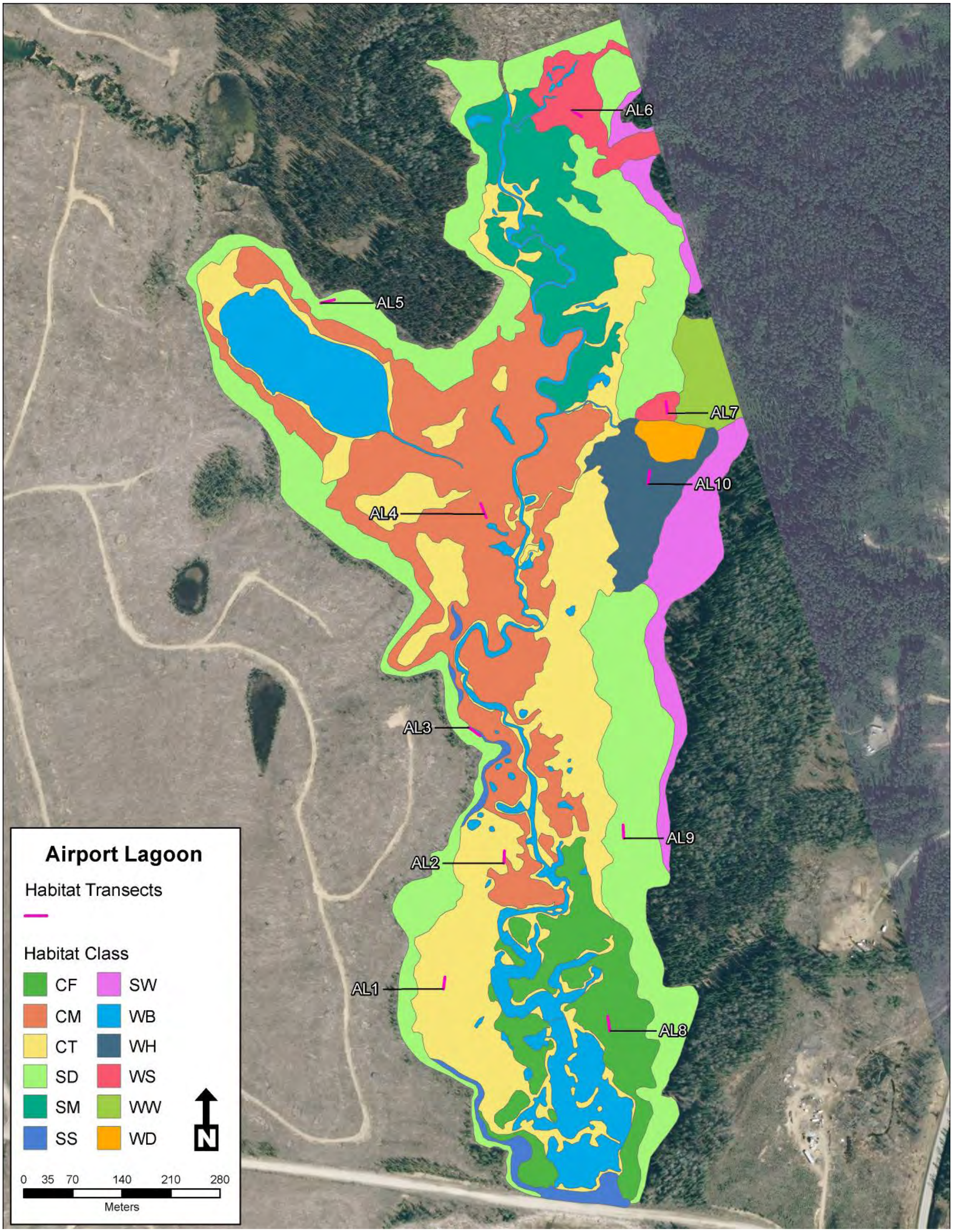


**Figure 12. Habitat classes and transect locations in the Airport Lagoon site.**

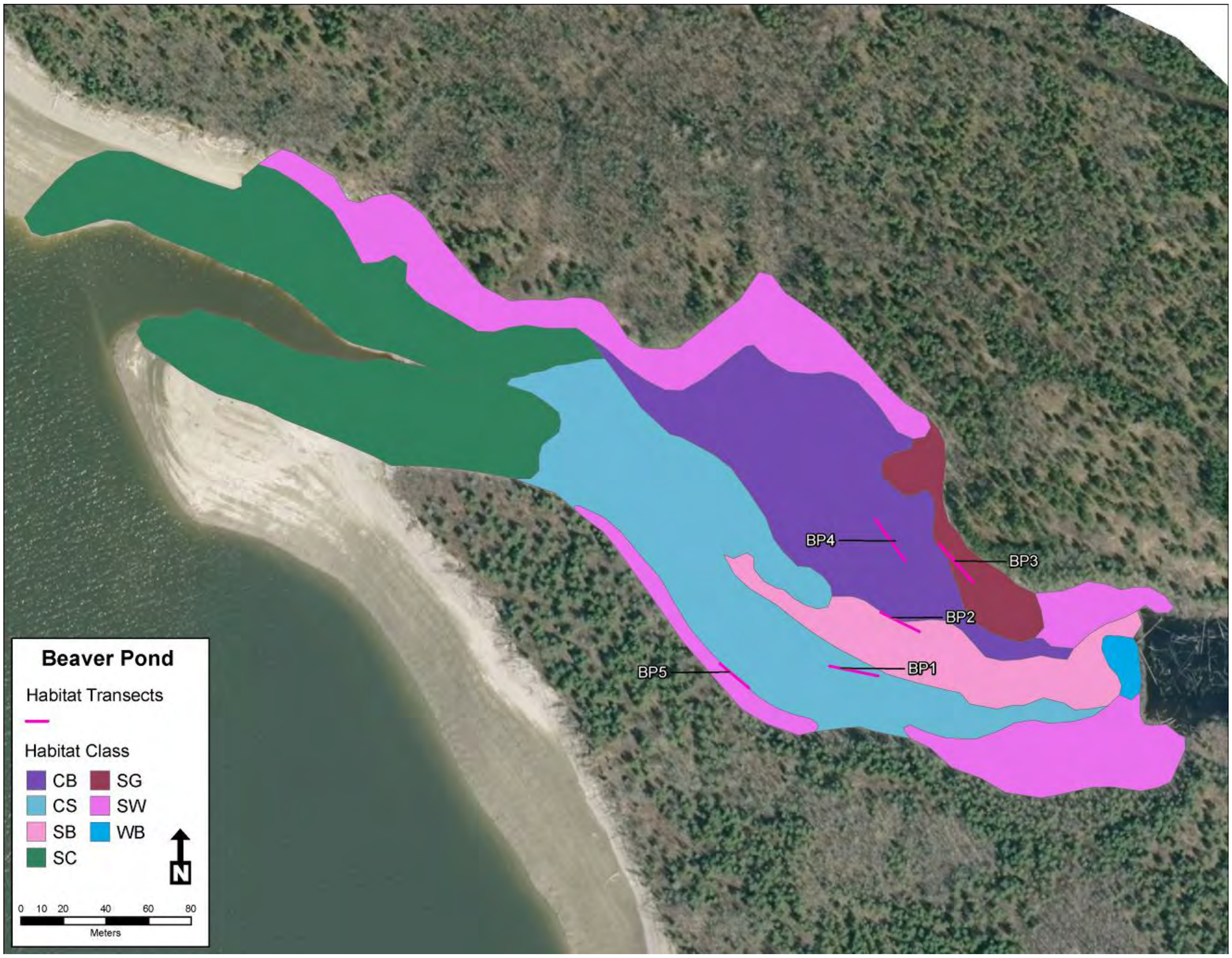


**Figure 13. Habitat classes and transect locations in the Beaver Pond site.**

**Table 3. Number of polygons and areas of final riparian habitat classes identified during photo interpretation for the Airport Lagoon and Beaver Pond sites. Refer to Appendix 10 for detailed descriptions of the habitat classes.**

| Site | Habitat Class | Number of Polygons | Area (ha) | | | | Percent of Total Area |
|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Mean | Total | |
| Airport Lagoon | CF | 8 | 0.02 | 3.11 | 0.52 | 4.16 | 6.29 |
| | CM | 6 | 0.05 | 8.79 | 2.05 | 12.32 | 18.61 |
| | CT | 46 | 0.00 | 4.26 | 0.30 | 13.65 | 20.62 |
| | SD | 5 | 0.44 | 6.91 | 3.20 | 16.00 | 24.18 |
| | SM | 7 | 0.06 | 2.54 | 0.58 | 4.03 | 6.09 |
| | SS | 4 | 0.03 | 0.55 | 0.19 | 0.74 | 1.12 |
| | SW | 3 | 0.17 | 2.36 | 0.98 | 2.94 | 4.44 |
| | WB | 46 | 0.00 | 2.76 | 0.16 | 7.28 | 11.00 |
| | WD | 1 | 0.45 | 0.45 | 0.45 | 0.45 | 0.67 |
| | WH | 1 | 1.97 | 1.97 | 1.97 | 1.97 | 2.98 |
| | WS | 2 | 0.19 | 1.35 | 0.77 | 1.54 | 2.33 |
| | WW | 1 | 1.10 | 1.10 | 1.10 | 1.10 | 1.66 |
| | **Total** | **130** | | | | **66.19** | |
| Beaver Pond | CB | 1 | 0.76 | 0.76 | 0.76 | 0.76 | 17.40 |
| | CS | 1 | 0.94 | 0.94 | 0.94 | 0.94 | 21.31 |
| | SB | 1 | 0.32 | 0.32 | 0.32 | 0.32 | 7.31 |
| | SC | 2 | 0.55 | 0.69 | 0.62 | 1.25 | 28.36 |
| | SG | 1 | 0.15 | 0.15 | 0.15 | 0.15 | 3.51 |
| | SW | 4 | 0.09 | 0.51 | 0.24 | 0.94 | 21.46 |
| | WB | 1 | 0.03 | 0.03 | 0.03 | 0.03 | 0.65 |
| | **Total** | **11** | | | | **4.397** | |

**Table 4. Site characteristics for each transect at the Airport Lagoon and Beaver Pond study sites, Williston Lake, BC**

| Site | Transect | BGC Unit | Water Source[1] | Soil Moisture Regime[2] | Soil Nutrient Regime[3] | Successional Status[4] | Structural Stage[5] | Elevation (m) | Slope (%) | Aspect (°) | % Organic Matter | % Rocks | % Decayed Wood | % Mineral Soil | % Bedrock | % Water | Drainage[6] | Flood Regime[7] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Airport Lagoon | AL1 | SBSmk1 | F | 7 | E | DC | 2b | 671 | 1 | 140 | 93 | 0 | 2 | 0 | 0 | 5 | v | A |
| | AL2 | SBSmk1 | F | 7 | E | DC | 2a | 668 | 0 | 999 | 97 | 0 | 3 | 0 | 0 | 0 | v | A |
| | AL3 | SBSmk1 | P | 2 | A | DC | 2b | 677 | 15 | 30 | 5 | 0 | 4 | 91 | 0 | 0 | r | O |
| | AL4 | SBSmk1 | F | 6 | E | DC | 2b | 672 | 1 | 170 | 98 | 0 | 2 | 0 | 0 | 0 | i | A |
| | AL5 | SBSmk1 | P | 3 | B | DC | 2b | 679 | 15 | 169 | 60 | 0 | 35 | 5 | 0 | 0 | r | F |
| | AL6 | SBSmk1 | F | 7 | E | DC | 2b | 673 | 1 | 999 | 99 | 0 | 1 | 0 | 0 | 0 | p | F |
| | AL7 | SBSmk1 | F | 7 | E | DC | 2b | 676 | 3 | 260 | 99 | 0 | 1 | 0 | 0 | 0 | v | F |
| | AL8 | SBSmk1 | F | 7 | C | DC | 2a | 674 | 3 | 260 | 96 | 0 | 3 | 0 | 0 | 1 | i | A |
| | AL9 | SBSmk1 | P | 6 | E | DC | 2b | 675 | 6 | 272 | 65 | 0 | 35 | 0 | 0 | 0 | i | F |
| | AL10 | SBSmk1 | F | 7 | E | DC | 2b | 675 | 2 | 284 | 70 | 0 | 27 | 0 | 0 | 3 | v | F |
| Beaver Pond | BP1 | SBSmk2 | G | 5 | C | DC | 2a | 670 | 6 | 4 | 0 | 1 | 1 | 98 | 0 | 0 | v | A |
| | BP2 | SBSmk2 | F | 7 | C | DC | 2b | 679 | 1 | 220 | 0 | 0 | 12 | 38 | 0 | 50 | v | F |
| | BP3 | SBSmk2 | P | 3 | B | DC | 2b | 675 | 25 | 230 | 0 | 18 | 1 | 81 | 0 | 0 | r | F |
| | BP4 | SBSmk2 | G | 7 | D | DC | 2a | 673 | 5 | 227 | 0 | 1 | 2 | 97 | 0 | 0 | m | F |
| | BP5 | SBSmk2 | P | 4 | D | DC | 2b | 685 | 20 | 44 | 5 | 2 | 50 | 43 | 0 | 0 | m | F |

1 P=Precipitation, G=Groundwater, S=Snowmelt, F=Stream sub-irrigation and flooding, M=Mineral spring, T=Tidal, freshwater, E=Tidal, saltwater, Z=Permafrost
2 0=Very Xeric, 1 = Xeric, 2 = Subxeric, 3= Submesic, 4= Mesic, 5= Subhygric, 6=Hygric, 7=Subhygric, 8=Hydric
3 A=Very poor, B=Poor, C=Medium, D=Rich E=Very rich, F=Saline
4 DC = Disclimax
5 2a= Forb dominated – includes non-graminoid herbs and ferns; 2b= Graminoid dominated – includes grasses, sedges, reeds, and rushes
6 v=very poorly drained, p=poorly drained =imperfectly drained, m=moderately well drained, w=well drained, r=rapidly drained, x = very rapidly drained
7 A=annual flood, O=occasional flooding, F=frequent flooding

**Table 5. Vegetation cover summary for transects sampled in Year 2 at the Airport Lagoon and Beaver Pond sites.**

| Site | Transect | No. Herb Species | Average % Herb Cover | No. Moss/ Lichen Species | Average % Moss/Lichen Cover | No. Shrub Species | Average % Shrub Cover |
|---|---|---|---|---|---|---|---|
| Airport Lagoon | AL1 | 2 | 0.35 | 1 | 9.7 | 0 | 0.00 |
| | AL2 | 1 | 0.61 | 1 | 13.1 | 0 | 0.00 |
| | AL3 | 4 | 0.27 | 0 | 0 | 0 | 0.00 |
| | AL4 | 1 | 9.7 | 0 | 0 | 0 | 0.00 |
| | AL5 | 5 | 6.11 | 0 | 0 | 0 | 0.00 |
| | AL6 | 7 | 8.87 | 1 | 32.4 | 0 | 0.00 |
| | AL7 | 7 | 22.01 | 2 | 99.8 | 0 | 0.10 |
| | AL8 | 2 | 2.84 | 1 | 9.2 | 0 | 0.00 |
| | AL9 | 5 | 3.96 | 2 | 1.2 | 0 | 0.00 |
| | AL10 | 5 | 3.57 | 3 | 23.1 | 1 | 0.45 |
| Beaver Pond | BP1 | 2 | 8.98 | 0 | 0 | 0 | 0.00 |
| | BP2 | 3 | 1.61 | 0 | 0 | 1 | 0.10 |
| | BP3 | 3 | 1.6 | 0 | 0 | 0 | 0.00 |
| | BP4 | 1 | 12.8 | 0 | 0 | 0 | 0.00 |
| | BP5 | 3 | 1.94 | 0 | 0 | 1 | 0.30 |
| **TOTALS** | | | **5.68** | | **38.21** | | **0.01** |

A variety of plant species were identified at the two study sites during both the Year 1 and 2 ground surveys. Most of these species observed in both years occurred in habitat classes located at lower elevations in the drawdown zone and were considered likely to be tolerant of inundation. Examples of these species include bluejoint, swamp horsetail (*Equisetum fluviatile*), water smartweed (*Persicaria amphibian*), and creeping feathermoss (*Amblystegium serpens*).

In addition, many of the plant species identified during the Year 1 ground surveys were not detected (either absent or only dead remains were observed) during the Year 2 ground surveys. These species were generally observed within habitat classes located in the middle to upper elevations of the drawdown zone and are considered likely to be intolerant to flooding events. The most common of these species include Norwegian cinquefoil (*Potentilla norvegica*), cattails (*Typha latifolia*), fireweed (*Epilobium angustifolium*), red raspberry (*Rubus idaeus*), tree seedlings (e.g., trembling aspen [*Populus tremuloides*]), willows, members of Brassicaceae (e.g., Spreading-pod Rockcress [*Arabis divaricarpa*]) and Asteraceae (e.g., Smooth Hawksbeard [*Crepis capillaris*]), little meadow foxtail (*Alopecurus aequalis*), and small bedstraw (*Galium trifidum*.

In Year 1, a candidate red-listed species was identified during ground surveys (green-sheathed sedge [*Carex feta*]). As there are 197 species (including subspecies) of sedges in BC (Meidinger et al. 2009), an independent confirmation of the species identification was requested. The original identification of green-sheathed sedge was confirmed by D. Coxson (Professor, UNBC). Following discussion with the BC Conservation Data Centre (J. Penny, Program Botanist), a sample was sent to the UBC Herbarium for comparison with herbarium specimens and further confirmation as there are no previous records of the species from northern BC. Upon receipt, the specimen was confirmed to be bronze sedge (*Carex aenea*) (F. Lomer, Honorary Research Associate, UBC Herbarium).

## 5.2 Waterfowl Surveys

A total of 367 individuals distributed among 24 species of waterfowl and shorebirds were detected at both sites, although only three species and four individuals were detected at the Beaver Pond site (Table 6). All species observed at the Beaver Pond site were also observed at the Airport Lagoon. Only Killdeer, Lesser Scaup, and Semipalmated Plover were recorded at the Beaver Pond site. Long-billed Dowitcher was the most commonly detected species, but was only detected in the May 16 survey. Canada Goose and Ring-necked Duck were the next most commonly detected species; however, only Canada Goose was detected on all four survey sessions. American Wigeon, Green-winged Teal, and Lesser Yellowlegs were also relatively common. All other species comprised fewer than 20 individuals (Table 6). The majority of individuals (184) and species (14) were detected during the first survey on May 1 at the Airport Lagoon site. The survey on May 16 detected 13 species, but 68 of the 118 individuals detected were Long-billed Dowitcher.

**Table 6. Summary of 2012 waterfowl survey detections at the Airport Lagoon and Beaver Pond sites, Williston Lake, BC**

| Study Area | Date | Station | American Wigeon | Barrow's Goldeneye | Bufflehead | Blue-winged Teal | Canada Goose | Canvasback | Common Loon | Common Merganser | Greater Yellowlegs | Green-winged Teal | Hooded Merganser | Killdeer | Lesser Scaup | Lesser Yellowlegs | Long-billed Dowitcher | Mallard | Northern Pintail | Northern Shoveler | Ring-necked Duck | Red-necked Grebe | Semipalmated Plover | Semipalmated Sandpiper | Spotted Sandpiper | Station Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Airport Lagoon | May 1 | WSP-01 | | | | | 4 | | | 10 | | 3 | 2 | | | | | 2 | | | | | | | | **21** |
| | | WSP-02 | | | | | 5 | | | | | 7 | | | | 2 | | 4 | 4 | | | | | | | **22** |
| | | WSP-04 | 34 | 1 | 7 | | 9 | | | | | 3 | | | 6 | 5 | | 3 | 5 | 12 | 49 | 1 | | | | **135** |
| | | WSP-06 | | | | | 1 | | | | | 5 | | | | | | | | | | | | | | **6** |
| | | Total | 34 | 1 | 7 | | 19 | | | 10 | | 18 | 2 | | 6 | 7 | | 9 | 9 | 12 | 49 | 1 | | | | **184** |
| | May 9 | WSP-01 | | | | | 1 | 2 | | | 1 | | | | | | | | 6 | | | | 4 | 6 | | **20** |
| | | WSP-02 | | | | | 4 | | | | | | | 4 | | | | | | | | | | | | **8** |
| | | WSP-04 | | | | | | | 1 | | | 5 | | | | | | | | | | | | | | **6** |
| | | WSP-06 | | | | | | | | | 1 | | | | | | | | | | | | | | | **1** |
| | | Total | | | | | 5 | 2 | 1 | | | 5 | | 4 | | | | | 6 | | | | 4 | 6 | | **35** |
| | May 16 | WSP-01 | | | | | 1 | | | | 3 | 2 | | | | | 68 | | | 4 | | | | | 2 | **80** |
| | | WSP-02 | | | | | 6 | | | | 1 | | | 1 | | | | | | | | | 3 | 1 | | **12** |
| | | WSP-04 | 4 | | | | | | 1 | | 1 | 2 | | | | 1 | | 3 | | | | | | | | **12** |
| | | WSP-06 | | | | | | | | | 1 | | | | | 12 | | | | | | | | | 1 | **14** |
| | | Total | 4 | | | | 7 | | 1 | | 6 | 4 | | 1 | | 13 | 68 | 3 | | 4 | | | 3 | 1 | 3 | **118** |
| | May 31 | WSP-01 | | | | 1 | 14 | | | | | | | | | | | | | | | | | | | **15** |
| | | WSP-02 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | WSP-04 | | | | | | | | | | | | 2 | | | | | | | | | | | 1 | **3** |
| | | WSP-06 | | | | | 4 | | | | 4 | | | | | | | | | | | | | | | **8** |
| | | Total | | | | 1 | 18 | | | | 4 | | | 2 | | | | | | | | | | | 1 | **26** |
| | **Total** | | 38 | 1 | 7 | 1 | 49 | 2 | 2 | 10 | 12 | 27 | 2 | 7 | 6 | 20 | 68 | 12 | 15 | 16 | 49 | 1 | 7 | 7 | 4 | **363** |

| Study Area | Date | Station | American Wigeon | Barrow's Goldeneye | Bufflehead | Blue-winged Teal | Canada Goose | Canvasback | Common Loon | Common Merganser | Greater Yellowlegs | Green-winged Teal | Hooded Merganser | Killdeer | Lesser Scaup | Lesser Yellowlegs | Long-billed Dowitcher | Mallard | Northern Pintail | Northern Shoveler | Ring-necked Duck | Red-necked Grebe | Semipalmated Plover | Semipalmated Sandpiper | Spotted Sandpiper | Station Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Beaver Pond** | May 18 | WSP-05 | | | | | | | | | | | | | 2 | | | | | | | | 1 | | | **3** |
| | June 1 | WSP-05 | | | | | | | | | | | | 1 | | | | | | | | | | | | **1** |
| | June 8 | WSP-05 | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Total** | | | | | | | | | | | | | 1 | 2 | | | | | | | | 1 | | | **4** |
| **Grand Total** | | | **38** | **1** | **7** | **1** | **49** | **2** | **2** | **10** | **12** | **27** | **2** | **8** | **8** | **20** | **68** | **12** | **15** | **16** | **49** | **1** | **8** | **7** | **4** | **367** |

### 5.3 Songbird Surveys

A total of 59 species were detected encompassing 440 detections and 611 individuals. The Airport Lagoon site had higher species richness, with 56 of the 59 total species being detected versus 24 of 59 total species at the Beaver Pond site (Appendix 12). An average of 14.5 (n=17) species were detected per point count station at the Airport Lagoon site compared to an average of 12.0 (n=3) per station at the Beaver Pond site.

At the Airport Lagoon site, the majority of detections (30.5%, n=112) were made in the shrub band adjacent to the drawdown zone, with slightly fewer birds detected in forested habitat above the drawdown zone (27.0%, n=99). The remaining detections were either in the drawdown zone (22.3%, n=82), fly-overs (18.8%, n=69) or unknown (1.4%, n=5). In contrast at the Beaver Pond site, the majority of detections were in the forest area (79.5%, n=58) surrounding the drawdown zone (6.8% of detections, n=5). The remaining detections were in shrubs (12.3%, n=9) or were fly-overs (1.4%, n=1).

Nest searching surveys found a total of 10 nests of seven different species, five nests at the Airport Lagoon site and five nests at the Beaver Pond site (Table 7). Nests were found within the drawdown zone and in adjacent areas (~ 50 m from edge of drawdown zone).

**Table 7. Nest types and vegetation cover in 2012 at the Airport Lagoon and Beaver Pond sites.**

| Site | Date | Species | Type | % Veg. Cover 0-0.5 m | Veg. Species 0-0.5 m | % Veg. Cover 0.5-2 m | Veg. Species 0.5-2 m |
|---|---|---|---|---|---|---|---|
| Airport Lagoon | June 9 | Spotted Sandpiper | Ground | 40 | Aster spp. | - | - |
| | June 9 | Lincoln's Sparrow | Ground | 98 | Grass | - | - |
| | June 9 | Chipping Sparrow | Shrub | 60 | Willow | 50 | Willow |
| | June 9 | Lincoln's Sparrow | Ground | 80 | Sedge | - | - |
| | June 11 | American Three-toed Woodpecker | Cavity | 100 | Snag | - | - |
| Beaver Pond | 8 June | American Robin | Tree | 70 | Trembling Aspen | 40 | Trembling Aspen |
| | 10 June | Chipping Sparrow | Shrub | 30 | Spruce | - | - |
| | 12 June | Chipping Sparrow | Shrub | 60 | Sub-alpine fir | 20 | Sub-alpine fir |
| | 12 June | Yellow-rumped Warbler | Tree | 70 | Sub-alpine fir | 60 | Sub-alpine fir |
| | 12 June | American Redstart | Shrub | 10 | Alder spp. | 30 | Alder spp. |

## 5.4 Amphibian Surveys

Three amphibian species were detected during the systematic surveys: western toad, long-toed salamander, and wood frog (Table 8). The western toad, a blue-listed species in BC and a federal Special Concern species, represented 8 of the total detections, including 2 pairs in amplexus. There was only a single detection of a wood frog, and two detections each for long-toed salamander and tadpoles (Table 8). Tadpole observations (unidentified but likely western toad) included a single individual on May 31st at the Airport Lagoon (transect 40) and a group of 100 tadpoles at the Beaver Pond on Jun 12th. The UTM coordinates for all amphibian detections are provided in Appendix 13.

**Table 8. Amphibian detections in 2012 at the Airport Lagoon and Beaver Pond sites.**

| Site | Date | Transect | Search Effort (min.) | Western toad | Long-toed salamander | Wood frog | Transect Total |
|---|---|---|---|---|---|---|---|
| **Airport Lagoon** | May 1 | 2 | 7 | | | | **0** |
| | | 3 | 6 | | | | **0** |
| | | 7 | 7 | | | | **0** |
| | | 10 | 8 | | | | **0** |
| | | 14 | 12 | | | | **0** |
| | | 25 | 10 | | | | **0** |
| | | 28 | 9 | | | | **0** |
| | | 32 | 12 | | | | **0** |
| | | 35 | 10 | | | | **0** |
| | | 37 | 9 | | | | **0** |
| | | 40 | 7 | | | | **0** |
| | May 9 | 2 | 16 | | | | **0** |
| | | 3 | 11 | | | | **0** |
| | | 7 | 9 | | | | **0** |
| | | 10 | 12 | | | | **0** |
| | | 14 | 10 | | | | **0** |
| | | 25 | 10 | | | | **0** |
| | | 28 | 12 | | | | **0** |
| | | 32 | 12 | | | | **0** |
| | | 35 | 9 | | | | **0** |
| | | 37 | 11 | | | | **0** |
| | | 40 | 10 | | | | **0** |
| | May 17 | 2 | 23 | | | | **0** |
| | | 3 | 13 | | | | **0** |
| | | 7 | 29 | 1 | | | **1** |
| | | 10 | 31 | | | | **0** |
| | | 14 | 13 | | | | **0** |
| | | 25 | 56 | 4 | 2 | | **6** |
| | | 28 | 10 | | | | **0** |
| | | 32 | 21 | 1 | | | **1** |
| | | 35 | 13 | | | | **0** |
| | | 37 | 0 | | | | **0** |
| | | 40 | 16 | | | | **0** |

| Site | Date | Transect | Search Effort (min.) | Western toad | Long-toed salamander | Wood frog | Transect Total |
|---|---|---|---|---|---|---|---|
| | May 31 | 2 | 9 | | | | **0** |
| | | 3 | 3 | | | | **0** |
| | | 7 | 11 | | | | **0** |
| | | 10 | 4 | | | | **0** |
| | | 14 | 29 | | | | **0** |
| | | 25 | 17 | | | | **0** |
| | | 28 | 12 | | | | **0** |
| | | 32 | 7 | | | | **0** |
| | | 35 | 11 | 1 | | | **1** |
| | | 37 | 7 | | | | **0** |
| | | 40 | 13 | | | | **1*** |
| | **Total** | | | 7 | 2 | 0 | **10*** |
| **Beaver Pond** | May 18 | BP-A-01 | 69 | 1 | | | **1** |
| | June 1 | BP-A-01 | 44 | | | | **0** |
| | June 8 | BP-A-01 | 36 | | | | **0** |
| | June 12 | BP-A-01 | 33 | | | 1 | **2*** |
| | **Total** | | | 1 | 0 | 1 | **3*** |
| **Species Totals** | | | | **8** | **2** | **1** | **13*** |

* Includes unidentified tadpole detections - The tadpole detection on June 12th included 100 individuals.

## 5.5 Fish Surveys

A total of 620 fish representing 11 species were collected over the duration of the sampling program with the majority collected by fyke net (457 of 620 captures), followed by electrofishing (118 of 620 captures), and minnow traps (44 of 620 captures) (Table 9, Appendix 14). Electrofishing and minnow trapping captured similar sized fish from different habitats (lotic and lentic habitats, respectively) while the fyke nets caught the largest fish. The majority of fish species captured were non-sportfish. Lake chub (*Couesius plumbeus*), were the most commonly captured species, followed by redside shiner (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*), and brassy minnow (*Hybognathus hankinsoni*) (Table 10). Other non-sportfish species captured were peamouth (*Mylocheilus caurinus*), longnose sucker (*Catostomus catostomus*), white sucker (*C. commersonii*), largescale sucker (*C. macrocheilus*), and prickly sculpin (*Cottus asper*) (Table 10). The only sportfish species captured were bull trout (*Salvelinus confluentus*) at the Beaver Pond and juvenile burbot (*Lota lota*) at the Airport Lagoon (Table 10). Water quality data collected on each sampling date are included in Appendix 15.

**Table 9. Fish sampling methods and effort by date in 2012 at the Airport Lagoon and Beaver Pond sites.**

| Site | Date | Method | Total Effort[1] | No. of Fish | CPUE[2] |
|---|---|---|---|---|---|
| Airport Lagoon | May 17 | Electrofishing | 6815s | 86 | 0.757 |
| | | Minnow traps | 296.70h | 38 | 0.128 |
| | | Fyke Net | 26.75h | 78 | 2.92 |
| | June 1 | Electrofishing | 2386s | 31 | 0.78 |
| | July 20 | Minnow traps | 239.92h | 5 | 0.021 |
| | | Fyke nets | 38.67h | 375 | 9.8 |
| Beaver Pond | May 18 | Electrofishing | 897s | 1 | 0.067 |
| | July 22 | Minnow traps | 133.50h | 1 | 0.007 |
| | | Fyke net | 22.75h | 4 | 0.176 |

[1] – Electrofishing effort expressed in seconds (active sampling), minnow traps and fyke nets in hours (passive sampling)
[2] – Electrofishing CPUE = fish/minute; minnow trap and fyke net CPUE = fish/hour

**Table 10. Summary of fish species captured by date and method in 2012 at the Airport Lagoon and Beaver Pond sites.**

| Site | Date | Method | Species | | | | | | | | | | | | Method Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lake chub | Brassy minnow | Peamouth | Northern pikeminnow | Redside shiner | Longnose sucker | White sucker | Largescale sucker | Sucker sp. | Bull trout | Burbot | Prickly sculpin | |
| **Airport Lagoon** | May 17 | EF | 6 | | | 37 | 3 | | | 4 | 3 | | 18 | 15 | 86 |
| | | MT | 18 | 2 | | | 9 | | | 2 | | | 5 | 2 | 38 |
| | | TN | 16 | 4 | 1 | 9 | 36 | 2 | | 3 | | | 7 | | 78 |
| | June 1 | EF | 6 | 1 | | 3 | | 1 | | 1 | | | 17 | 2 | 31 |
| | July 20 | MT | 3 | | | 1 | 1 | | | | | | | | 5 |
| | | TN | 150 | 49 | | 34 | 77 | 46 | 14 | 6 | | | | | 376 |
| | **Total** | | 199 | 56 | 1 | 84 | 126 | 49 | 14 | 16 | 3 | | 47 | 19 | 614 |
| **Beaver Pond** | May 18 | EF | | | | | 1 | | | | | | | | 1 |
| | July 22 | MT | | | 1 | | | | | | | | | | 1 |
| | | TN | | | | 1 | | 1 | | 1 | | 1 | | | 4 |
| | **Total** | | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | | 6 |
| **Species Totals** | | | 199 | 56 | 2 | 85 | 127 | 50 | 14 | 17 | 3 | 1 | 47 | 19 | 620 |

# 6 DISCUSSION

As this is the second year of a ten year monitoring program, the results presented offer a preliminary overview of wildlife habitats and indicator groups. The focus of field activities in 2012 was to collect additional baseline data from established survey stations and transects.

The general conditions observed at both sites in 2012 were considerably different than in 2011. The biggest difference was significantly less vegetation cover in 2012 compared to 2011. This is considered to be a result of the different reservoir conditions prior to the surveys in each year. The Year 1 surveys occurred following a year of low reservoir levels that did not result in the inundation of either site during the growing season. The Year 2 surveys occurred following a year where the reservoir approached full pool and both sites were inundated for an extended period. However, even with the extended period of inundation, conditions at the Airport Lagoon in May 2012 appeared to be drier than in May 2011. Conditions at the Beaver Pond site appeared to be wetter than in 2011, as would be expected following inundation. Some variability in the results for Years 1 and 2 was expected due to the difference in reservoir conditions that preceded each sampling season.

As in 2011, some of the results may have also been affected by weather conditions during spring 2012. Temperatures were generally average but with considerable variability over short periods of time (Appendix 16). Even with the variability, the temperatures in early to mid May appeared to be cooler than average (Appendix 16). Precipitation in April was average while May was much drier than average, with approximately half as much precipitation as normal (Appendix 16).

The vegetation mapping and ground-truthing identified 16 vegetated habitat classes and one non-vegetated (open water) habitat class at both sites. With the exception of one vegetated habitat class that was common to both sites, the vegetation communities documented at both sites were different. However, the distribution of the habitat classes followed a similar pattern at both the Airport Lagoon and Beaver Pond sites. The general pattern of habitats was a band of coarse woody debris parallel to the edge of the reservoir at full pool transitioning into a band of sparsely vegetated sand to an area of sparsely vegetated mud adjacent to the water's edge.

The habitat classes observed are assumed to have developed in response to the annual flooding regime from reservoir operations. As the timing of reservoir filling and the maximum elevation reached varies from year to year the species present in each of the habitat classes is expected to be variable. In 2010 reservoir levels did not exceed 665 m during the growing season resulting in most of the mapped area at both sites not being flooded. This may have allowed for colonization by species that are less tolerant of inundation. Reservoir levels in 2011 were much higher than in 2010 with the water level reaching 665 m in mid-June and a maximum level of 671.43 m in late August. As a result, all transects and the majority of mapped habitat classes were inundated in 2011.

Plant species that were identified at the two study sites during Year 1 and Year 2 ground surveys are likely to be tolerant to flooding events. A majority of these species are adapted to wet soils that are often saturated for most or the entire growing season (e.g., swamp horsetail). Many of these species have also been observed as regularly occurring within the drawdown zone of other reservoirs located in B.C (e.g., bluejoint at Arrow Lakes).

Plant species identified at the study sites during Year 1 ground surveys that were not detected (either absent or only dead remains were observed) during Year 2 ground surveys are likely to be intolerant to flooding events. Based on their life history, some of the species identified are adapted to dry to mesic soils (e.g., fireweed, red raspberry and trembling aspen) and therefore intolerant of flooding. However, a few species identified are adapted to moist to wet soils and yet were still found to be intolerant to flooding (e.g., dead remains of Norwegian cinquefoil and cattails were apparent across the Airport Lagoon site). Their intolerance may be related to the timing (early to middle of the growing season), the duration and depth of flooding.

Additionally, during Year 2 ground surveys, many large mats of bryophyte cover were found to be uprooted and relocated (e.g., deposited along the shoreline at the upper limits of the drawdown zone). It is suspected that during flooding, these large mats were removed from the soil surface by water currents, floated and then deposited once water levels receded. The majority of bryophyte cover on these removed mats did not survive the relocation, suggesting a somewhat indirect intolerance to flooding.

Although differences in reservoir conditions are considered the primary reason for the fewer species detected in the Year 2 ground surveys, the timing of the surveys may have also been a contributing factor. Surveys were conducted earlier in the growing season (June 2 to 4$^{th}$) due to forecasted reservoir levels that would result in the majority of sites being flooded by late June. Therefore some species may not have been detected either due to a lack of distinguishing characteristics or a lack of above ground growth.

The amphibian surveys detected most of the same species as in 2011 but in lower numbers. Western toad, wood frog, and long-toed salamander were all observed in 2012. As in 2011, this is consistent with other inventory work completed in the area. Hengeveld (2000) found that western toad, wood frog, and Columbia spotted frog were the most common species in watersheds adjacent to Williston Lake. The most notable detections this year were the observation of long-toed salamander adults on one transect at the Airport Lagoon. Western toad and wood frog were the only species observed at this site in 2011. Adult long-toed salamanders were also observed at the Beaver Pond site but were not in the defined survey area. There were no detections of Columbia spotted frogs or boreal chorus frogs in 2012. The single observation of a boreal chorus frog in 2011 may have be a misidentification as this species is not known to occur in the area (Hengeveld 2000, Matsuda et al. 2006).

The earlier start of the surveys in 2012 may have assisted in the detection of early breeding species such as long-toed salamander. Long-toed salamanders and wood frog are known to start breeding before the snow and ice melts in northern British Columbia (Matsuda et al. 2006). However, the weather conditions during the early season surveys were generally cool and windy and are the probable reason for the lack of detections. The cool, dry weather in the region during early and mid May have also reduced the number of detections. The low vegetation cover observed at both sites in 2012 may have also contributed to the lower number of detections as a result of reduced cover. The different reservoir conditions between years may have also contributed to the different results between years.

The waterfowl survey results in 2012 were similar to those in 2011, although the inclusion of shorebirds increased both species richness and overall numbers detected. Waterfowl surveys were started and completed earlier in 2012 than in 2011, likely providing a more accurate characterization of migrating waterfowl use of the sites. Given the occurrence of early spring ice on Williston Lake limiting access in both 2011 and 2012, it is likely that fewer surveys will be completed each year at the Beaver Pond than at the Airport Lagoon site.

Two of the species detected during the waterfowl and shorebird surveys were also confirmed as nesting on site. These include the incidental observation of nesting Canada Goose during amphibian surveys and the detection of a Spotted Sandpiper nest during the songbird surveys at the Airport Lagoon site in 2012. Greater Yellowlegs are also suspected of breeding near the Airport Lagoon site, but this has not been confirmed. Given that both sites were thoroughly nest-searched, the majority of waterfowl and shorebirds detected were likely migrants. Variability in species composition detected on surveys (e.g., the single detection of one large flock on Long-billed Dowitchers on May 16 at Airport Lagoon) probably reflects variability in timing and route of migration from year to year.

In both 2011 and 2012, the vast majority of waterfowl using both sites were migrants stopping over and then moving to other breeding areas. Based on breeding habitat requirements of several of the waterfowl species that were detected during out surveys, the lack of good nesting habitat (e.g., well developed areas of emergent vegetation for Ring-necked Ducks and well-vegetated grasslands/shrublands for American Wigeon, Green-wing-teal, and Mallards) is the main reason for the observed lack of breeding waterfowl.

Overall, songbird survey results from 2012 were similar to results from 2011 at both the Airport Lagoon and Beaver Pond sites. Total species detected was identical between the two years, and 2012 had only slightly more individuals detected than 2011. Some differences in species composition were recorded. American Three-toed Woodpecker, Barn Swallow, Canada Goose, Cassin's Vireo, Mountain Bluebird, Northern Flicker, and Northern Pintail were detected in 2012 but not in 2011. However, all of these species were noted at the site outside of point count surveys in 2011, and so were not unique occurrences in 2012. It should be noted that Barn Swallow is Blue-listed in BC and designated as Threatened by COSEWIC.

The difference in frequency of detections in the different areas (e.g., drawdown zone, forest) at the two sites is probably accounted for by the difference in area. The Beaver Pond has a small, featureless drawdown area with low use by birds and lacks the well-developed shrub habitat that exists on the eastern side of the Airport Lagoon site. The small drawdown zone area relative to the surrounding forest habitat likely explains why a high proportion of detections are in forest habitat at the Beaver Pond site.

Although nest searching efforts were expanded further in 2012 to areas adjacent to the drawdown zone, fewer nests were found in 2012 than in 2011. This is likely a result of random variability in nest searching success. Also, some of the species such as Osprey (with large stick nests) and Tree Swallows (obvious cavities in isolated snags) that had nests recorded in 2011 were not recorded in 2012. Given the relatively small area of both sites and relatively large nesting territories of some species, small changes in nesting patterns by some species will result in variability in the number of nests found each year.

Fish sampling by electrofishing, minnow trapping, and fyke nets was effective and confirmed the presence of fish at both proposed wetland enhancement sites. The three methods of sampling resulted in the collection of 11 of 22 species known to occur in the reservoir in 2012. Two species collected in 2011 were not observed in 2012 (rainbow trout and slimy sculpin) and two new species were collected in 2012 (bull trout and white sucker). Between the two sites a total of 13 fish species have been observed over the first two years of the project.

The fish sampling results for 2011 and 2012 from the Airport Lagoon confirms that this site has a resident fish population of cyprinids, suckers, and sculpins. Lake chub was again the most abundant species at this site in 2012. The relative abundance of most species was similar to

2011 although the numbers of fish captured were much higher due to two of the fyke net sets. Notable changes in relative abundance included an increase in the number of burbot and northern pikeminnow captured. Few small suckers (too small to be identified to species) were captured in 2012 compared to 2011. The majority of suckers were large enough to identify to species. The majority of burbot were captured by electrofishing and were similar in size indicating they may belong to the same age class (Appendix 17). Pikeminnow were captured primarily by electrofishing in May and by fyke net in July.

Brassy minnow were captured again in 2012 at the Airport Lagoon by all three sampling methods. Almost all of the captures (49 of 56) of this species were from a single fyke net in July (FN2, see Figure 10 for location). The length frequency distribution for brassy minnow was bimodal, indicating that at least two age classes were present and suggesting that this species reproduces in the Airport Lagoon (Appendix 17). Other species with length frequency distributions that suggested the presence of more than one age class include lake chub, northern pikeminnow, redside shiner, and prickly sculpin (Appendix 17). These are also likely resident species in the Airport Lagoon. A pair of prickly sculpins of similar size (85 mm and 89 mm TL) was captured from the same location on EF1 suggesting they may have been a breeding pair.

Some variation between the fish sampling results in 2011 and 2012 for the Airport Lagoon was expected due to sample variability between years. In 2012, fish sampling at the Airport Lagoon was completed earlier in the season than in 2011 but the primary difference between the two years was sampling in 2012 occurred after a season where the reservoir was near full pool for an extended period of time while the sampling in 2011 occurred following a year when the maximum reservoir level was just above the level of the outlet culverts at the Airport Lagoon. All areas sampled in 2012 had been inundated when the reservoir reached its maximum level in August 2011 while all areas sampled in 2011 had not been inundated during the previous season.

The July sampling results at the Airport Lagoon may have also been affected by a blockage of the outlet culvert. Water levels in the lagoon were an estimated 2-3 meters lower than the water level in the reservoir indicating that the outlet culverts were blocked. It is unknown when this occurred or if it affected the incidental migration of fish into the lagoon. The water level observed in the lagoon during the July sampling appeared to be similar to what will occur after completion of the proposed wetland enhancement project. The blockage may also have an impact on data collected in Year 3 of the project.

Based on the description of the Beaver Pond site (Golder Associates Ltd 2010, 2011), it was originally expected that low numbers of fish would be encountered at this location. However, in 2011, electrofishing in one of the two reaches resulted in the capture of the highest number of fish and highest electrofishing CPUE of all sites sampled. A large mixed school of juvenile fish (unidentified suckers, redside shiners, lake chub, peamouth, and northern pike minnow) was also observed at the stream's outlet into the reservoir in 2011. In 2012, electrofishing at this site was completed one month earlier than in 2011 and only resulted in the capture of a single fish. No fish were observed at the stream outlet during the May 2012 sampling.

Reservoir conditions and sampling date are considered the likely reasons for the differences observed at the Beaver Pond site between 2011 and 2012. Sampling in 2012 occurred following a season where the reservoir was near full pool for an extended period and the sites were inundated while sampling in 2011 was after a year when the site was not inundated. The earlier sampling in 2012 allowed for observations of the lower part of the stream channel that was inundated during the 2011 sampling. This section of the stream channel contained abundant large woody debris and would likely be impassable to small fish. Although no fish were observed during the May site visit a few small fish were observed on June 1, 2012 during the amphibian survey at this site and a large school of small fish was observed at the stream mouth on June 3, 2012 when the site was visited to complete the vegetation surveys.

It was suggested in Year 1 that the sheltered nature of this inlet may provide preferred habitat for juvenile fish in comparison to adjacent, exposed areas of the reservoir shoreline (MacInnis et al. 2012). Observations and water quality data collected in 2012 provides some support to this hypothesis. On June 3 the stream outlet temperature was 18.5°C compared to 11.1°C on the reservoir outside of the inlet. The water temperature in the stream was 8.3°C on May 18 and not different from the reservoir surface temperature. There was no difference in surface water temperatures between the inlet and the reservoir during the July fish sampling. With two years of fish sampling at this site it appears that the Beaver Pond site does provide some preferred seasonal habitat for juvenile fish prior to inundation by the reservoir.

# 7 CONCLUSIONS

The baseline data collected in Years 1 and 2 of the GMSMON-15 project appear to support the preliminary impact and benefit predictions for the proposed wetland enhancements (Golder Associates Ltd 2011). However, the two years of data were collected under different reservoir conditions. The data collected in Year 1 was following a year (2010) when reservoir elevations did not reach a high enough level to inundate either the Airport Lagoon or the Beaver Pond sites. Data collected in Year 2 were collected following a year when reservoir levels were close to full pool for an extended period. Differences in the data collected for vegetation, amphibians and fish are considered to be primarily associated with the different reservoir conditions in each year. The cool, dry weather in early to mid May 2012 is also considered to have influenced the amphibian detections. Differences in waterfowl and songbird observations between the two years are attributed primarily to natural variability and not to differences in reservoir conditions.

Depending on the timing of construction of the projects in spring 2013, the collection of an additional season of baseline data will assist in the ability to make comparisons of pre- and post-treatment abundance of the target species at both sites. Data collected in spring 2013 will be collected under similar reservoir conditions to 2012 (i.e., following a year when the reservoir level was close to full pool for an extended period). If the Airport Lagoon culvert is still blocked in spring 2013, the results would be more representative of the post-treatment conditions.

For vegetation, an additional year of baseline data will provide a better characterization of the vegetation types that will not be inundated by the wetland enhancement projects. The completion of the enhancement projects is expected to allow the development of aquatic vegetation that is currently non-existent or limited in extent at both sites. Additional changes in vegetation are also expected adjacent to the new wetlands as a result of the stabilized water levels. More detail on the current status of these vegetation types will assist in separating changes associated with the wetland enhancement projects from those associated with reservoir levels. The proposed wetland designs reduce the influence of reservoir conditions on these sites but do not entirely isolate them.

While some differences in the waterfowl and songbird results were observed on the first two years of the monitoring program the majority of differences were attributed to natural variability. The reduced vegetation in Year 2 did result in some changes in use of the site by some species with reduced use by some species (e.g., Savannah Sparrow) or a shift in use to the periphery of the site. For both waterfowl and songbirds, stabilization of the water regime should allow for development of wetland and riparian vegetation at both sites and therefore increase habitat availability. Depending on the time of ice off at the Airport Lagoon in relation to the reservoir following completion of the wetland enhancement, there may also be an increase in the numbers of spring migrants due to increased habitat area.

The lack of vegetation observed at both sites in 2012, may have reduced the numbers of amphibians observed due to poorer quality habitat (less cover). However, amphibian numbers are known to vary considerably from year to year so an additional year of baseline data would provide additional data collected under similar conditions to account for some of the natural variability. At both sites, the wetland enhancements should increase the amount of amphibian breeding habitat available. Additionally, at the Airport Lagoon, the changes may increase the accessibility of breeding habitat by reducing the distance to be traversed between upland areas and breeding habitat. However, the higher water levels at this site will eliminate many of the small pools currently used for breeding and potentially increase the risk of predation by fish at this site.

While there were differences in the fish results between the two years at the Beaver Pond site, these differences appear to be the result of differences in sample timing and seasonal use of the site by fish. Recommendations to confirm the apparent seasonal use of this area are provided below. Completion of this project is expected to have minimal effects on fish use of this area. There may be some potential for fish to become trapped in the wetland during years with reservoir levels that exceed the height of the proposed dike but this will not be different from the existing situation with the beaver dams at this site.

At the Airport Lagoon, the observed differences in fish populations between years (few small suckers in 2012) may be related to the differences in reservoir levels between the two years. Reservoir levels in 2010 were at or near the level of the outlet culverts for an extended period which likely increased the potential for young-of-the-year fish to move into the lagoon. Lower rates of movement are assumed to be associated with the higher water levels that occurred in 2011 and 2012 when the reservoir level is at the culvert elevation for a reduced period. While the blocked culvert observed in July 2012 will have prevented some fish movements into the lagoon, it is unknown if this will result in detectable differences in the fish community in 2013.

## 7.1 Recommendations

All recommendations from the Year 1 report (MacInnis et al. 2012) were implemented for Year 2 and should be continued for Year 3. Additional recommendations for Year 3 include:

- Should the proposed wetland enhancement projects be scheduled to be constructed in spring 2013, when reservoir levels are low, the construction should be coordinated with the GMSMON-15 monitoring program. Depending on the timing of construction, the completion of additional surveys prior to construction will contribute to the available baseline data for assessing the effectiveness of the project in improving wildlife habitat in the drawdown zone.

- Attempt to complete the amphibian surveys under the best possible environmental conditions (i.e., after 1-2 days of rain, low wind, and mild temperatures) to maximise the potential for amphibian detections. This can be challenging due to rapidly changing weather, particularly during the early season surveys.

- Low pool sampling with a fyke net at the Airport Lagoon site, near the causeway, was effective and should be continued in Year 3.

- To confirm the apparent seasonal use of the Beaver Pond site by juvenile fish, electrofishing should occur there on two occasions. The first would occur as early in the season as the site is accessible and near low pool. The second would occur later in the season when reservoir levels were about 664 m. This is the level when fish were observed at this site in Years 1 and 2.

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**Appendix 1. Locations of vegetation belt-transects.**

| Site | Transect[1] | UTM Zone | Easting | Northing |
|---|---|---|---|---|
| Airport Lagoon | AL1-1 | 10U | 492406 | 6125720 |
| | AL1-2 | 10U | 492404 | 6125703 |
| | AL2-1 | 10U | 492491 | 6125900 |
| | AL2-2 | 10U | 492490 | 6125882 |
| | AL3-1 | 10U | 492440 | 6126076 |
| | AL3-2 | 10U | 492456 | 6126064 |
| | AL4-1 | 10U | 492457 | 6126395 |
| | AL4-2 | 10U | 492465 | 6126375 |
| | AL5-1 | 10U | 492229 | 6126681 |
| | AL5-2 | 10U | 492249 | 6126686 |
| | AL6-1 | 10U | 492586 | 6126956 |
| | AL6-2 | 10U | 492601 | 6126947 |
| | AL7-1 | 10U | 492721 | 6126541 |
| | AL7-2 | 10U | 492723 | 6126524 |
| | AL8-1 | 10U | 492641 | 6125643 |
| | AL8-2 | 10U | 492638 | 6125664 |
| | AL9-1 | 10U | 492660 | 6125937 |
| | AL9-2 | 10U | 492661 | 6125918 |
| | AL10-1 | 10U | 492695 | 6126423 |
| | AL10-2 | 10U | 492698 | 6126442 |
| Beaver Pond | BP1-1 | 10U | 479296 | 6148230 |
| | BP1-2 | 10U | 479276 | 6148234 |
| | BP2-1 | 10U | 479313 | 6148248 |
| | BP2-2 | 10U | 479297 | 6148256 |
| | BP3-1 | 10U | 479335 | 6148268 |
| | BP3-2 | 10U | 479321 | 6148284 |
| | BP4-1 | 10U | 479307 | 6148277 |
| | BP4-2 | 10U | 479295 | 6148294 |
| | BP5-1 | 10U | 479243 | 6148225 |
| | BP5-2 | 10U | 479231 | 6148235 |

[1] -The ‘1’ suffix denoted the beginning of a transect and the ‘2’ suffix the end

.

**Appendix 2. Ecosystem field forms used for ground sampling of vegetation polygons.**

BRITISH COLUMBIA
MINISTRY OF FORESTS
BC ENVIRONMENT

## ECOSYSTEM FIELD FORM

| | | | | | |
|---|---|---|---|---|---|
| DATE Y M D | PLOT NO. | | | | |
| PROJECT ID. | FIELD NO. | SURVEYOR(S) | | | |

**SITE DESCRIPTION**

**LOCATION**

| | | | | | |
|---|---|---|---|---|---|
| GENERAL LOCATION | | | | | |
| FOREST REGION | MAPSHEET | UTM ZONE | LAT./ NORTH. | LONG./ EAST. | |
| AIRPHOTO NO. | X CO-ORD. | Y CO-ORD. | MAP UNIT | | |

**SITE INFORMATION**

| | | | | | |
|---|---|---|---|---|---|
| PLOT REPRESENTING | | | | | |
| BGC UNIT | SITE SERIES | TRANS./ DISTRIB. | ECOSECTION | | |
| MOISTURE REGIME | NUTRIENT REGIME | SUCCESS. STATUS | STRUCT. STAGE | REALM/ CLASS | |
| ELEV. m. | SLOPE % | ASPECT ° | MESO SLOPE POS. | SURFACE TOPOG. | |

**SITE DIAGRAM**

| | |
|---|---|
| SITE DISTURB. | PHOTO ROLL |
| EXPOS. TYPE | FRAME NOS. |

**NOTES**

**SUBSTRATE (%)**

| | | | |
|---|---|---|---|
| ORG. MATTER | | ROCKS | |
| DEC. WOOD | | MINERAL SOIL | |
| BEDROCK | | WATER | |

FS882 (1) HRE 98/5

**SOIL DESCRIPTION**

| | | | | | |
|---|---|---|---|---|---|
| GEOLOGY | BEDROCK | C.F. LITH. | SURVEYOR(S) | PLOT NO. | |
| TERRAIN | TEXTURE 1 / 2 | SURFICIAL MATERIAL 1 / 2 | SURFACE EXPR. 1 / 2 | GEOMORPH. PROCESS 1 / 2 | PROFILE DIAGRAM |
| SOIL CLASS. | HUMUS FORM | HYDROGEO. | | | |
| ROOTING DEPTH cm | ROOT RESTRICT. LAYER TYPE | WATER SOURCE | DRAINAGE | | |
| R. Z. PART. SIZE | DEPTH cm | SEEPAGE cm | FLOOD RG. | | |

**ORGANIC HORIZONS/LAYERS**

| HOR/ LAYER | DEPTH | FABRIC STRUCTURE | FABRIC vPOST | MYCEL. AB. | FECAL AB. | ROOTS AB. | ROOTS SIZE | pH | COMMENTS (consistency, character, fauna, etc): |
|---|---|---|---|---|---|---|---|---|---|
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**MINERAL HORIZONS/LAYERS**

| HOR/ LAYER | DEPTH | COLOUR | ASP | TEXT. | % COARSE FRAGMENTS G | C | S | TOTAL | SHAPE | ROOTS AB. | ROOTS SIZE | STRUCTURE CLASS | STRUCTURE KIND | pH | COMMENTS (mottles, clay films, effervesc., etc): |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
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NOTES:

FS882 (2) HRE 98/5

**VEGETATION**

| SPP. LIST COMP. ☐ PART. ☐ | % COVER BY LAYER | TREE (A) | SHRUB (B) | HERB (C) | MOSS / LICHEN (D) | SURVEYOR(S) | PLOT NO. | PAGE OF |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| TREES | A1 | A2 | A3 | A | B1 | B2 | B | HERB LAYER (C) | % | MOSS / LICHEN / SEEDLING (D) | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

| SHRUBS | B1 | B2 | B |
|---|---|---|---|
| | | | |

| ADDITIONAL SPECIES | LAYER | % |
|---|---|---|
| | | |

NOTES: __________

FS882 (3) HRE 98/5

**Appendix 3. Waterfowl survey station UTM coordinates on Williston Lake, BC.**

| SITE | STATION | UTM ZONE | EASTING | NORTHING |
|---|---|---|---|---|
| Airport Lagoon | WSP-01 | 10U | 492643 | 6125394 |
| | WSP-02 | 10U | 492468 | 6126031 |
| | WSP-04 | 10U | 492112 | 6126506 |
| | WSP-03 | 10U | 492426 | 6126227 |
| | WSP-06 | 10U | 492500 | 6126710 |
| Beaver Pond | WSP-05 | 10U | 479160 | 6148304 |

# Appendix 4. Field forms for waterfowl surveys.

**Land-based Waterfowl Survey**

| | | | |
|---|---|---|---|
| Project: | | Survey: | |
| Study Area: | | Date (dd/mm/yyyy): | |
| Station: | | Station UTM Zone and Coordinates: | |
| Surveyors: | | | |

| | Time | CC | Ceiling | Wind | Wind Direc. | Temperature | Reservoir | Snow Depth (cm) | Precipitation |
|---|---|---|---|---|---|---|---|---|---|
| Start | | | | | | | | | |
| End | | | | | | | | | |

| % snow | % ice | % sand | % gravel | % cobble | % flooded veg. | % other |
|---|---|---|---|---|---|---|
| | | | | | | |

| Polygon ID | Species | # | Sex | # of broods | Age | Moving | Foraging | Other activity | Water | Land | Shallow | Deep | Mud | Shore | Emerg. veg. | Submer. Veg. | Flooded veg. | Grass | Shrub | Tree | Channel | Log stump | Ice | Snow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Comments: | |
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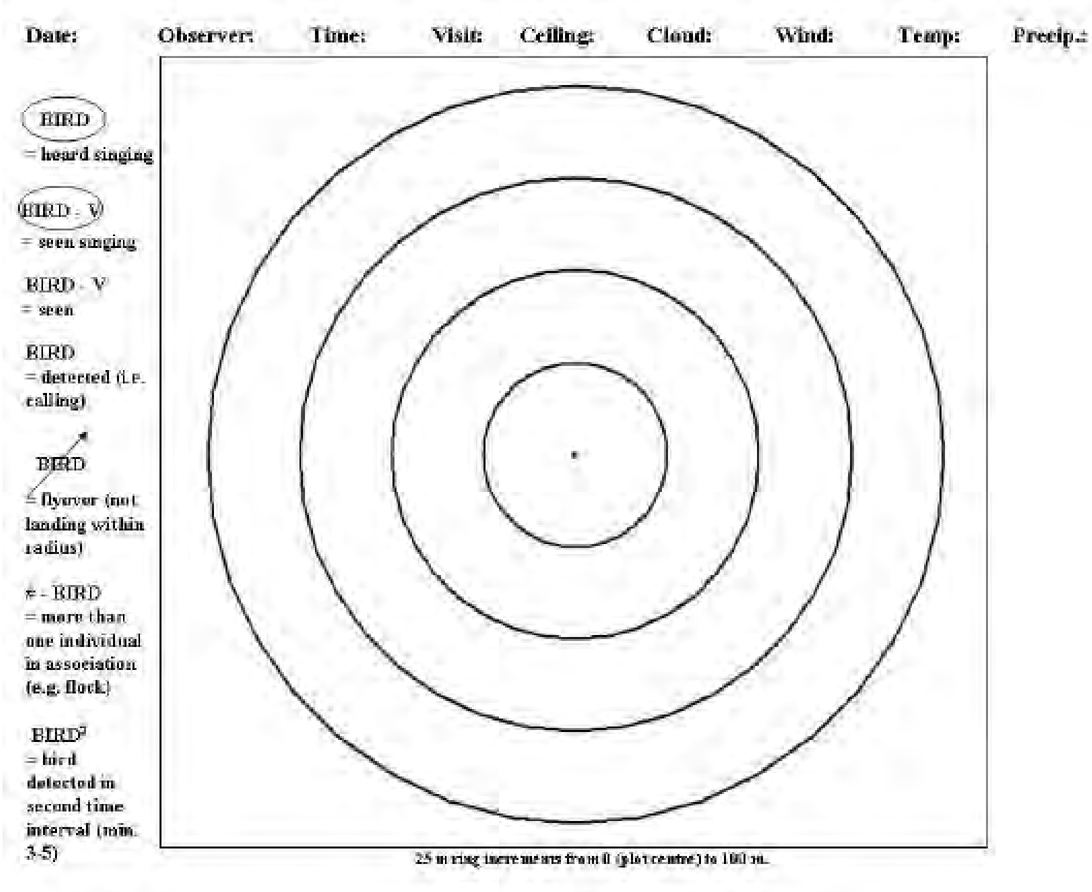
0 0.125 0.25 Kilometers


Beaver Pond
0 0.05 0.1 Kilometers
N

**Appendix 5. UTM coordinates of point count stations at the Airport Lagoon and Beaver Pond sites on Williston Lake, BC.**

| SITE NAME | POINT COUNT STATION | UTM ZONE | EASTING | NORTHING |
|---|---|---|---|---|
| Airport Lagoon | AL-01 | 10U | 492671 | 6125451 |
| | AL-02 | 10U | 492668 | 6125665 |
| | AL-03 | 10U | 492642 | 6125864 |
| | AL-04 | 10U | 492643 | 6126067 |
| | AL-05 | 10U | 492633 | 6126265 |
| | AL-06 | 10U | 492693 | 6126475 |
| | AL-07 | 10U | 492695 | 6126683 |
| | AL-08 | 10U | 492636 | 6126885 |
| | AL-09 | 10U | 492554 | 6127065 |
| | AL-10 | 10U | 492531 | 6126696 |
| | AL-11 | 10U | 492331 | 6126631 |
| | AL-12 | 10U | 492271 | 6126432 |
| | AL-13 | 10U | 492418 | 6126266 |
| | AL-14 | 10U | 492493 | 6126056 |
| | AL-15 | 10U | 492441 | 6125850 |
| | AL-16 | 10U | 492385 | 6125643 |
| | AL-17 | 10U | 492523 | 6125474 |
| Beaver Pond | BP-01 | 10U | 479204 | 6148354 |
| | BP-02 | 10U | 479387 | 6148249 |
| | BP-03 | 10U | 479264 | 6148207 |

## Appendix 6. Field form for breeding bird surveys.



**Appendix 7. Environmental variable codes and definitions for breeding bird surveys.**

**Ceiling:**
The height of cloud cover. Record the average height of clouds during the survey.

ATT = Above Tree-tops
BTT = Below Tree-tops
AR = Above Ridge
BR = Below Ridge
H = High
VH = Very High

**Cloud Cover (CC):**
The extent of cloud cover during the survey period.

1 = clear, 0% cloud cover
2 = scattered clouds, <50% cloud cover
3 = scattered clouds, >50% cloud cover
4 = unbroken clouds, 100% cloud cover

**Wind:**
The strength of the dominant wind over the survey period using the Beaufort Scale. If wind strength split evenly between 1 or more classes, choose that which best characterized the conditions and detectability of birds. Acceptable conditions are Winds 0-3. >3 is considered unacceptable for conducting point counts.

0 = calm (<2 km/h)
1 = light air (2-5 km/h)
2 = light breeze, leaves rustle (6-12 km/h)
3 = gentle breeze, leaves and twigs constantly move (13-19 km/h)
4 = moderate breeze, small branches move, dust rises (20-29 km/h)
5 = fresh breeze, small trees sway (30-39 km/h)
6 = strong breeze, large branches moving, wind whistling (40-49 km/h)
7 = moderate gale+, whole trees in motion (≥50 km/h)

**Precipitation:**
The type of precipitation (if any) during the survey period. Acceptable conditions are no rain through very light drizzle.

N = None
F = Fog
M = Misty Drizzle
D = Drizzle
LR = Light Rain
HR = Hard Rain
LS = Light Snow/Flurries
HS = Heavy Snow

**Appendix 8. Field form for systematic amphibian surveys.**

| ANIMAL OBS. FORM – Pond Breeding Amphibians - *Adult* | | | |
|---|---|---|---|
| Project: | | | |
| Survey: | | | |
| Study Area: | | | |
| Trans. Label: | | Stratum: | |
| Trans. Length (m): | | Trans. Bearing (°): | |
| Date (dd/mm/yyyy): | | | |
| UTM Zone and Coordinates: | POC - ______ | | |
| | POT - ______ | | |
| Surveyors: | | | |

| Obs. Day | Time | Ceiling | CC | Wind | Precip. | Temp. (ambi./ water) | Water Cond. |
|---|---|---|---|---|---|---|---|
| Start | | | | | | | |
| End | | | | | | | |

| Wpt. # | Time | Species | Sex | Age Class | Activity | Loc. | Cov. Obj. | Bot. Sub. |
|---|---|---|---|---|---|---|---|---|
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**Appendix 9. Field form for fish sampling.**

FISH COLLECTION FORM

| | | | | | |
|---|---|---|---|---|---|
| GAZETTED NAME | | (local) | | ☐ LAKE ☐ STREAM ☐ WETLAND | |
| WATERSHED CODE | | | | | |
| WATERBODY ID | | ILP MAP # | ILP # | SITE/LAKE CARD ATTACHED | ☐ Y ☐ N |
| PROJECT ID | | REACH # | – | FISH PERMIT # | |
| DATE | YY MM DD to YY MM DD | AGENCY | | CREW | ☐ RE-SAMPLE |

SITE / METHOD

| SITE # | NID MAP # | NID # | SITE UTM | MTD / NO. | STREAM CONDITION TEMP | CON | TURB. | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | | MTD | | | | | |
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FISH SUMMARY

| SITE # | MTD / # | H / P | SPECIES | STAGE | AGE | TOTAL # | MIN. LENGTH | MAX LENGTH | FISH ACT. | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
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GEAR SPECIFICATIONS

| C | SITE # | MTD / # | HAUL | DATE IN | TIME IN | DATE OUT | TIME OUT | NET / TRAP SPECIFICATIONS: NET TYPE | LENGTH | DEPTH | MESH SIZE | SET | HAB. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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ELECTROFISHER SPECIFICATIONS

| | SITE # | MTD / # | PASS | TIME IN | TIME OUT | EF SEC. | LENGTH | WIDTH | ENCL | VOLTAGE | FREQ. | PULSE | MAKE | MODEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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COMMENTS

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Rev. Apr. 1998

CARD ___ OF ___

## INDIVIDUAL FISH DATA

FISH COLLECTION FORM #

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | R __ F __ |
| | | | | | | | | | | | | | | | | R __ F __ |
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| | | | | | | | | | | | | | | | | R __ F __ |

## INDIVIDUAL FISH DATA

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | R __ F __ |
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COMMENT

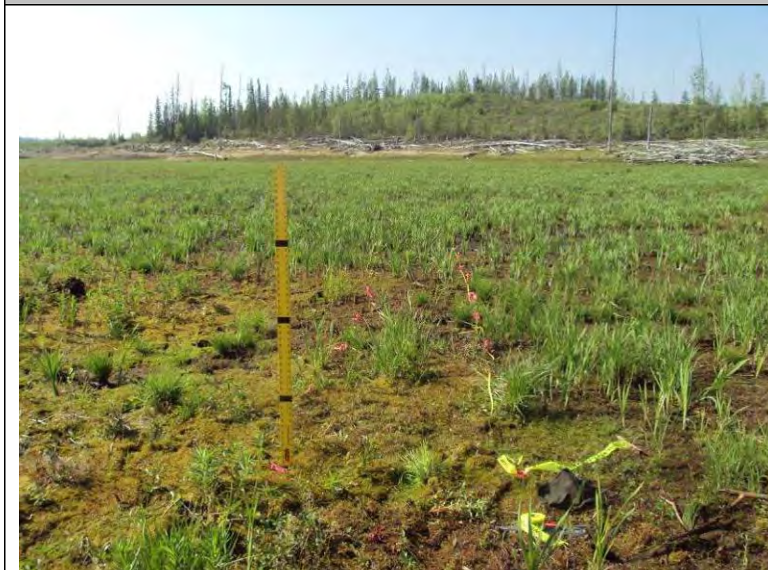
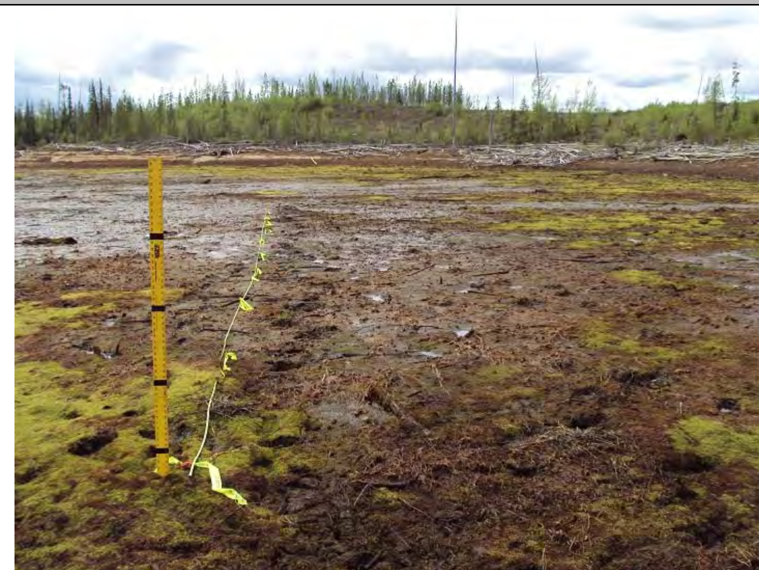
Rev. Apr. 1998

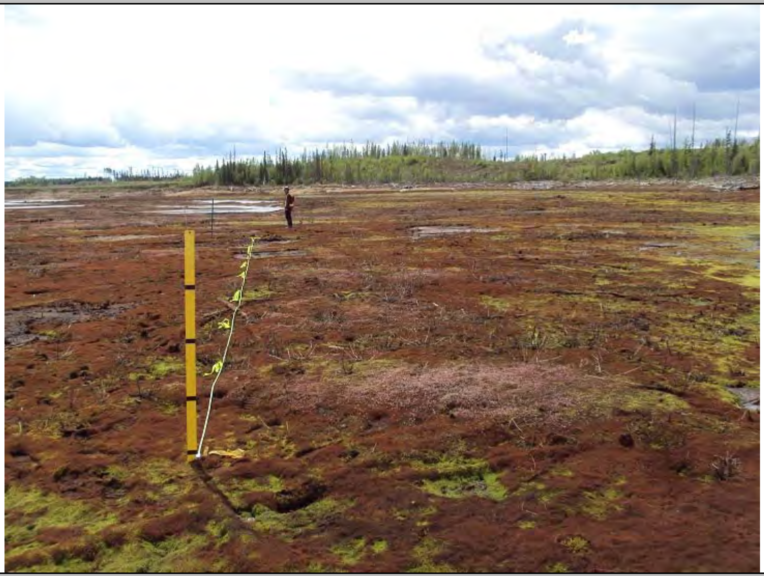
CARD ____ OF ____

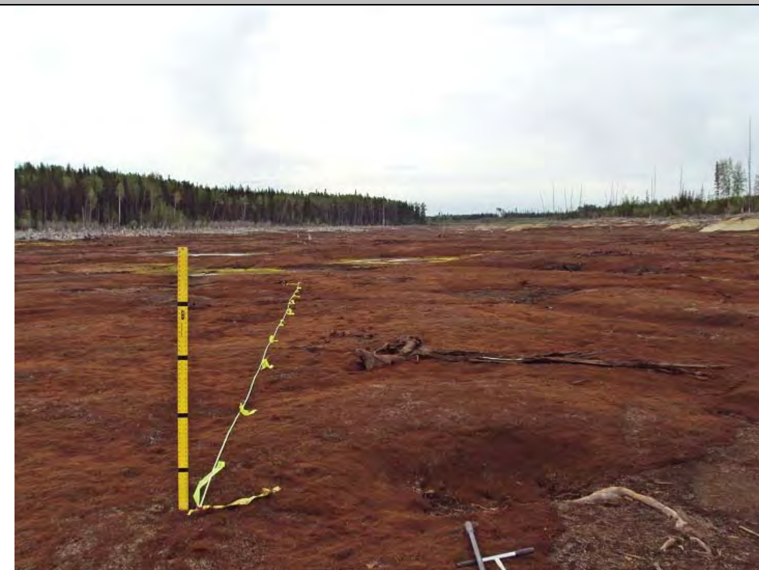
**Appendix 10. Habitat class descriptions in the draw-down zone at the Airport Lagoon and Beaver Pond sites.**

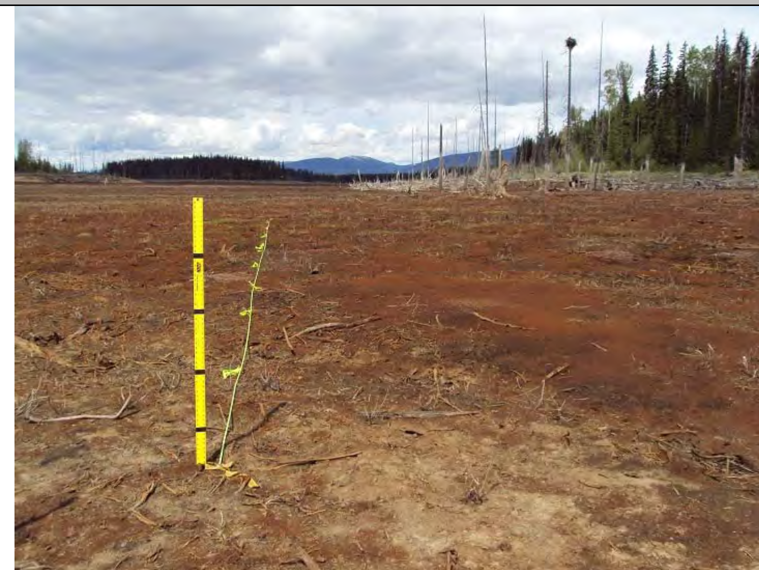
<table>
<tr><th rowspan="2">Habitat Class</th><th colspan="2">Representative Photographs</th></tr>
<tr><th>2011</th><th>2012</th></tr>
<tr><td rowspan="3">SD</td><td></td><td></td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">Shoreline Driftwood (SD): Moderate to high, grass dominated vegetation cover with high (50%) coarse woody debris cover on a gently sloping (3 to 15°) surface expression. Dominating species include bluejoint (Calamagrostis canadensis), Norwegian cinquefoil (Potentilla norvegica) and common horsetail (Equisetum arvense). A diversity of bryophytes such as marsh thread moss (Bryum pseudotriquetum), tree moss (Climancium dendroides) and purple horn-toothed moss (Ceratodon purpureus) may be present. Soils consist of a shallow (1-10 cm depth) organic layer overlying a moderate (11-30 cm) sandy mineral layer. Precipitation is the main water source, soils are rapidly drained and reservoir flooding expected to be frequent (every 2 to 5 years).</td></tr>
</table>

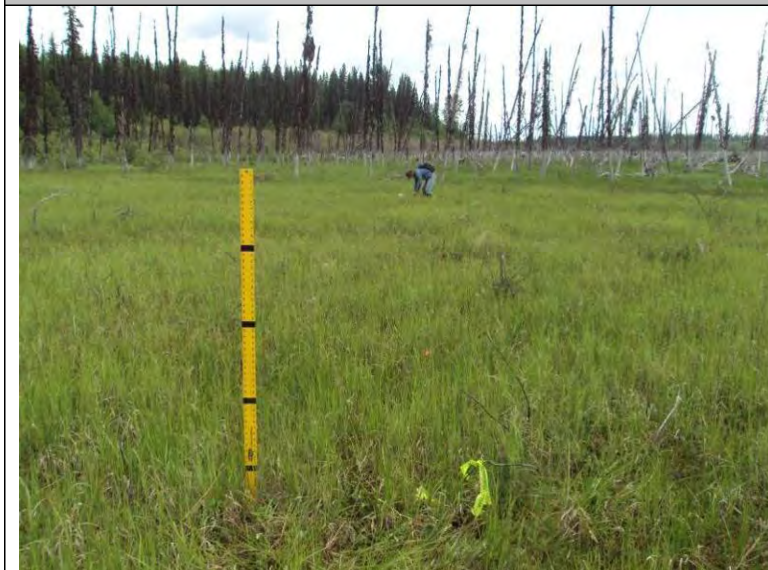
<table>
<tr><td rowspan="5">SS</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Shoreline Sand (SS): Sparse herbaceous vegetation cover with low (5 to 10%) coarse woody debris cover on a gently to moderate (15 to 26°) sloping surface expression. Dominating species include bluejoint, Norwegian cinquefoil, bronze sedge (Carex aenea), marsh yellow cress (Rorippa palustris) and pink corydalyis (Corydalis sempervirens). Soils are composed of a deep (30-50 cm) sandy mineral layer; organic layer is absent. Precipitation is the main water source, soils are rapidly drained and reservoir flooding is expected to be frequent to rare (only during extreme events).</td></tr>
</table>

| | Representative Photographs | |
|---|---|---|
| | **2011** | **2012** |
| CT |  |  |
| | **Description** | |
| | **Cattail Thread Rush (CT):** Moderate s sedge and bryophyte vegetation cover with low coarse woody debris and water cover (5%) on a plain surface expression. Dominating species include common cattail (*Typha latifolia*), bronze sedge, thread rush (*Juncus filiformis*) and creeping feathermoss (*Amblystegium serpens*). Soils are composed of a deep organic layer (at least 50 cm depth); mineral layer is absent. Groundwater water is the main water source, soils are very poorly drained and reservoir flooding is expected to be annual. | |

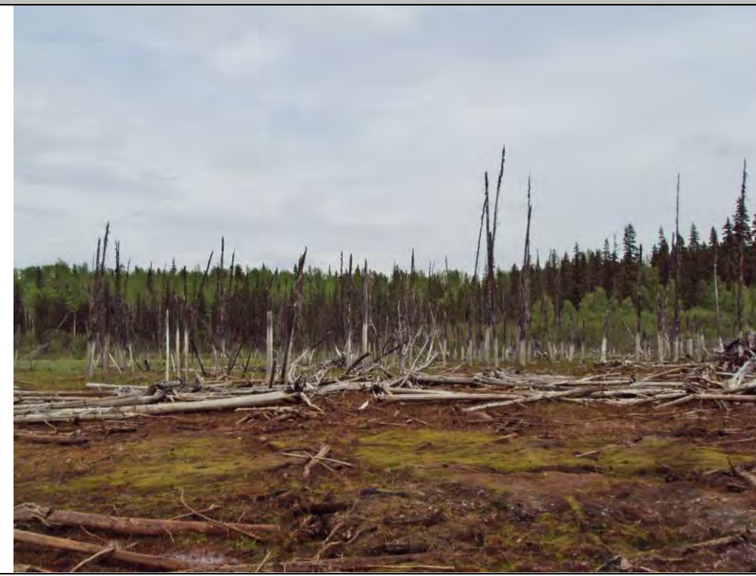
<table>
<tr><td rowspan="5">CM</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Cinquefoil Moss (CM): High bryophyte and moderate herbaceous perennial cover with low coarse woody debris cover on a plain to hummock surface depression. Dominating species include creeping feathermoss, Norwegian cinquefoil, fireweed (Epilobium angustifolium), seedlings of willow (Salix spp.) and trembling aspen (Populus tremuloides) and a few other unidentified herbaceous perennials. Soils are composed of a shallow to moderate organic layer (at least 30 cm) overlying a clay mineral layer. Groundwater is the main water source, soils are very poorly drained and reservoir flooding is expected to occur annually.</td></tr>
</table>

| | Representative Photographs | |
|---|---|---|
| | 2011 | 2012 |
| SM |  |  |
| | Description | |
| | **Smartweed Moss (SM):** High cover of remnants of smartweed (*Persicaria* spp.) from the previous growing season with negligible coarse wood debris cover (<3%) on a plain to hummock surface expression. Other species present include Norwegian cinquefoil, hook moss and marsh thread moss. Soils are composed of shallow to moderate organic layer (20 cm depth) overlying a clay mineral layer. Groundwater is the main water source, soils are imperfectly drained and reservoir flooding is expected to occur annually. | |

<table>
<tr><td rowspan="5">CF</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Cinquefoil Fireweed (CF): Moderate herbaceous perennial and bryophyte cover with negligible coarse woody debris cover on plain to gently sloping surface expression. Dominant species include Norwegian cinquefoil, fireweed, marsh yellow cress, and seedlings of willow and trembling aspen; creeping feathermoss is the dominant bryophyte. Soils are composed of a shallow organic layer overlying a moderate clay mineral layer. Groundwater is the main water source, soils are imperfectly drained and reservoir flooding is expected to be annual.</td></tr>
</table>

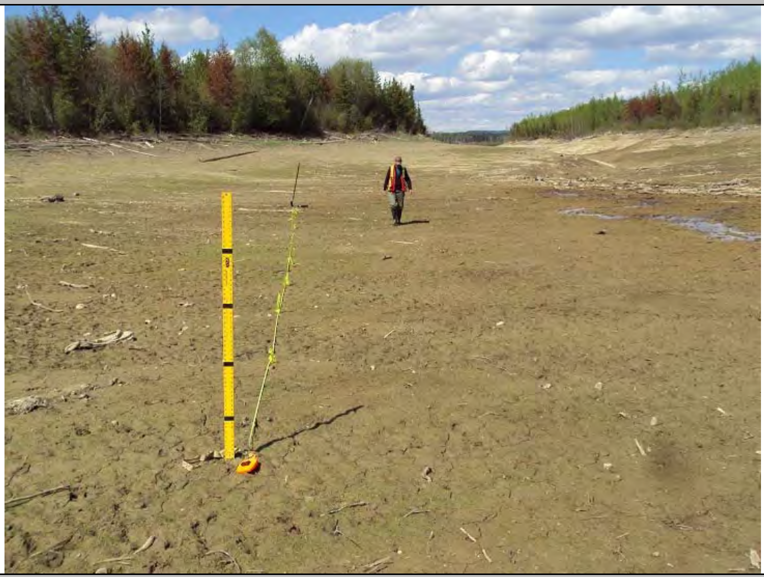
<table>
<tr><td rowspan="5">WS</td><th colspan="2">Representative Photographs</th></tr>
<tr><th>2011</th><th>2012</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">Wetland Sedge (WS): High sedge and bryophyte dominated vegetation cover with negligible coarse woody debris cover on a plain to depressed surface expression. Dominant species include hook moss, marsh thread moss, giant calliergon moss, common cattail, bronze sedge (along with 2 to 3 other species of sedges [Carex spp.]), swamp horsetail (Equisetum fluviatile), small bedstraw (Galium trifidum), water smartweed (Persicaria amphibian), common mare's-tail (Hippuris vulgaris) and buckbean (Menyanthes trifoliata). Soils are composed of a deep organic layer either overlying a clay mineral layer or mineral layer absent. Groundwater is the main water source (surface and subsurface seepage), soils are very poorly drained and reservoir flooding is expected to be frequent.</td></tr>
</table>

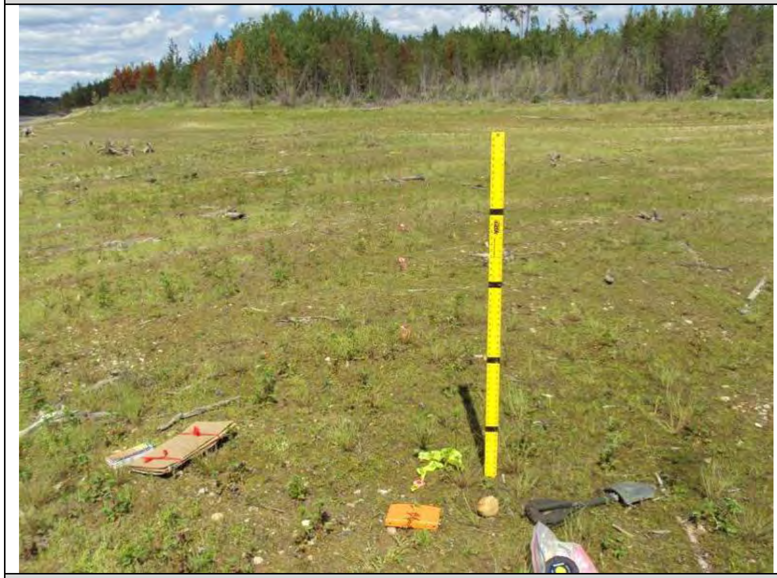
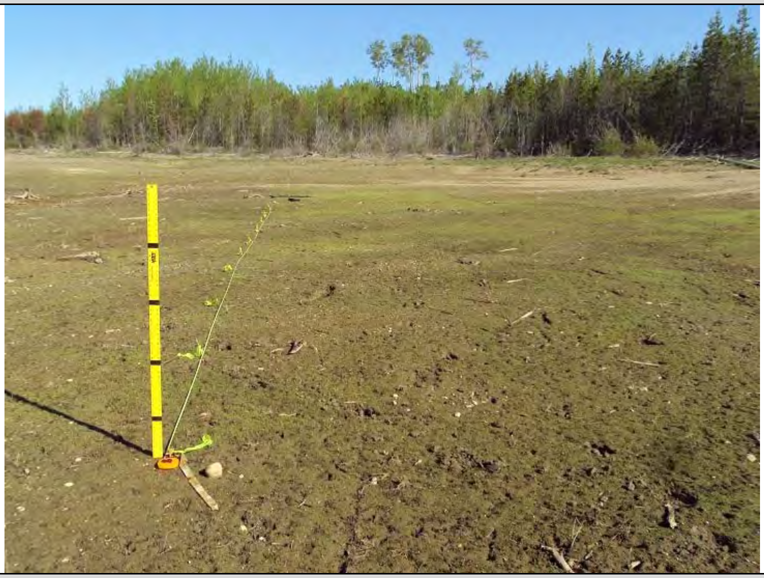
| | Representative Photographs | |
|---|---|---|
| | **2011** | **2012** |
| WW |  | No picture available |
| | **Description** | |
| | **Wetland Willow (WW):** Moderate shrub and high grass/sedge dominated vegetation cover with negligible coarse woody debris cover and a gentle sloping surface expression. Species present consist of a variety of willows, sedges, grasses and bryophytes. Flooding is expected to be frequent to rare. | |

<table>
<tr><td rowspan="5">WD</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Wetland Dead Trees (WS): High herbaceous perennial and low dead standing tree (snag) cover with low to moderate coarse woody debris cover on a gently sloping surface expression. Dominant species include swamp horsetail, water smartweed, buckbean, sedges and slender cottongrass (Eriophorum gracile). A low cover (approximately 15%) of standing dead black spruce (Picea mariana) trees is present. Groundwater is the main water source (surface and subsurface seepage), soils are very poorly drained and flooding is expected to be annual to frequent.</td></tr>
</table>

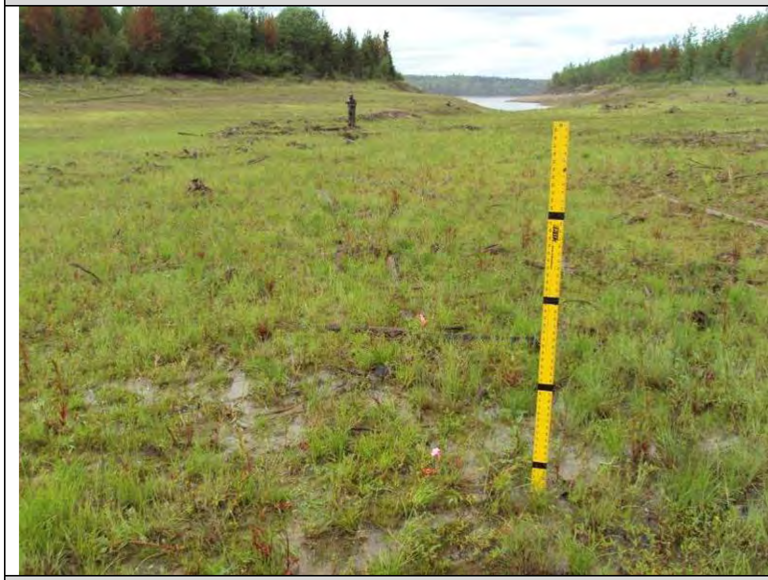
<table>
<tr><td rowspan="5">WH</td><th colspan="2">Representative Photographs</th></tr>
<tr><th>2011</th><th>2012</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">Wetland Horsetail (WH): High horsetail and bryophyte dominated vegetation cover with low to moderate coarse woody debris cover on a plain to gently sloping surface expression. Dominant species include swamp horsetail, Norwegian cinquefoil, buckbean, small bedstraw, willows, and a diversity of bryophytes (marsh thread moss, giant calliergon moss, glow moss and purple horn-toothed moss). Soils are composed of a moderate organic layer; mineral layer is absent. Groundwater is the main water source surface and subsurface seepage), soils are very poorly drained and flooding is expected to be annual to frequent.</td></tr>
</table>

<table>
<tr><td rowspan="5">SW</td><th colspan="2">Representative Photographs</th></tr>
<tr><th>2011</th><th>2012</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">Shoreline Willow (SW): High grass and shrub dominated vegetation cover with high coarse woody debris cover on a gently to moderate sloping surface expression. Dominant species include common horsetail, fireweed, bluejoint and Norwegian cinquefoil with patches of willow (e.g., Alaska willow [Salix alaxensis], Barclay's willow [Salix barclayi]. Soils are composed of a shallow organic layer overlying a clay mineral layer. Precipitation is the main water source, soils are moderately well drained and flooding is expected to be rare.</td></tr>
</table>

<table>
<tr><td rowspan="5">CS</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Cryptantha Speedwell (CS): Moderate herbaceous perennial cover with negligent coarse woody debris and low coarse rock cover (5%) on a plain to gentle sloping surface expression. Dominant species includes Torrey's cryptantha (Cryptantha torreyana), purslane speedwell (Veronica peregrina var. xalapensis) and Norwegian cinquefoil. Soils are composed of a deep clay mineral layer; organic layer is absent. Groundwater is the main water source, soils are very poorly drained and flooding is expected to occur annually.</td></tr>
</table>

<table>
<tr><td rowspan="5">CB</td><td colspan="2">Representative Photographs</td></tr>
<tr><td>2011</td><td>2012</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Description</td></tr>
<tr><td colspan="2">Cinquefoil Bluegrass (CB): Moderate herbaceous perennial cover with low coarse woody debris and coarse rock cover on a gently sloping surface expression. Dominant species include red sandy-spurry (Spergularia rubra), abbreviated bluegrass (Poa abbreviata ssp. pattersonii), Arctic pearlwort (Sagina saginoides) and Norwegian cinquefoil. Soils are composed of a deep clay mineral layer; overlying organic layer is absent. Groundwater is the main water source, soils are very poorly drained and flooding is expected to occur annually.</td></tr>
</table>

<table>
<tr><td rowspan="5">SC</td><th colspan="2">Representative Photographs</th></tr>
<tr><th>2011</th><th>2012</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">Shoreline Cinquefoil (SC): Sparse herbaceous vegetation cover with low coarse woody debris and coarse rock cover on gentle to moderate sloping surface expression. The most common species present is Norwegian cinquefoil. Water source is precipitation and flooding is expected to be annual to frequent.</td></tr>
</table>

| | Representative Photographs | |
|---|---|---|
| | **2011** | **2012** |
| SB |  |  |
| | **Description** | |
| | **Stream Bluejoint (SB):** Moderate to high sedge and bryophyte cover with negligible coarse woody and low water cover on a plain to gently sloping surface expression. Dominant species include marsh thread moss and aquatic apple moss (*Philonotis fotana*), marsh yellow cress, Norwegian cinquefoil, bronze sedge, Enander's sedge (*Carex lenticularis* var. *dolia*), purslane speedwell, willow, American speedwell (*Veronica americana*) and bluejoint. Soil are composed of a moderate organic layer (10 cm depth) overlying a clay and sand mineral layer. Groundwater is the main water source, soils are very poorly drained and flooding is expected to be frequent. | |

| | Representative Photographs | |
|---|---|---|
| | **2011** | **2012** |
| SG |  |  |
| | **Description** | |
| | **Shoreline Gravel (SG):** Low to moderate grass dominated vegetation cover with negligent coarse woody debris and moderate coarse rock cover on a gently to moderate sloping surface expression. Dominant species include bluejoint, Norwegian cinquefoil, bronze sedge, fireweed, common horsetail and purslane speedwell. Soils are composed of a deep sandy mineral layer; organic layer is absent. Precipitation is the main water source, soils are rapidly drained and reservoir flooding is expected to be rare. | |

| | | |
|---|---|---|
| WB | **Water Body (WB):** Areas of open water and perennial water flow. Emergent or submergent vegetation identified include white water-buttercup (*Ranunculus aquatilis*), small yellow water-buttercup (*Ranunculus gmelinii*), buckbean, common cattail, common mare's-tail, water smartweed, common duckweed (*Lemna minor*), variegated yellow pond-lily (*Nuphar variegata*), hornwort (*Ceratophyllum* sp.) and a few other species unidentified. |  |

**Appendix 11. Summary of percent cover by plant species averaged across 10 quadrats in a 20 m belt-transect for 15 transects.**

| Group | Species | Transect | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AL1 | AL2 | AL3 | AL4 | AL5 | AL6 | AL7 | AL8 | AL9 | AL10 | BP1 | BP2 | BP3 | BP4 | BP5 | |
| Herbs/Forbs/ Graminoids | Bluejoint | 0.00 | 0.00 | 0.00 | 0.00 | 4.30 | 0.10 | 3.10 | 0.00 | 2.35 | 3.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.58 | **2.32** |
| | Buckbean | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **6.25** |
| | Common horsetail | 0.00 | 0.00 | 0.00 | 0.00 | 0.63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.05 | 0.00 | 0.66 | **0.78** |
| | Common mare's-tail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.36** |
| | Common spike-rush | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **1.07** |
| | Green sedge | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.30** |
| | Marsh cinquefoil | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **1.96** |
| | Reed canarygrass | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.23** |
| | Sedge sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.20 | 4.75 | 0.00 | 0.00 | 0.05 | 0.00 | 0.05 | 0.00 | 0.00 | 0.70 | **0.97** |
| | Small yellow water-buttercup | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.05** |
| | Swamp horsetail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.70 | 0.55 | 0.00 | 0.00 | 2.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **2.95** |
| | Thread rush | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.25** |
| | Gramineae 4 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.13** |
| | Unknown 3 | 0.01 | 0.41 | 0.00 | 9.70 | 0.00 | 0.00 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **2.80** |
| | Unknown 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.77 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **1.07** |
| | Unknown 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | 0.69 | 0.05 | 10.60 | 0.00 | **4.81** |
| | Unknown 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.80 | 0.87 | 0.00 | 0.00 | 0.00 | **1.34** |
| | Unknown 18 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.05** |
| | Unknown 19 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.04** |
| | Unknown 20 | 0.00 | 0.00 | 0.05 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.09** |
| | Water sedge | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 | 0.00 | **0.30** |
| | Water smartweed | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.16 | 2.60 | 0.00 | 0.15 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **1.24** |
| | **Herb/Forb/Graminoid Total** | **0.13** | **0.41** | **0.07** | **9.70** | **1.10** | **1.27** | **3.15** | **1.42** | **0.74** | **1.28** | **4.85** | **0.54** | **0.47** | **10.60** | **0.65** | **1.24** |
| Mosses | Creeping Feathermoss | 9.70 | 13.10 | 0.00 | 0.00 | 0.00 | 32.40 | 10.80 | 9.20 | 0.50 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | Giant Calliergon Moss | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 89.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **10.86** |
| | Tree Moss | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **44.63** |
| | Hook Moss | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.70** |
| | **Moss Total** | **9.7** | **13.1** | **0** | **0** | **0** | **32.4** | **49.9** | **9.2** | **0.6** | **7.7** | **0** | **0** | **0** | **0** | **0** | **22.55** |
| Shrubs | Bebb's willow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | **0.30** |
| | Willow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.45 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | **0.60** |
| | **Shrub Total** | **0** | **0** | **0** | **0** | **0** | **0** | **0.1** | **0** | **0** | **0.45** | **0** | **0.05** | **0** | **0** | **0.3** | **0.45** |

**Appendix 12. Summary of bird detections by point count station across three replicates at the Airport Lagoon and Beaver Pond sites, Williston Lake, BC.**

| Species[1] | POINT COUNT STATION | | | | | | | | | | | | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AL-01 | AL-02 | AL-03 | AL-04 | AL-05 | AL-06 | AL-07 | AL-08 | AL-09 | AL-10 | AL-11 | AL-12 | AL-13 | AL-14 | AL-15 | AL-16 | AL-17 | BP-01 | BP-02 | BP-03 | |
| **ALFL** | | | | 1 | 2 | 1 | 4 | | | | | | | | | | 2 | 2 | | | 12 |
| **AMCR** | | | 2 | | 1 | | | | | | | | | | | | | | | | 3 |
| **AMKE** | | | | | | | | | | | | | | | | | | | 1 | | 1 |
| **AMRE** | | | | 1 | 1 | | 1 | 4 | | | 1 | | | | | | | 2 | 4 | 2 | 16 |
| **AMRO** | 3 | 1 | 2 | 1 | | 1 | 3 | | 3 | 2 | | 2 | | 2 | 2 | 1 | | 1 | 1 | 1 | 26 |
| **ATTW** | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| **BAEA** | 1 | | | | | | | | | | | | | | | | | | | | 1 |
| **BARS** | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| **BCCH** | | | | | | | | | 1 | | | | | | | | | 1 | | | 2 |
| **BHCO** | | | 1 | 2 | 1 | | 1 | 2 | 2 | | 1 | | | | | | | | | | 10 |
| **BWTE** | | | | | | | | | | | | | | 1 | | | | | | | 1 |
| **CANG** | | | | | 1 | | | 1 | | | 1 | | | 2 | 1 | | 1 | | | | 7 |
| **CAVI** | | | 1 | | | | | | | | | | | | | | | | | | 1 |
| **CEDW** | 1 | 1 | | 1 | | 2 | 1 | 2 | 1 | | | | | | 1 | | | | | | 10 |
| **CHSP** | 2 | 1 | 1 | 3 | | | 2 | 1 | | 1 | 3 | 1 | | | | | | | 2 | 3 | 20 |
| **COLO** | | | | | | | | | | | 1 | 1 | | | | | 1 | | | | 3 |
| **CORA** | | | | | | | | | | | 1 | 2 | | | 1 | | | | 1 | | 5 |
| **COYE** | | | | | | | | | 1 | | | 1 | | | | | | | | | 2 |
| **DEJU** | 1 | | | 1 | | 1 | 3 | 1 | 1 | | | | 1 | 1 | | 1 | | | 2 | | 13 |
| **DUFL** | | | | | | | | | | | | | 1 | 2 | 1 | | | 4 | | | 8 |
| **GRYE** | | 1 | 1 | | | | 1 | | | | 1 | | 2 | | | | | | | | 6 |
| **HAFL** | | 1 | | | | | 1 | 1 | | 2 | | 1 | 1 | 1 | | 1 | | 1 | | | 10 |
| **HETH** | | | | | | | | | | | | | | | 1 | | | | | | 1 |
| **KILL** | | | 1 | 1 | | | 2 | | | | | | 2 | | | | | | | 1 | 7 |
| **LEFL** | | | | | | | | | 1 | | | | | | | | | | | | 1 |
| **LEYE** | | 1 | | 1 | | | | | | 1 | | | 1 | | | | | | | | 4 |
| **LISP** | 2 | 1 | 1 | 1 | | 1 | 2 | 1 | | | | 1 | | | | | | | | | 10 |
| **MALL** | | 1 | | | 1 | 1 | | 1 | | | | | | | | | | | | | 4 |
| **MAWA** | | | | 1 | | | | | | | | 1 | | | | | | | | | 2 |
| **MGWA** | | | | 1 | | | | | | | 1 | | | | | | | | | | 2 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOBL** | | | | | | | | | | 2 | | | | | 1 | | | | | | 3 |
| **NOFL** | | 1 | 1 | | | | | | | | | | | | | | | | | | 2 |
| **NOPI** | | | | | | | | | | | | | 1 | | | | | | | | 1 |
| **NOWA** | 2 | 3 | 1 | 1 | 3 | 1 | | | 1 | | | | | | | | | | 1 | | 13 |
| **OCWA** | 2 | 3 | 2 | | | | 1 | | 1 | 2 | 2 | 4 | 4 | 2 | 1 | 3 | 2 | 4 | 3 | 5 | 41 |
| **OSFL** | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| **OSPR** | | 1 | 2 | | 3 | | | | | | 1 | | | | | | | | | | 7 |
| **PISI** | 3 | 1 | 2 | 1 | 1 | 4 | 1 | 3 | | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | | | 2 | 31 |
| **RBNU** | | | 1 | | | | | | | | | | | | | | | | | | 1 |
| **RCKI** | | | | | | 1 | | 2 | | | 1 | 1 | | | | | | | | | 5 |
| **REVI** | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| **RUHU** | | | | | | | | 1 | | | | | | | | | | | | | 1 |
| **SAVS** | | | | | 1 | | | 2 | 1 | 1 | | | 3 | | | | | | | | 8 |
| **SOSP** | | | 1 | | 1 | 1 | | 1 | 3 | | | | | | | | | | | | 7 |
| **SPSA** | 1 | 1 | 3 | | 2 | | 2 | | 1 | 4 | 1 | 1 | 1 | | 2 | 1 | | 1 | | | 21 |
| **SWTH** | 1 | | 1 | | | | | | | 1 | 1 | | | | | | | 2 | 1 | | 7 |
| **TEWA** | | 1 | 5 | 2 | 1 | | 2 | 1 | | | 1 | | | | | | | 3 | | 1 | 17 |
| **TRES** | | | 1 | 1 | | | | 1 | 1 | 1 | | 2 | 1 | 2 | 3 | 1 | | | 1 | | 15 |
| **VGSW** | | | | | | | | | | | | 1 | | | 1 | | | | | | 2 |
| **WAVI** | 3 | 1 | | | | | | 2 | | | | | | | | | | 5 | 5 | 3 | 19 |
| **WETA** | 1 | | | | | | | | | 2 | 2 | | | | | | 1 | | | | 6 |
| **WEWP** | | | | | | | | | | | 1 | | | | | | | | | | 1 |
| **WISN** | | | | | | | | | | | 1 | 1 | | | | | | | | | 2 |
| **WIWA** | 2 | | | 1 | | | | | | | | 1 | | | | 1 | 2 | 2 | | | 9 |
| **WIWR** | | | | 1 | | | | | | | | | | | | | | | | | 1 |
| **WTSP** | 1 | 1 | | | | 1 | | | | | | | | | | | | 1 | | 1 | 5 |
| **YRWA** | 3 | | | | | | | 1 | | | 4 | 1 | | | 1 | | 2 | 1 | | | 13 |
| **YWAR** | | | | 2 | 2 | 1 | | 2 | 1 | | | | | 1 | | | | | | 1 | 10 |
| **Grand Total** | 29 | 24 | 30 | 24 | 21 | 16 | 27 | 30 | 19 | 22 | 27 | 24 | 19 | 15 | 17 | 11 | 12 | 30 | 22 | 21 | 440 |

[1]Species codes follow RIC (2002)

**Appendix 13. UTM coordinates of amphibian detections at the Airport Lagoon and Beaver Pond sites on Williston Lake, BC.**

| SITE | DATE | TRANSECT | START TIME | END TIME | SPECIES | TIME | AGE CLASS | UTM ZONE | EASTING | NORTHING |
|---|---|---|---|---|---|---|---|---|---|---|
| Airport Lagoon | 17-May-12 | 7 | 9:30 | 9:59 | Western Toad | 9:43 | Adult | 10U | 492489 | 6126021 |
| Airport Lagoon | 17-May-12 | 32 | 14:11 | 14:32 | Western Toad | 14:24 | Adult | 10U | 492620 | 6126485 |
| Airport Lagoon | 17-May-12 | 25 | 15:45 | 16:41 | Western Toad | 16:01 | Adult | 10U | 492470 | 6126936 |
| Airport Lagoon | 17-May-12 | 25 | 15:45 | 16:41 | Western Toad | 16:07 | Adult | 10U | 492474 | 6126939 |
| Airport Lagoon | 17-May-12 | 25 | 15:45 | 16:41 | Long-toed Salamander | 16:24 | Adult | 10U | 492447 | 6126952 |
| Airport Lagoon | 17-May-12 | 25 | 15:45 | 16:41 | Long-toed Salamander | 16:25 | Adult | 10U | 492455 | 6126956 |
| Beaver Pond | 18-May-12 | BP-A-01 | 10:15 | 11:24 | Western Toad | 10:18 | Adult | 10U | 479233 | 6148297 |
| Beaver Pond | 12-Jun-12 | BP-A-01 | 7:55 | 8:28 | Unknown | 7:58 | Tadpoles | 10U | 479274 | 6148252 |
| Beaver Pond | 12-Jun-12 | BP-A-01 | 7:55 | 8:28 | Wood Frog | 8:14 | Adult | 10U | 479398 | 6148216 |

**Appendix 14. Fish capture data for 2012 (Year 2).**

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | burbot | 111 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | burbot | 159 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | burbot | 163 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 34 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 35 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 38 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 43 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 44 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 50 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 60 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 85 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | prickly sculpin | 89 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | largescale sucker | 65 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | largescale sucker | 66 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | lake chub | 35 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | lake chub | 46 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | lake chub | 77 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | lake chub | 85 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 25 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 26 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 26 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 29 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 29 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 29 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 30 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 31 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 31 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 32 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 32 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 33 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 34 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 35 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 37 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 37 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 38 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 41 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 42 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 42 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 44 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | northern pikeminnow | 46 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | redside shiner | 77 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | sucker sp. | 53 |
| Airport Lagoon | 17/05/2012 | electrofisher | 1 | sucker sp. | 61 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | burbot | 123 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | burbot | 127 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | burbot | 158 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | burbot | 182 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | prickly sculpin | 51 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | lake chub | 74 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 33 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 37 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 39 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 39 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 40 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 41 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 44 |
| Airport Lagoon | 17/05/2012 | electrofisher | 2 | northern pikeminnow | 45 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 116 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 120 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 127 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 128 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 145 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 146 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 147 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 153 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 157 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 157 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | burbot | 165 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | prickly sculpin | 33 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | prickly sculpin | 44 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | prickly sculpin | 45 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | prickly sculpin | 48 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | prickly sculpin | 54 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | largescale sucker | 61 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | largescale sucker | 64 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | lake chub | 42 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 29 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 30 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 32 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 32 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 39 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 39 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | northern pikeminnow | 44 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | redside shiner | 36 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | redside shiner | 38 |
| Airport Lagoon | 17/05/2012 | electrofisher | 3 | sucker sp. | 34 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 140 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 145 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 147 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 149 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 153 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 158 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | burbot | 176 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | brassy minnow | 38 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | brassy minnow | 53 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | brassy minnow | 58 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | brassy minnow | 74 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | largescale sucker | 61 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | largescale sucker | 98 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | largescale sucker | 106 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 72 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 72 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 93 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 95 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 41 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 42 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 44 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 44 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 45 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 46 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 46 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 49 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 81 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 82 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 82 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | lake chub | 91 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | longnose sucker | 117 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | longnose sucker | 138 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 38 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 39 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 40 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 41 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 41 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 42 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 43 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 43 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | northern pikeminnow | 88 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | peamouth | 49 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 32 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 34 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 37 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 37 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 38 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 38 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 39 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 40 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 41 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 47 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 48 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 51 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 52 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 54 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 57 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 58 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 63 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 65 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 65 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 66 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 71 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 71 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 71 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 73 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 74 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 75 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 76 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 77 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 78 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 78 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 79 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 79 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 80 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 95 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 98 |
| Airport Lagoon | 17/05/2012 | fyke net | 1 | redside shiner | 101 |
| Airport Lagoon | 17/05/2012 | minnow trap | 1 | lake chub | 79 |
| Airport Lagoon | 17/05/2012 | minnow trap | 2 | burbot | 143 |
| Airport Lagoon | 17/05/2012 | minnow trap | 3 | largescale sucker | 135 |
| Airport Lagoon | 17/05/2012 | minnow trap | 3 | lake chub | 70 |
| Airport Lagoon | 17/05/2012 | minnow trap | 3 | lake chub | 79 |
| Airport Lagoon | 17/05/2012 | minnow trap | 5 | brassy minnow | 62 |
| Airport Lagoon | 17/05/2012 | minnow trap | 7 | lake chub | 84 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | brassy minnow | 63 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | largescale sucker | 123 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 71 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 72 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 72 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 73 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 77 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 79 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 79 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 80 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 83 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 87 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 88 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 93 |
| Airport Lagoon | 17/05/2012 | minnow trap | 8 | lake chub | 95 |
| Airport Lagoon | 17/05/2012 | minnow trap | 9 | prickly sculpin | 98 |
| Airport Lagoon | 17/05/2012 | minnow trap | 9 | lake chub | 73 |
| Airport Lagoon | 17/05/2012 | minnow trap | 10 | burbot | 143 |
| Airport Lagoon | 17/05/2012 | minnow trap | 11 | burbot | 129 |
| Airport Lagoon | 17/05/2012 | minnow trap | 11 | burbot | 135 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | burbot | 129 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | prickly sculpin | 50 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 54 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 58 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 66 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 67 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 67 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 69 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 72 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 74 |
| Airport Lagoon | 17/05/2012 | minnow trap | 12 | redside shiner | 81 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Beaver Pond | 18/05/2012 | electrofisher | 1 | redside shiner | 27 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 118 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 121 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 123 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 125 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 131 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 132 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 133 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 134 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 135 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 138 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 141 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 143 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 155 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 158 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 159 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 161 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | burbot | 161 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | brassy minnow | 43 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | prickly sculpin | 47 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | prickly sculpin | 49 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | largescale sucker | 115 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 41 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 45 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 47 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 50 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 76 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | lake chub | 90 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | longnose sucker | 128 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | northern pikeminnow | 41 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | northern pikeminnow | 47 |
| Airport Lagoon | 01/06/2012 | electrofisher | 4 | northern pikeminnow | 51 |
| Airport Lagoon | 20/07/2012 | fyke net | 1 | longnose sucker | 157 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 34 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 34 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 51 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 53 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 55 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 56 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 56 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 56 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 61 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 61 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 61 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 61 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 62 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 62 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 62 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 63 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 63 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 65 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 66 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 67 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | brassy minnow | 70 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 82 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 98 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 110 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 111 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 131 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | largescale sucker | 152 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 27 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 34 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 35 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 37 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 38 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 38 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 44 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 45 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 48 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 55 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 59 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 62 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 63 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 65 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 67 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 72 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 83 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 84 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | lake chub | 97 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 77 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 78 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 90 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 91 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 91 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 92 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 101 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 103 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 107 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 109 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 116 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 123 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 131 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 136 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 136 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 137 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 139 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 141 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 141 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 142 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 145 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 146 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 146 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 147 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 148 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 149 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 150 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 152 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 153 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 155 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 156 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 158 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 159 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 161 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 161 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 161 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 163 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 164 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 164 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 164 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 164 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 170 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 176 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 178 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | longnose sucker | 239 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 30 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 33 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 35 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 35 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 36 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 36 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 37 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 37 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 48 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 51 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 52 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 53 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 55 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 80 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 94 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 114 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 119 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 121 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 122 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 126 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 128 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 130 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 131 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 132 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 134 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 134 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 138 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | northern pikeminnow | 142 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 27 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 31 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 32 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 43 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 43 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 44 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 44 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 44 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 44 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 45 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 46 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 46 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 47 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 49 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 49 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 49 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 50 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 51 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 51 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 52 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 53 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 54 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 55 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 57 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 58 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 61 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 66 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 66 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 67 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 70 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 70 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 71 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 71 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 73 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 74 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 75 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 75 |

| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 75 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 76 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 77 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 78 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 78 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 78 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 78 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 79 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 79 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 79 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 81 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 81 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 81 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 81 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 82 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 83 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 83 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 83 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 84 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 85 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 88 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 88 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 88 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 90 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 91 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 91 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 95 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 96 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 97 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 97 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 100 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 102 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | redside shiner | 104 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 126 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 146 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 160 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 168 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 184 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 192 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 192 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 196 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 235 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 235 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 248 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 268 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 290 |
| Airport Lagoon | 20/07/2012 | fyke net | 2 | white sucker | 380 |
| Airport Lagoon | 20/07/2012 | minnow trap | 2 | northern pikeminnow | 54 |
| Airport Lagoon | 20/07/2012 | minnow trap | 6 | lake chub | 67 |
| Airport Lagoon | 20/07/2012 | minnow trap | 12 | lake chub | 61 |
| Airport Lagoon | 20/07/2012 | minnow trap | 12 | lake chub | 65 |

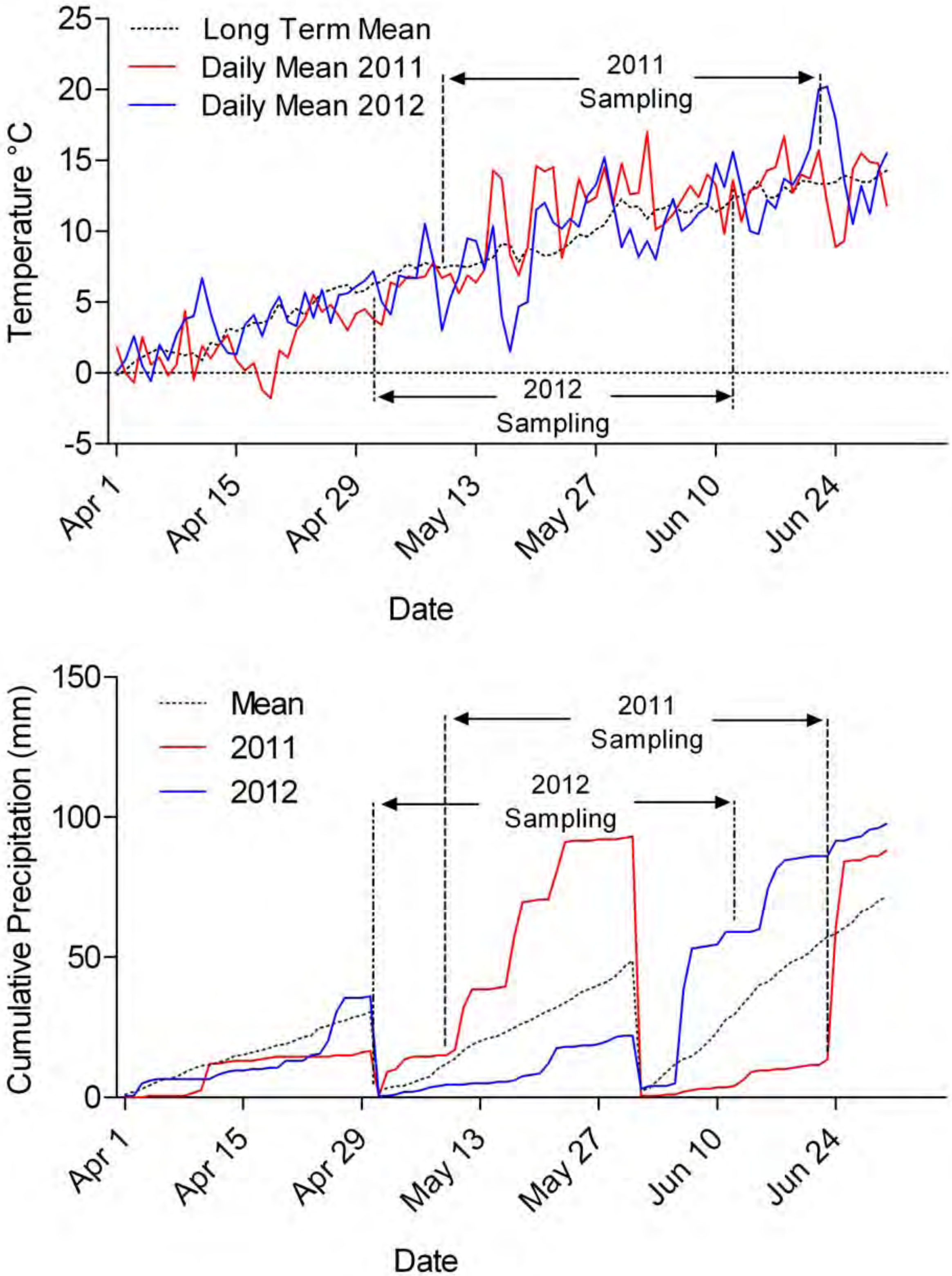
| Location | Date (dd/mm/yyyy) | Capture Method | Sample Site | Species | Length (mm) |
|---|---|---|---|---|---|
| Airport Lagoon | 20/07/2012 | minnow trap | 12 | redside shiner | 90 |
| Beaver Pond | 22/07/2012 | fyke net | 1 | bull trout | 210 |
| Beaver Pond | 22/07/2012 | fyke net | 1 | largescale sucker | 334 |
| Beaver Pond | 22/07/2012 | fyke net | 1 | longnose sucker | 323 |
| Beaver Pond | 22/07/2012 | fyke net | 1 | northern pikeminnow | 352 |
| Beaver Pond | 22/07/2012 | minnow trap | 3 | peamouth | 127 |

**Appendix 15. Water quality data collected during fish sampling at the Airport Lagoon and Beaver Pond sites.**

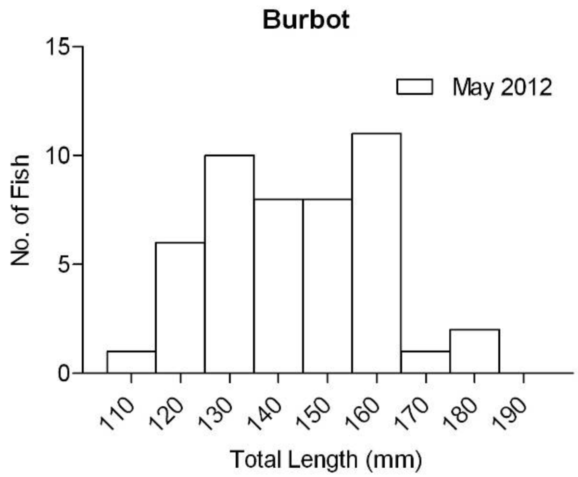
| Site | Date | Location[1] | Temperature (°C) | Conductivity (µS/cm) | pH | Dissolved Oxygen (mg/L) | Turbidity[2] | Secchi Depth (m) |
|---|---|---|---|---|---|---|---|---|
| Airport Lagoon | May 17 | EF2 | 9.58 | 250 | 7.7 | 12.4 | C | n/a |
| | | EF3 | 8.8 | 212 | 7.12 | 12.03 | C | n/a |
| | | EF1 | 12.9 | 218 | 7.34 | 12.02 | C | n/a |
| | June 1 | EF4 | 14.9 | 252 | 6.87 | 9.28 | C | n/a |
| | July 20 | near MT4 | 22.1 | 180.8 | 8.02 | 8.16 | n/a | 4.1 |
| Beaver Pond | May 18 | EF1 | 8.3 | 72 | 4.52 | 11.55 | C | n/a |
| | June 3 | EF1 | 18.9 | 114.7 | 6.32 | 7.42 | C | n/a |
| | | lake[3] | 11.1 | 98.7 | 7.00 | 10.33 | n/a | - |
| | July 22 | near TN1[3] | 18.5 | 75.8 | 7.76 | 8.02 | n/a | 2.05 |
| | | lake[3] | 18.7 | 78.1 | 7.97 | 8.33 | n/a | 2.8 |

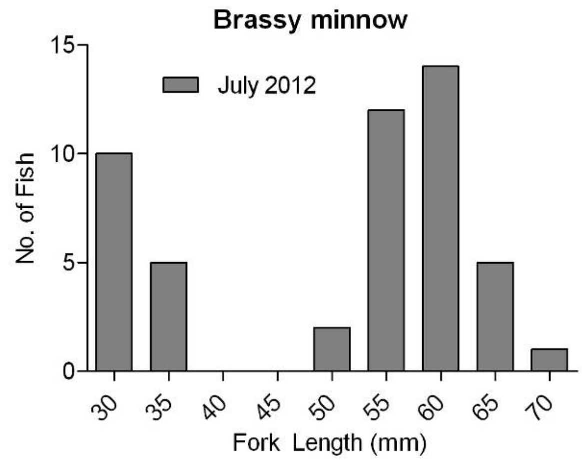
[1] – Refer to the fish sampling locations in Figures 9 and 10
[2] – Relative turbidity, see RIC (2001) for definitions.
[3] – Taken at surface.

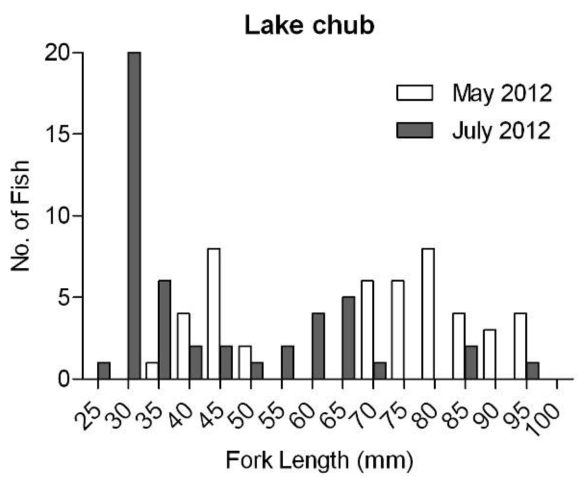
**Appendix 16. Daily mean temperature and cumulative monthly total precipitation in spring 2012 and the long term means in the study region. Data from Environment Canada and observed at the Mackenzie Airport weather station (Station name: Mackenzie A).**

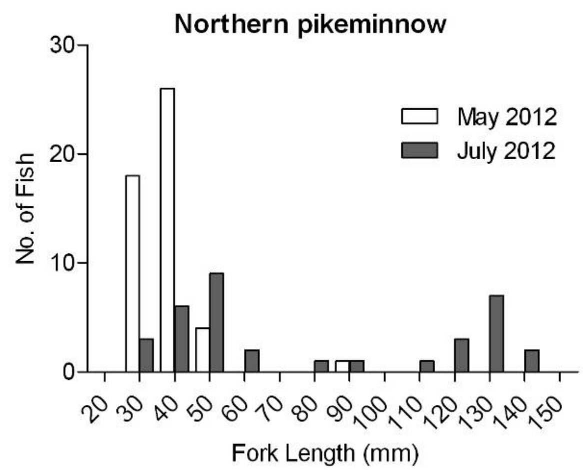


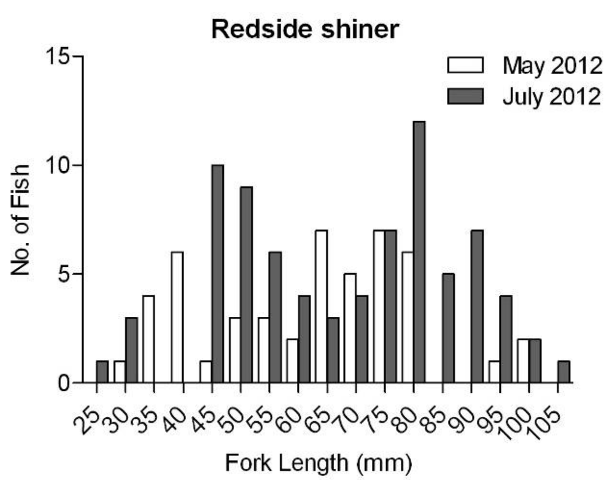
**Appendix 17. Length-frequency distributions for the common fish species at Airport Lagoon.**

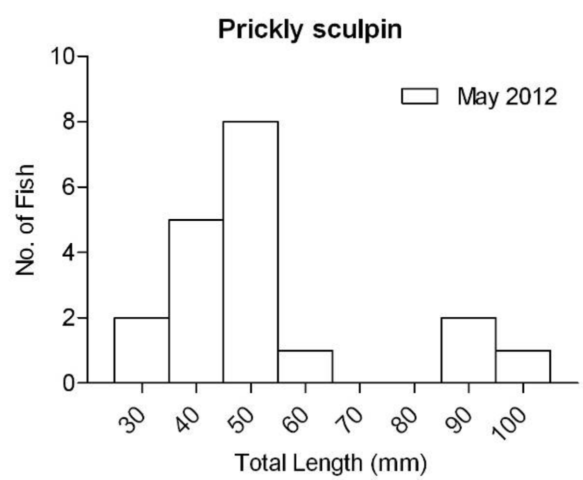

Burbot
May 2012
No. of Fish
0
5
10
15
110
120
130
140
150
160
170
180
190
Total Length (mm)


Brassy minnow
July 2012
No. of Fish
0
5
10
15
30
35
40
45
50
55
60
65
70
Fork Length (mm)


Lake chub
May 2012
July 2012
No. of Fish
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Fork Length (mm)


Northern pikeminnow
May 2012
July 2012
No. of Fish
0
10
20
30
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Fork Length (mm)


Redside shiner
May 2012
July 2012
No. of Fish
0
5
10
15
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
Fork Length (mm)


Prickly sculpin
May 2012
No. of Fish
0
2
4
6
8
10
30
40
50
60
70
80
90
100
Total Length (mm)