
**Dezé Energy Corporation
Taltson River Hydroelectric Expansion Project**



**July-August 2008 Littoral Habitat Assessment of
Lady Gray Lake, Nonacho Lake and Trudel Creek**

February 2009

Prepared by:



CAMBRIA GORDON
STRATEGIC EXPERTISE IN THE NORTHWEST

SCIENCE ■ TECHNICAL ■ ENVIRONMENTAL MANAGEMENT ■ GRAPHIC MEDIA

TABLE OF CONTENTS

1. INTRODUCTION.....	1
1.1 Background and Rationale	1
1.2 Study Areas	1
1.2.1 Lady Gray Lake	1
1.2.2 Nonacho Lake	2
1.2.3 Trudel Creek	4
2. METHODS	4
2.1 Site Selection.....	4
2.2 Shallow Water Habitat Assessment	8
2.2.1 Transects, Depth Measurements and Vegetation	9
2.2.2 Fish Sampling and Observations	10
3. RESULTS	10
3.1 Lady Gray Lake.....	10
3.1.1 Transects, Depth Measurements and Vegetation	10
3.1.2 Fish Sampling Observations and Habitat Quality	11
3.2 Nonacho Lake	12
3.2.1 Transects, Depth Measurements and Vegetation	12
3.2.2 Fish Sampling and Observations	13
3.3 Trudel Creek	14
3.3.1 Transects, Depth Measurements and Vegetation	14
4. DISCUSSION	16
4.1 Lady Gray Lake.....	16
4.2 Nonacho Lake	17
4.3 Trudel Creek	17
5. REFERENCES	18
APPENDIX A - LADY GRAY LAKE, SITE SPECIFIC DATA	1
APPENDIX B - NONACHO LAKE, SITE SPECIFIC DATA.....	1
APPENDIX C - TRUDEL CREEK, SITE SPECIFIC DATA.....	1

1. INTRODUCTION

1.1 Background and Rationale

The Taltson Hydroelectric Expansion Project (the “Project”) is a development that adds a new 56 MW powerplant to the existing 18 MW Taltson Twin Gorges Plant and interlinks the expanded generation facility through a new transmission line to supply hydropower to Ekati, Diavik, Snap Lake mines and the proposed Gahcho Kué diamond mine. The Project would supply over 420 GWh per year of renewable electricity to the mines and existing customers, displacing a significant portion of the diesel currently consumed at those mine sites.

The Expansion Project will require an alteration of the existing hydrographs throughout the Taltson River, potentially affecting fish and fish habitat in Nonacho Lake, the Taltson River downstream of Nonacho Lake and Trudel Creek. Of specific concern are areas where the hydrograph would shift temporally as well as spatially, thereby changing the months in which high and low flows occur. The greatest effect would occur in shallow and littoral areas around the lakes and in the river. For this reason, an assessment of the shallow and shoreline habitat in two representative lakes (Nonacho Lake and Lady Gray Lake) and Trudel Creek, was conducted to collect baseline information and determine the likely effect of the proposed new hydrograph.

Specific information was collected at sites throughout Lady Gray and Nonacho Lakes as a reconnaissance to determine if there are any similarities in shallow water habitat characteristics within each lake. Visual observations were made at other sites throughout the Project area to confirm that the two lakes could be used as typical examples to represent the typical vegetated littoral habitat within the system between Nonacho Lake and Twin Gorges. Specific goals of the field program on Lady Gray and Nonacho Lake and Trudel Creek were to:

- Identify the types of shallow water habitat present in the lakes;
- Assess shallow habitat areas and determine the elevation range at which the submergent and emergent vegetation communities are currently growing; and
- Assess the overall quality of the shallow fish habitat.

This report summarizes data from the desktop review and field assessments completed in July and August 2008.

1.2 Study Areas

Lady Gray Lake and Nonacho Lake (both located in the Taltson Basin) were examined from July 5-11 2008. Trudel Creek was assessed on August 20-21 2008.

1.2.1 Lady Gray Lake

Lady Gray Lake is located on the Taltson River, mid-way between Nonacho Lake to the north, and the Taltson Twin Gorges Hydro Facility to the south (Figure 1). Lady Gray Lake is a long narrow lake with a variable shoreline made up of a combination of shallow bays and steeper rocky shores. Lady Gray provides a variety of habitat types for fish species such as lake trout (*Salvelinus namaycush*), northern pike (*Esox lucius*) and white sucker (*Catostomus commersoni*).

Anticipated temporal changes in the hydrograph may affect submergent and emergent plant communities. These changes could potentially affect fish that use the littoral zone, particularly northern pike which rely on littoral vegetation and shallow bench type habitat for spawning and rearing.

Potential effects of lower water levels during the growing season (June-August) on the emergent and submergent plant communities were of particular interest and were the focus of the field program. The hydrographs for Lady Gray Lake can be found in the Basin Model Report (Rescan, 2008).

1.2.2 Nonacho Lake

Nonacho Lake is located approximately 200 km north of the Taltson Twin Gorges hydro facility along the Taltson River (Figure 1). Nonacho Lake is approximately 850 km² in size and is the largest lake in the Project area. Nonacho Lake provides habitat for species such as lake trout, northern pike, lake whitefish and white sucker.

Nonacho Lake was chosen as a study area as there is potential for the anticipated changes in the hydrograph to affect submergent and emergent plant communities in the lake, potentially affecting littoral fish habitat and fish populations, particularly northern pike.

The potential effects of changes in water levels on emergent and submergent vegetation during the key growing season are of particular interest and were the focus of the July 2008 field program. The hydrographs for Nonacho Lake can be found in the Basin Model Report (Rescan, 2008).

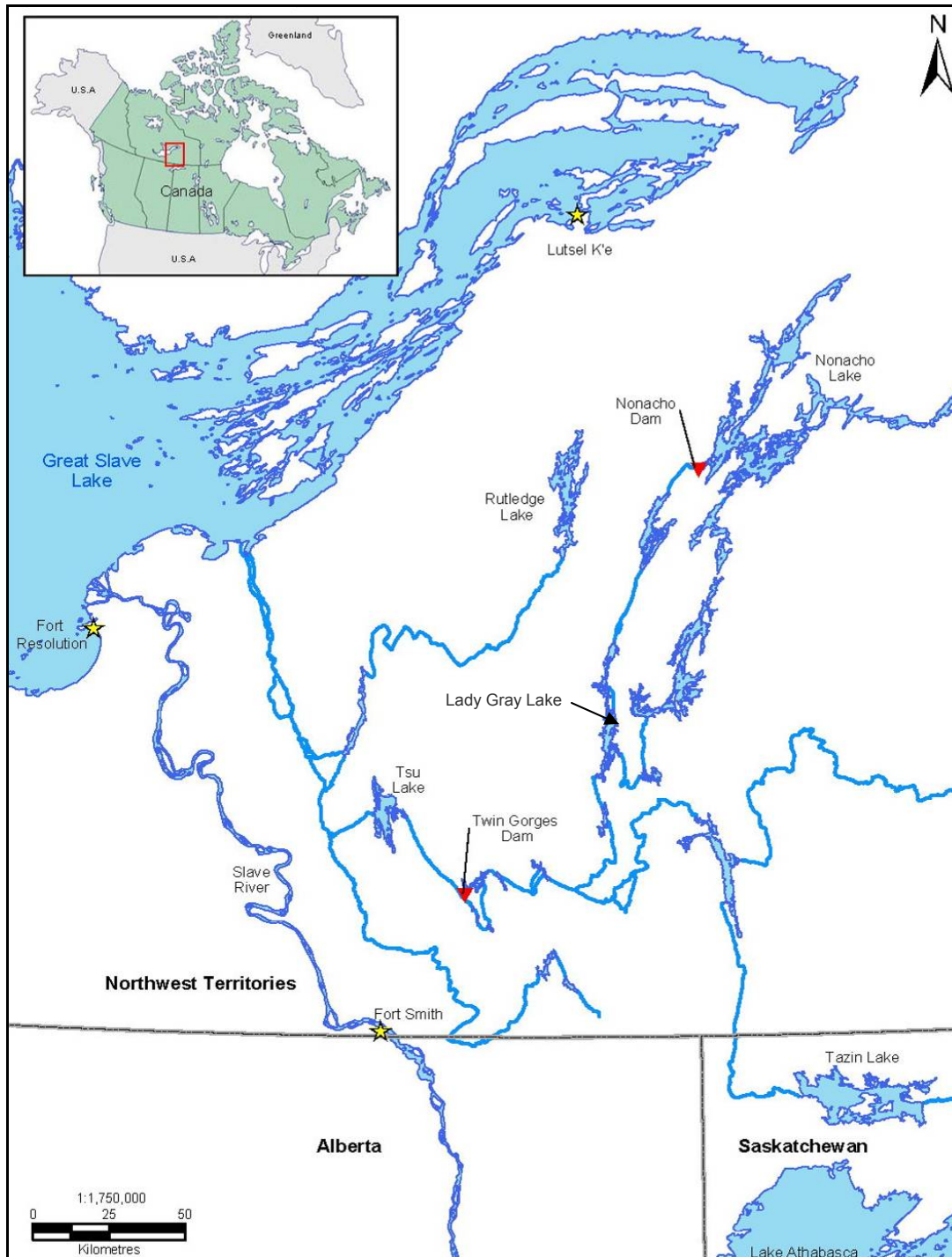


Figure 1. Location Map for the Taltson Basin, Lady Gray Lake and Nonacho Lake.

1.2.3 Trudel Creek

Trudel Creek flows from the Twin Gorges Forebay to the downstream end of Elsie falls where it flows back into the Taltson River. Trudel Creek provides habitat for a number of species including northern pike, lake whitefish and whitesucker.

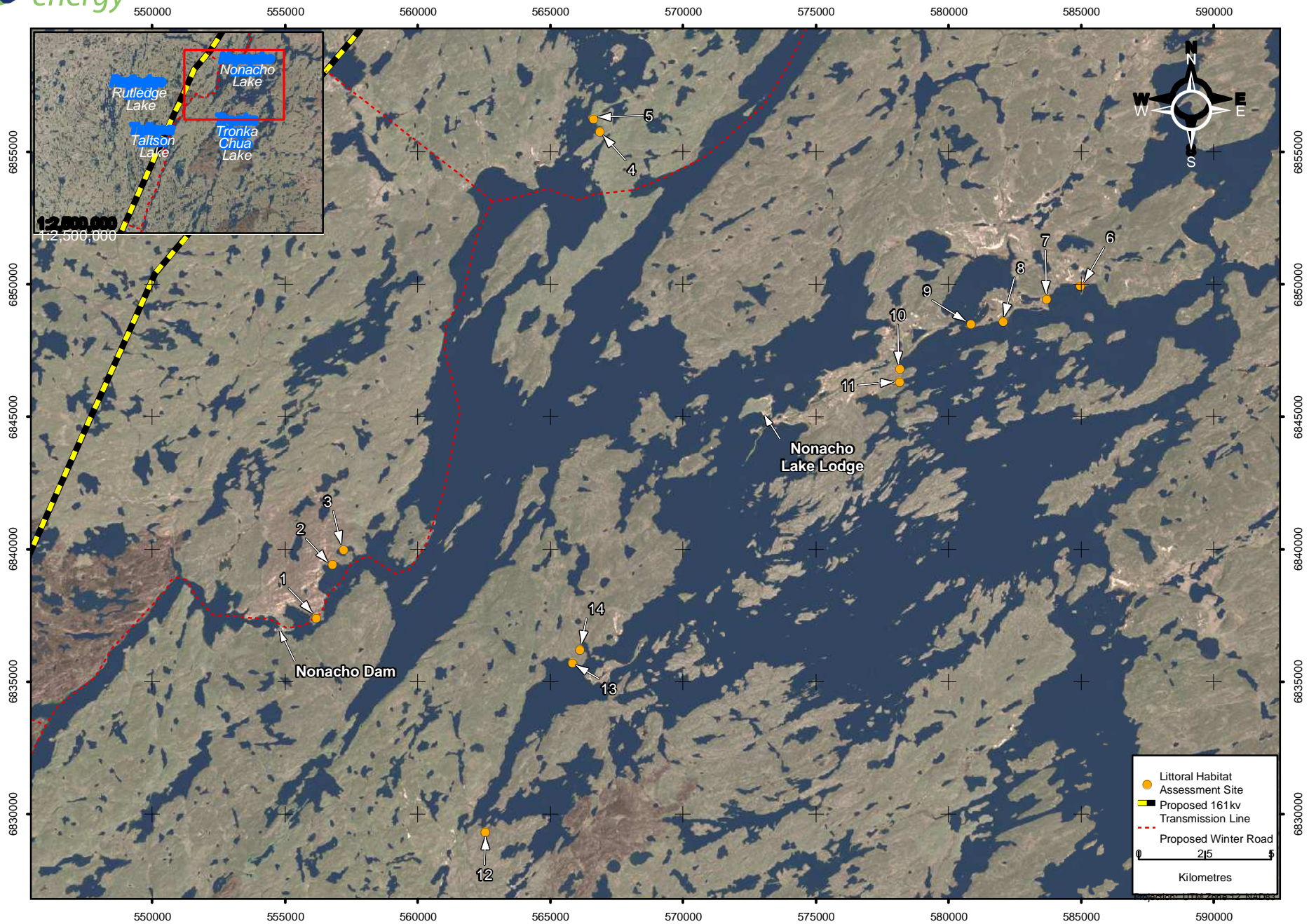
Trudel Creek was chosen as a study area as there is potential for the anticipated changes in the hydrograph to affect submergent and emergent plant communities along the river and lake sections of Trudel Creek, potentially affecting littoral fish habitat and fish populations, particularly northern pike.

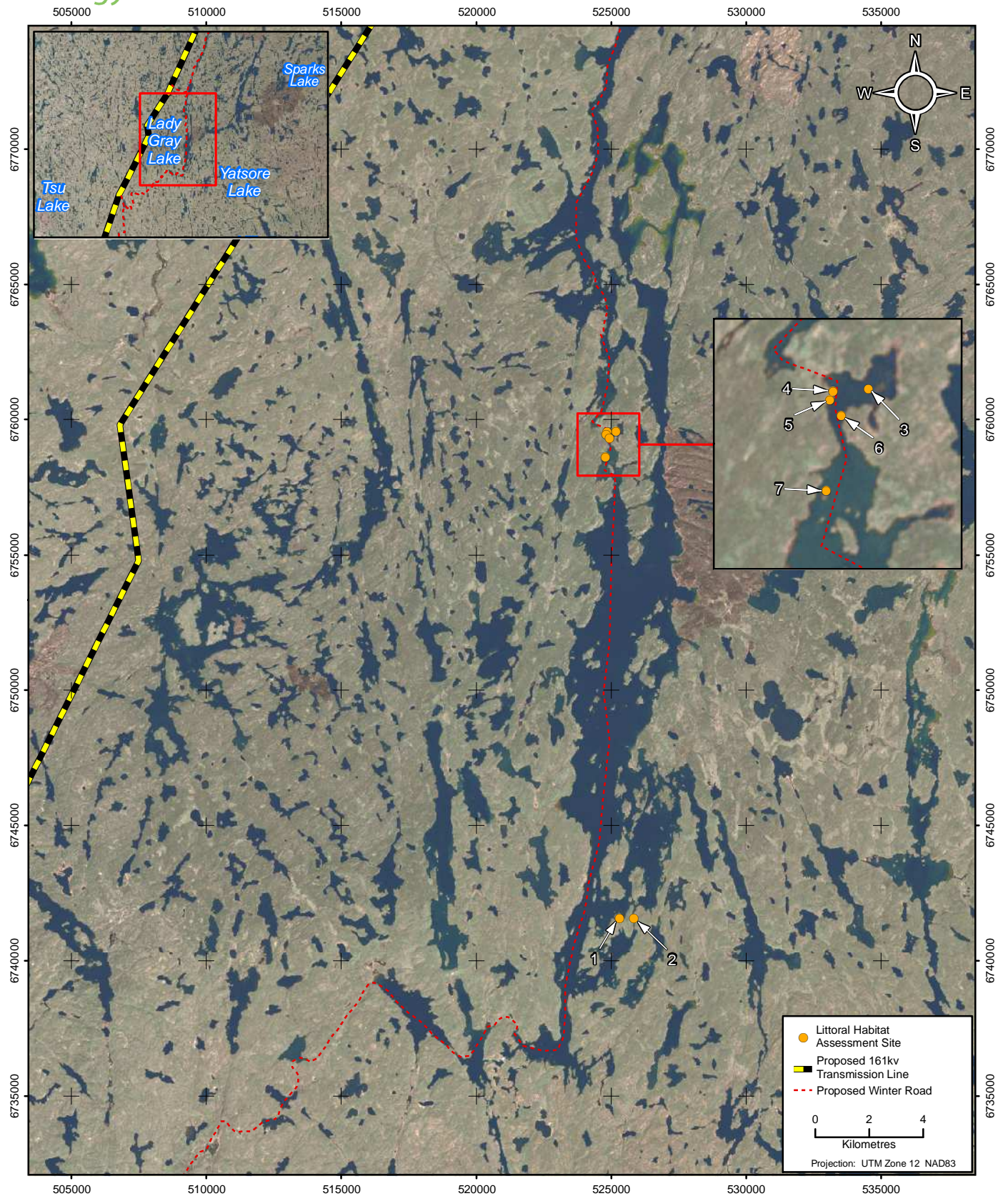
The potential effects of changes in water levels on emergent and submergent vegetation during the key growing season are of particular interest and were the focus of the August 2008 field program. The hydrographs for Trudel Creek can be found in the Basin Model Report (Rescan 2008).

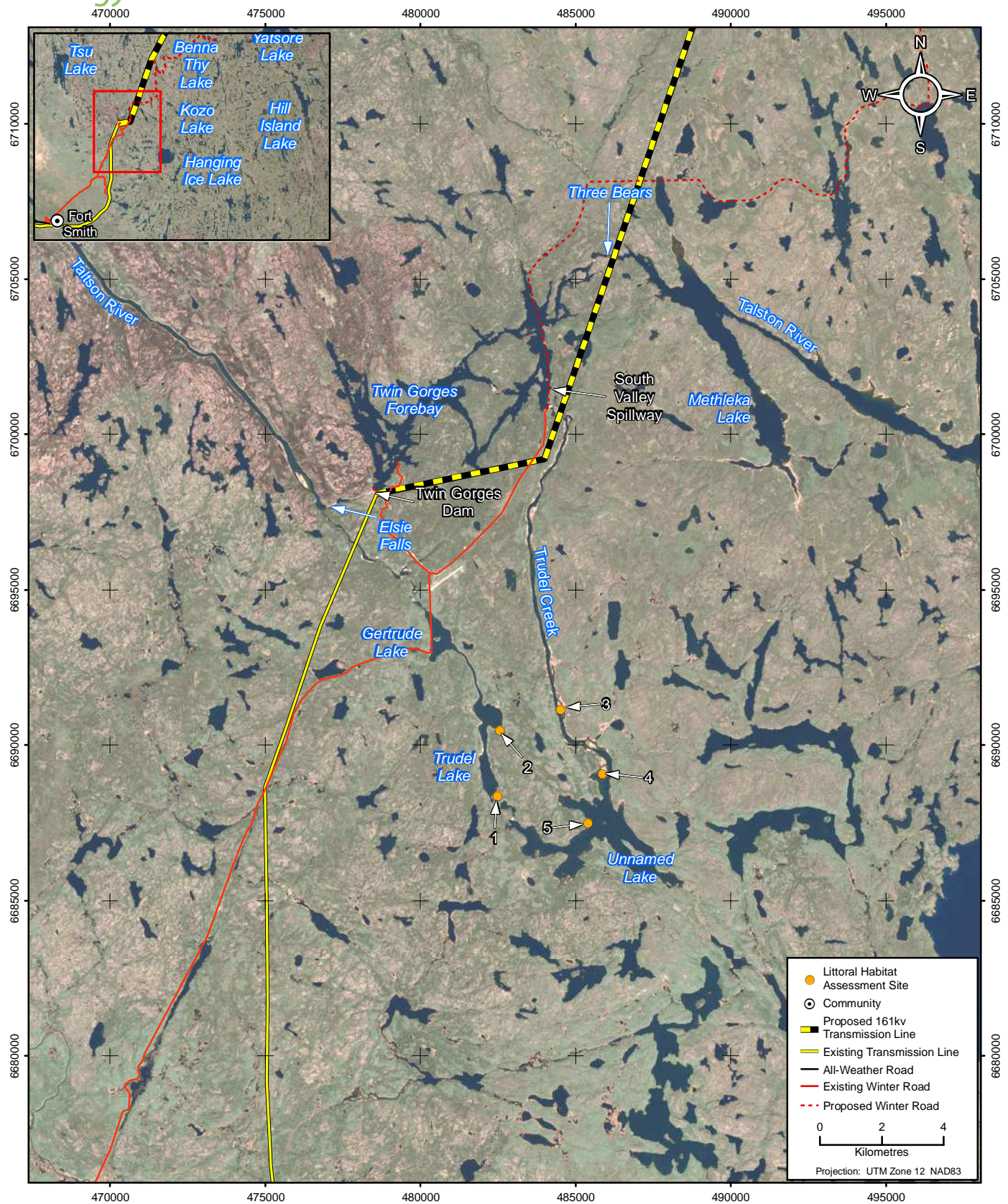
2. METHODS

2.1 Site Selection

A desktop review, using satellite and aerial photographs, was completed prior to field work in order to identify potential sample sites (i.e. wetlands and shallow water habitats) within Lady Gray and Nonacho Lake and Trudel Creek. In order to represent the size of each study area, the assessment was completed through 8 representative sample sites on Lady Gray Lake, 14 representative sample sites on Nonacho Lake, and 5 representative sites on Trudel Creek and its associated lakes. Visual observations were made at each site to determine if there were trends in shallow water habitat characteristics throughout the study lakes and between other lakes located between Nonacho and Twin Gorges. Sites were selected in order to represent all or as many shallow habitat types present within the study area as possible. Sites sampled in Nonacho Lake, Lady Gray Lake and Trudel Creek are illustrated in Figure 2, Figure 3 and Figure 4.







TALTSON

Hydroelectric Expansion Project

Trudel Creek Littoral Habitat Sites

Figure 4

2.2 Shallow Water Habitat Assessment

The field component of the shallow habitat assessment was completed on July 5-6, 2008 in Lady Gray Lake and July 9-11, 2008 in Nonacho Lake by Jason Cote and Carmen Tattersfield of Cambria Gordon Ltd. A local field assistant, Johnny Desjarlais, from Fort Smith assisted Cambria Gordon with the assessment. The Trudel Creek assessment was completed on August 20 and 21st by Miranda Schulz and Jason Cote of Cambria Gordon Ltd.

Field sampling work at Lady Gray Lake and Trudel Creek was facilitated through the use of a small boat that was slung, via helicopter, to the sampling locations. During these assessments, the field crew stayed at the Twin Gorges camp.

Field crews stayed at Carter's Nonacho Lake Fishing Lodge during the course of the field work at Nonacho Lake. Transportation was facilitated through Carter's Lodge, who provided a boat as well as a guide to take the field crew from site to site. Local knowledge of the lake greatly increased the speed at which the field crew traveled the lake and completed the assessment.

In order to complete the assessment and determine any trends in shallow water habitats within each lake, a number of qualitative and quantitative activities were completed including:

- Transects and depth measurements to determine the elevation range at which submergent and emergent vegetation currently occurs;
- Vegetation identification to determine what species are most prevalent in the shallow habitats of each lake;
- Fish sampling (beach seine or angling) and observations to assist with the assessment of habitat quality;
- Water quality sampling at most sites for supplementary information (Nephelometric Turbidity Units (NTU), salinity, conductivity and dissolved oxygen were measured using a YSI metre).

Methods of data collection were site specific and varied as determined by the size of the area, depths and substrates (e.g. the use of the beach seine was not possible in many areas due to large amounts of woody debris). Details specific to the site selection and methods used in each area are described below:

Lady Gray Lake

Satellite imagery from Google Earth was used to determine the general locations of shallow water habitat throughout Lady Gray Lake. Once the field crew was on location, further reconnaissance and aerial photography was completed in order to determine more specific sampling locations. On the first day, two sites were assessed near the downstream end of the lake and on the second day, a set of 5 sites were assessed near the mid to upstream end of the lake. Visual observations were also made throughout much of the lake, from a helicopter.

Nonacho Lake

Prior to the initiation of the July 2008 field program, Cambria Gordon Ltd. completed aerial photography to document wetland areas on Nonacho Lake. These flight lines and photographs

were mapped and then used to complete the desktop review and assist in the selection of potential shallow water sample sites on Nonacho Lake.

Sites selected during the desktop review provided the basis and a starting point for the assessment; however, once on location, it was determined that a much larger area of lake shore could be covered than originally anticipated. This was possible as a result of the help and knowledge of a local resident/guide from Nonacho Lake Lodge as well as the use of their larger boat.

A large portion of the south west area of the lake was covered on day 1 (July 9). The central and north east areas of the lake were covered on day 2 (July 10) and the southern area of the lake down to Tronka Chua Gap was covered on day 3 (July 11).

Trudel Creek

General site locations in Trudel Creek were selected based on knowledge of the area from previous site visits and through the use of aerial photomosaics. Once on location, sites were selected to obtain a representative sample in both the riverine and lacustrine areas of the Trudel Creek system.

2.2.1 Transects, Depth Measurements and Vegetation

In order to determine the elevation range at which submergent and emergent vegetation currently occurs, transects were completed at sites in each area.

A tight chain was stretched out from the shoreline, or the uppermost extent of the emergent vegetation, to depths where no more submergent vegetation was growing. At each metre interval along the tight chain, the distance from shore and water depth was recorded. Observations about the plant species and substrate types were recorded, particularly at the depths where transitions in plant communities occurred. Along some transects, the water became too deep to wade before the vegetation ended. At these sites, estimations on distance and depth to the end of vegetation were made.

Three to five transects were completed at each sample site. At larger sample sites where it was not feasible to complete transects, a boat was used to move around the edge of the vegetated area. Water depths were measured at transition zones between vegetation types.

Transect and depth information from each site was then used to determine if there were trends throughout the study areas with respect to the elevations at which different vegetation types occur and the elevation range at which emergent and submergent plant communities currently exist.

Water depth measurements were converted to elevation, in metres above sea level (masl), using hydrology benchmarks which were established specifically for the Project. The benchmarks used were located at the outlet of Lady Gray Lake and at transects 9 and 12 on Trudel Creek, and the Water Survey Canada (WSC) benchmark on Nonacho Lake near Carter's Lodge. The elevation range of the emergent and submergent vegetation at each site was calculated and then used to determine the total elevation range as well as the mean elevation range of emergent and submergent vegetation in each lake.

It was important to determine, and use, the elevation (rather than water depth) at which different vegetation and transition zones occur so that the information could be used in relation

to the modelled hydrographs of the lakes and Trudel Creek, which were developed based on elevations in masl.

2.2.2 Fish Sampling and Observations

Fish sampling was completed to aid in the overall assessment of the fish habitat quality and availability in shallow water throughout the lake. Fish sampling and observation methods varied between sites depending on characteristics such as substrate and water depth.

Where possible, a 9 m beach seine was used to sample shallow shorelines around each site. This method was not possible in many areas due to the uneven rocky substrate and large amounts woody debris and dead trees around the lakes.

Angling was also used as a sampling method, particularly in Nonacho Lake. A lure was dragged along the edges of the vegetated habitat and in the deeper open water adjacent to the sample site.

Visual observations were used to approximate the abundance and length of fish as well as habitat quality, especially at sites where use of the beach seine was not possible.

No fish sampling was completed in Trudel Creek during this field program.

3. RESULTS

3.1 Lady Gray Lake

Transects and/or depth measurements were completed at 4 of the 7 sites, which were characterized by shallow vegetated habitat. The remaining 3 sites were characterized by rocky shorelines; therefore, no measurements of vegetation or transition zones were completed. At these sites, fish sampling and visual observations were made. Three main types of shallow water habitat were sampled in Lady Gray Lake:

- Shallow and sheltered bay like areas with deep organic substrates and dense vegetation;
- Shallow and more exposed bench type habitat with rocky substrate and dense vegetation; and
- Shallow rocky shorelines with little or no vegetation.

3.1.1 Transects, Depth Measurements and Vegetation

Transects were completed at sites where shallow water bench habitat supported emergent and/or submergent vegetation. The waterline elevation at the time of assessment was 309.25 masl.

Emergent vegetation communities appeared to be fairly consistent throughout Lady Gray Lake and were primarily comprised of:

- Water Sedge (*Carex aquatilis*);
- Beaked Sedge (*Carex Utriculata*);
- Swamp horsetail (*Equisetum fluviatile*);
- Common great bulrush (*Typha lacustris*);

- Creeping spikerush (*Eleocharis palustris*); and
- Small yellow pond lily (*Nuphar variegatum*).

Transect measurements indicate that the emergent plant community assessed in Lady Gray Lake was present within a total elevation range of 309.25 masl to 307.75 masl, at the time of assessment in early July.

The submergent vegetation community was also fairly consistent throughout Lady Gray Lake and was primarily comprised of:

- Pondweeds (*Potamogeton* spp.); and
- Bladderworts (*Utricularia* spp.)

Transect measurements indicate that the submerged plant community assessed was present within an approximate elevation range of 309.25 masl to 307.75 masl.

It should be noted that the sampling was completed in the early growing season and it is likely that later in the growing season the range of the submergent vegetation, in particular, would extend to lower elevations. This is due to its annual growth pattern.

The total elevation range of emergent and submergent vegetation is illustrated in Figure 5. Refer to Appendix A for site specific data on Lady Gray Lake.

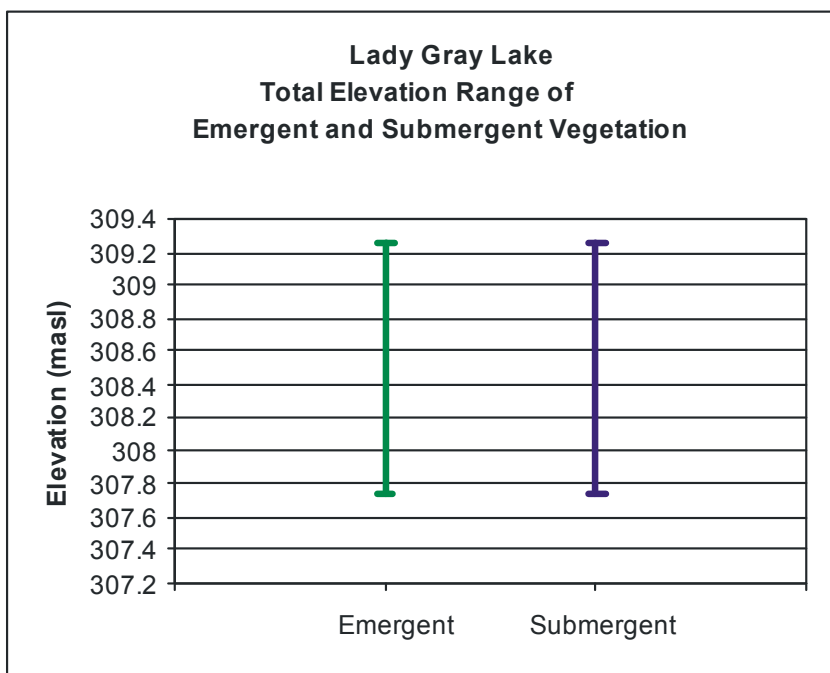


Figure 5. Total elevation range of emergent and submergent vegetation in Lady Gray Lake.

3.1.2 Fish Sampling Observations and Habitat Quality

Fish sampling using a 9 m beach seine and visual observations was completed at most sites to confirm the fish species utilizing the shallow vegetated areas throughout Lady Gray Lake and determine the species using these areas as primary habitat. Sampling efforts using the beach seine were only successful in areas where the substrate was smooth. It was not possible to complete sets in dense vegetation or on substrates containing larger rocks or woody debris. In

these areas, visual observations proved to be a reliable method to determine if, for example, northern pike were present.

Overall, sampling and visual observations confirmed that northern pike are present in shallow areas with dense emergent and submergent vegetation. No other fish species were seen during the site sampling. There were about 12 adult northern pike, (average) observed at each site with appropriate habitat. These areas provide preferred spawning, rearing and feeding habitat for northern pike. No pike were captured or observed along the shallow bedrock shorelines of Sites 4-6. A lack of cover and food indicate that these rocky areas provide poor habitat for northern pike due to a lack of cover and food.

Site specific details, photos and data collected at each of these sites can be found Appendix A.

3.2 Nonacho Lake

The Nonacho Lake shallow water habitat assessment was completed from July 9 – 11, 2008. During this time data were collected throughout Nonacho Lake at a total of 14 specific sites. Transects and depth measurements were completed at 7 of the 14 specific sites to measure and document the elevation range at which the emergent and submergent vegetation were growing at the time of assessment. At the remaining 7 sites, observations and notes were made about vegetation and fish communities. Three main shallow habitat types were observed within Nonacho Lake, which include:

- Isolated and sheltered bays with emergent and submergent vegetation growing from the high water mark and extending toward the middle of the bay;
- Shallow and exposed shorelines supporting mainly emergent vegetation growing from the water's edge out into the open lake water;
- Bench areas supporting sedge platforms which extend from the terrestrial vegetation out to a transition area where the emergent sedge communities extend into the open water.

3.2.1 Transects, Depth Measurements and Vegetation

Transects were completed in water supporting emergent and/or submergent vegetation. The waterline elevation at the time of assessment in Nonacho Lake was 323.4 masl.

Emergent vegetation communities appeared to be fairly consistent throughout Nonacho Lake and were primarily comprised of:

- Water Sedge (*Carex aquatilis*);
- Beaked Sedge (*Carex utriculata*);
- Common cattail (*Typha latifolia*); and
- Swamp horsetail (*Equisetum fluviatile*).

Transect measurements indicate that the emergent plant community assessed from July 9-11, 2008 was present within a total elevation range of 323.4 masl to 322.58 masl.

The submergent vegetation community was also fairly consistent throughout Nonacho Lake and was mainly comprised of:

- Pondweeds (*Potamogeton* spp.).

Transect measurements indicate that the submerged plant community assessed on July 9-11, 2008 was present within a total elevation range of 323.1 masl to 322.35 masl.

It should be noted that the sampling was completed in the early growing season and it is likely that later in the growing season the range of the submergent vegetation, in particular, would extend to lower elevations. This is due to its annual growth pattern. Submerged vegetation seedlings approximately 1-5 cm in height were also noticed at many sites in Nonacho Lake.

The total elevation range of emergent and submergent vegetation in Nonacho Lake is illustrated in Figure 6. Refer to Appendix B for site specific information on Nonacho Lake.

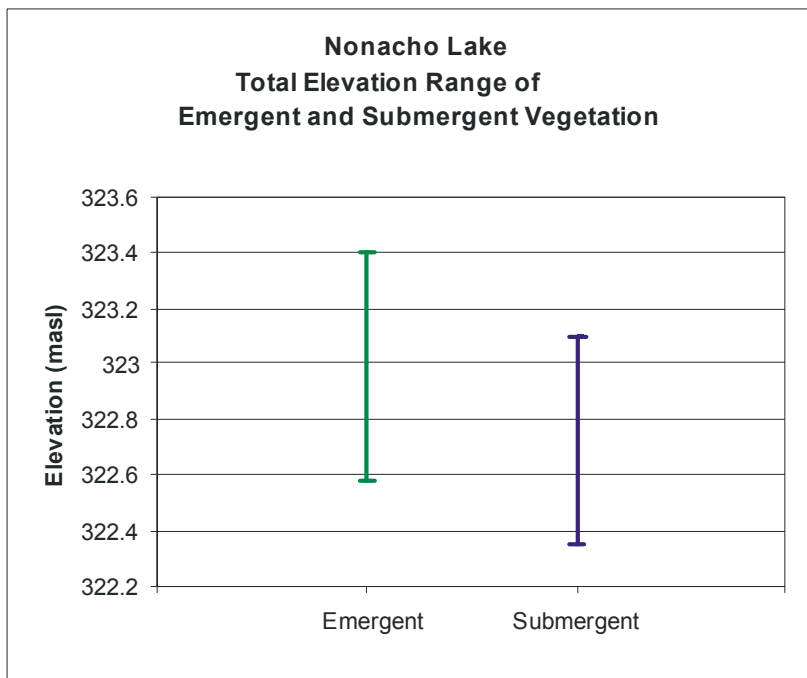


Figure 6. Total elevation range of emergent and submergent vegetation in Nonacho Lake.

3.2.2 Fish Sampling and Observations

Fish sampling was completed at 7 sites to confirm the fish species utilizing these areas and provide a better assessment of the quality of shallow and littoral vegetated shorelines throughout Nonacho Lake. In general, fish sampling efforts demonstrated that northern pike were present in shallow vegetated habitats.

Angling efforts were completed in the open water adjacent to the vegetation sample sites. Lake trout were more commonly captured than northern pike. Northern pike were rarely captured in open water areas where no vegetation or dead trees were present for cover. Adult and juvenile northern pike were utilizing waters in and amongst the dead trees, submergent and emergent vegetation.

Visual observations, while walking or boating slowly through the emergent vegetation, proved to be a very reliable method to confirm the presence of northern pike. Pike were easily identified as they lurked amongst the vegetation in the clear water.

Many northern pike fry were also visually observed travelling in schools along the vegetated shorelines. The size of these fish indicated that northern pike had spawned during the month of June in Nonacho Lake. The greatest number of juvenile pike were observed at Site 4 where the shoreline was more sheltered and vegetation provided cover over a fine gravel substrate.

The use of the beach seine was not possible at most locations in Nonacho Lake due to the large amounts of woody debris and dead trees along the flooded shoreline.

Overall, the shallow vegetated shorelines and bay areas of Nonacho Lake provide preferred spawning, rearing and feeding habitat for northern pike.

Site specific details, photos and data collected at each of these sites can be found Appendix B.

3.3 Trudel Creek

The Trudel Creek shallow water habitat assessment was completed from August 20-21, 2008. During this time data were collected throughout Trudel creek at a total of 5 representative sites. Sites 1 and 2 were located in Trudel Lake, Site 3 in upper Trudel Creek, and Sites 4 and 5 in Unnamed Lake. Transects and depth measurements were completed at each site to measure and document the elevation range at which the emergent and submergent vegetation were growing at the time of assessment. No fish sampling was completed in Trudel Creek during this field assessment.

3.3.1 Transects, Depth Measurements and Vegetation

Transects were completed in water supporting emergent and/or submergent vegetation. At the time of assessment the waterline elevation at Site 1 and 2 was 219.71 masl. The waterline elevation at Sites 3, 4 and 5 was 229.17 masl. An elevation gradient exists along Trudel Creek causing this variation in waterline elevation. The elevation of the aquatic vegetation also varies between the upper and lower areas of Trudel Creek due to this gradient.

Emergent vegetation communities appeared to be fairly consistent throughout the Trudel system and were primarily comprised of:

- Beaked Sedge (*Carex utriculata*);
- Common mare's tail (*Hippuris vulgaris*); and
- Horsetails (*Equisetum* spp.).

Transect measurements indicate that the emergent plant community in the upper reach of Trudel Creek (Site 3) and Unnamed Lake (Sites 4-5) was present within a total elevation range of 229.67 masl to 229.04 masl (Figure 7). The emergent plant community in Trudel Lake was present within a total elevation range of 220.63 masl to 219.68 masl (Sites 1-2) (Figure 8).

The submergent vegetation community was also fairly consistent throughout the Trudel system and was primarily comprised of:

- Pondweed (*Potamogeton* spp.).

Transect measurements indicate that the submergent plant community in the upper reach of Trudel Creek and Unnamed Lake was present within a total elevation range of 229.34 masl to 228.33 masl. These elevation ranges are based only on the transect measurements taken.

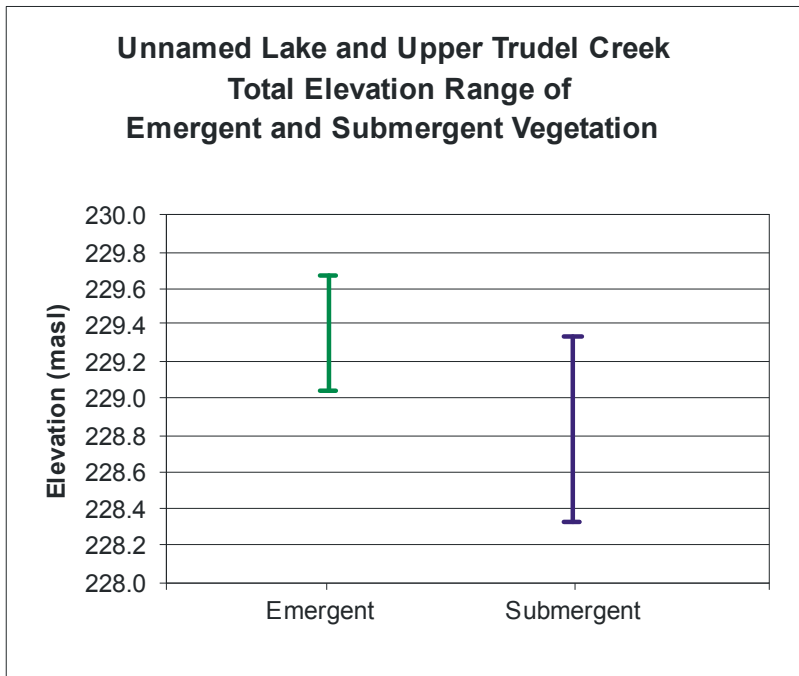


Figure 7. Total elevation range of emergent and submergent vegetation in Unnamed Lake and Upper Trudel Creek (Site 3-5).

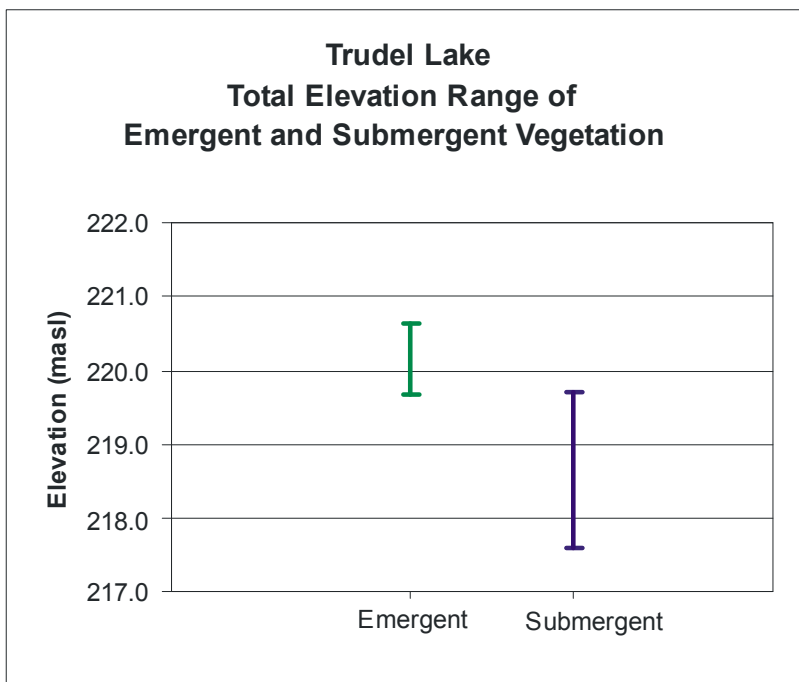


Figure 8. Total elevation range of emergent and submergent vegetation in Trudel Lake (Site 1-2).

Further spot measurements around Unnamed Lake were taken and indicate that the submergent plant community in Unnamed Lake continues to depths greater than that noted on these transects. It appears that vegetation grows continuously across the shallow bay areas of the

lake, and up to 2.5 m below the waterline elevation at the time of assessment. This depth would be equivalent to 226.17 masl.

The submergent plant community in Trudel Lake was present within a total elevation range of 219.71 masl to 217.61 masl (Figure 8). As with Unnamed Lake, spot measurements through Trudel Lake indicate that submerged vegetation grows beyond the limit of the transects to depths of up to 3 m below the waterline elevation at the time of assessment. This depth would be equivalent to 216.71 masl.

Site specific details, photos and data collected at each of these sites can be found in Appendix C.

4. DISCUSSION

4.1 Lady Gray Lake

Shallow water habitat is abundant in Lady Gray Lake. There are many islands and bay areas that provide shallow vegetated habitat. In general, shallow water habitat was consistent throughout the lake with respect to vegetation communities and fish habitat.

Visual observations and field data collection indicate that most of the shallow bench type areas in Lady Gray Lake support either emergent or submergent vegetation. Emergent vegetation typically grows at higher elevations than the submergent species, because it does not require constant inundation of water. Submergent vegetation grows at lower elevations within the lake/creek profile as it requires constant inundation of water.

Trends in the distribution of plant species along the elevation gradient were evident. Bench-like bay areas typically supported sedge platforms on the upper margins. These platforms generally gave way to emergent sedge communities, then emergent bull rushes and pond lily at deeper elevations. Submergent species, like pondweed, were present amongst the bulrushes and pond lily and extended out into the deeper water.

Observations and sampling suggest that all areas supporting aquatic vegetation in Lady Gray Lake also provide preferred northern pike spawning and feeding habitat. Exposed rocky shorelines with little or no vegetation did not appear to provide suitable habitat for pike and no other fish species were seen.

When compared, the range of the emergent plant community is similar to the range of the baseline high and low water levels in Lady Gray Lake for the months of June and July. This indicates that the emergent vegetation community grows within the yearly fluctuations of water levels in the lake.

It is difficult to determine if the minimum elevation at which aquatic vegetation was found in this lake at the time of assessment is, in fact, the minimum elevation at which the aquatic species will grow. Small seedlings were noted on the lake bottom at many locations. It was not possible to determine the species or the extent to which these plants would grow. It is likely that later in the growing season, the aquatic vegetation would be growing at lower elevations (deeper in the lake profile) once it was further established. It is also possible that a greater diversity of submergent plant species would be noted later in the growing season.

No rooted depth samples or seed bank samples were taken. If the rooted depth or a significant seed bank exists at lower elevations than visually observed, then it is possible that submergent species could grow and vegetated habitat would be available at lower elevations if the water level were to decrease.

4.2 Nonacho Lake

Less shallow bench type habitat was available in Nonacho Lake compared to more steeply sloping bedrock shorelines. Much of the shallow habitat in the lake is present in bay areas that were flooded after the development of the Nonacho control structure.

Each shallow habitat observed was utilized by northern pike, indicating that these areas provide preferred habitat where cover is present. Woody debris and logs provide cover in addition to vegetation in certain areas. No other fish species were seen in the shallow littoral habitats.

As with Lady Gray Lake, it is difficult to determine if the minimum elevation at which aquatic vegetation was found in this lake at the time of assessment is, in fact, the minimum elevation at which the aquatic species will grow. Small seedlings were noted on the lake bottom at many locations. It was not possible to determine the species or the extent to which these plants would grow. It is likely that later in the growing season, the aquatic vegetation would be growing at lower elevations (deeper in the lake profile) once it was further established. It is also possible that a greater diversity of submergent plant species would be noted later in the growing season.

It may also be important to determine the rooted depth of the vegetation in these shallow habitats. If the rooted depth or a significant seed bank exists at lower elevations than visually observed, then it is possible that submergent species could grow and vegetated habitat would be available at lower elevations if water levels were to decrease.

4.3 Trudel Creek

Shallow water habitat and riparian wetlands are abundant throughout the upper and mid-reaches of Trudel Creek and its associated lakes. These bench-type habitats generally support a consistent community of emergent and submergent vegetation, extending out from the high water mark.

Sediment bars along the upper reaches of Trudel Creek (Site 3) provide a suitable substrate for emergent and submergent vegetation. Along these bars, the minimum elevation at which the submergent vegetation is present is likely not limited by depth, but by the steep drop off into thalweg and increased current. That is, if the current were to decrease the rooted depth of submergent vegetation would likely increase.

In Unnamed and Trudel Lakes, where there is no velocity, the minimum elevation (greatest depth) at which the submergent vegetation can grow appears to be limited by depth rather than velocity, as a more gradual bathymetry is present, and extends further down into the lake profile.

5. REFERENCES

- Johnson, D. Kershaw, L, MacKinnon, A, and Pojar, J. 1995. Plants of the Western Boreal Forest & Aspen Parkland. Lone Pine Publishing: Alberta, Canada.
- Pojar J. and MacKinnon. 2004. Revised Plants of Coastal British Columbia. Lone Pine Publishing: British Columbia, Canada.

APPENDIX A – LADY GRAY LAKE, SITE SPECIFIC DATA

- Waterline elevation in Lady Gray Lake July 5-8 2008 – 309.25 masl.

Lady Gray (LG) - Site 1

Site 1 was located towards the downstream end of Lady Gray Lake. This site was a relatively small and sheltered bay with a deep organic substrate and dense emergent vegetation (Figure 9). This site, along with Site 2, represent relatively isolated shallow habitat compared to the surrounding area of the lake, which is characterized by steeper bedrock banks and little to no submergent vegetation.



Figure 9. Site 1 sheltered bay area.



Figure 10. Transect at Site 1.

Depth transects and fish sampling was completed at Site 1 (Figure 10). Site 1 transects and beach seine sampling locations are illustrated in Figure 11.



Figure 11. Sample Site 1 on Lady Gray Lake.

The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 1 which is illustrated in Figure 12.

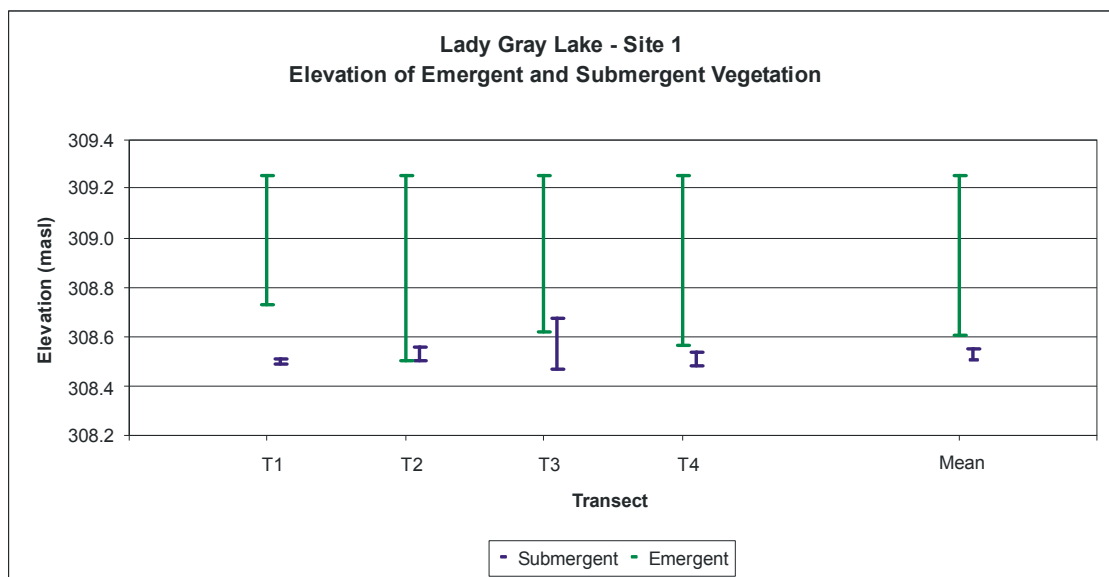


Figure 12. Emergent and submergent elevation range for transects at Site 1.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation at Site 1 are listed below:

Emergent Vegetation:

- Maximum: 309.25 masl (all transects)
- Minimum: 308.50 masl (transect 2)
- Mean range: 309.25 masl to 308.61 masl

Submergent Vegetation:

- Maximum: 308.67 masl (transect 3)
- Minimum: 308.47 masl (transect 3)
- Mean range: 308.55 masl to 308.51 masl

Figure 13 illustrates the bathymetric profile of each transect along with the mean elevation range of emergent and submergent vegetation at the site.

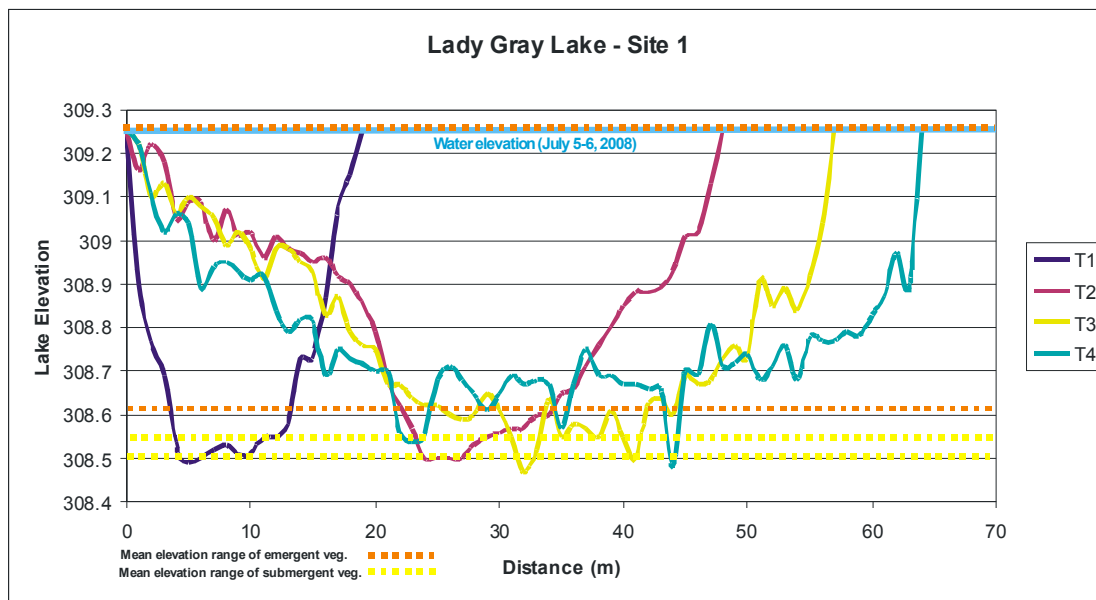


Figure 13. Transect profiles and the mean elevation range of emergent and submergent vegetation at Site 1.

Fish sampling was completed at Site 1 using 6 sets of the 9 m beach seine. A total of 11 adult northern pike were captured at this site, along with one juvenile. The fish were captured in areas where emergent vegetation was present.

LG - Site 2

Sample Site 2 was located near the downstream end of Lady Gray Lake. The site was a large and sheltered bay area located on an inlet off the main lake. This was a complex site supporting a large sedge platform, emergent sedge, bull rush and pond lily, as well as various submergent species such as pondweed (Figure 14 and Figure 15). The entire bay area was less than 2 m deep. This was a large site so transects were only completed in one area.



Figure 14. Emergent sedge at Site 2.



Figure 15. Emergent bulrush at Site 2.

A total of 4 transects were completed at Site 2. Transect locations are noted in Figure 16 along with notes on depth measurements and beach seine sample sites.

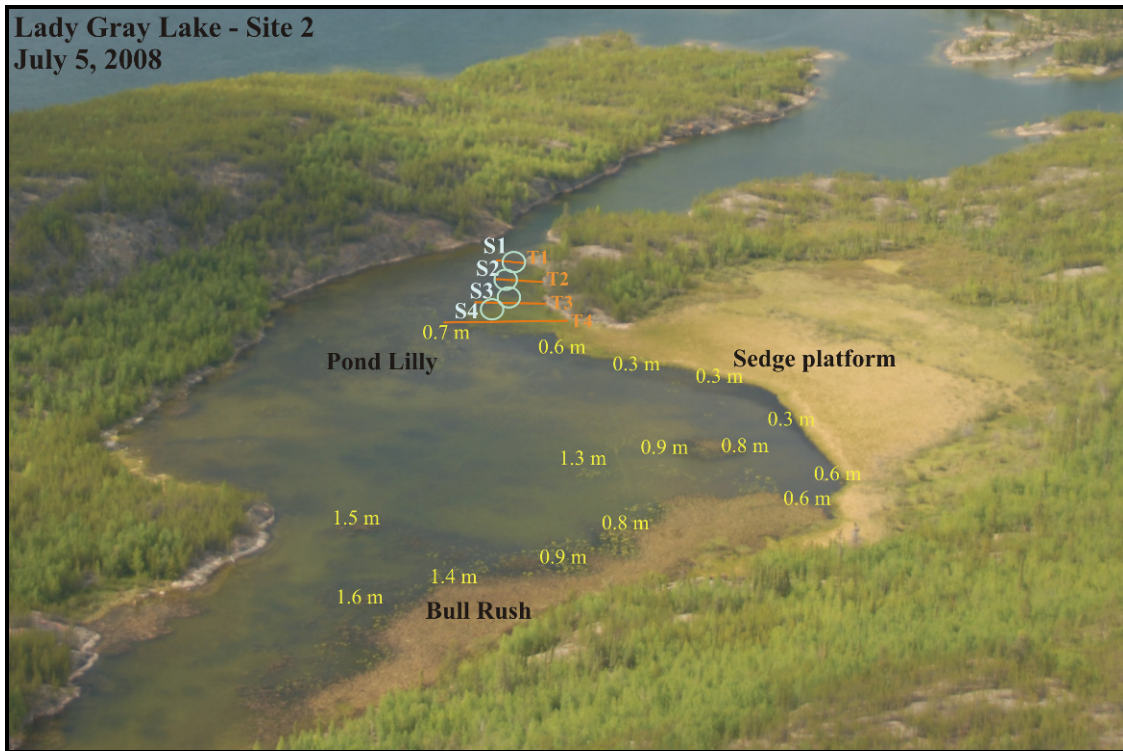


Figure 16. Sample Site 2 on Lady Gray Lake. (S1-S4: seine sample sites, T1-T4: transects)

The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 2 which is illustrated in Figure 17.

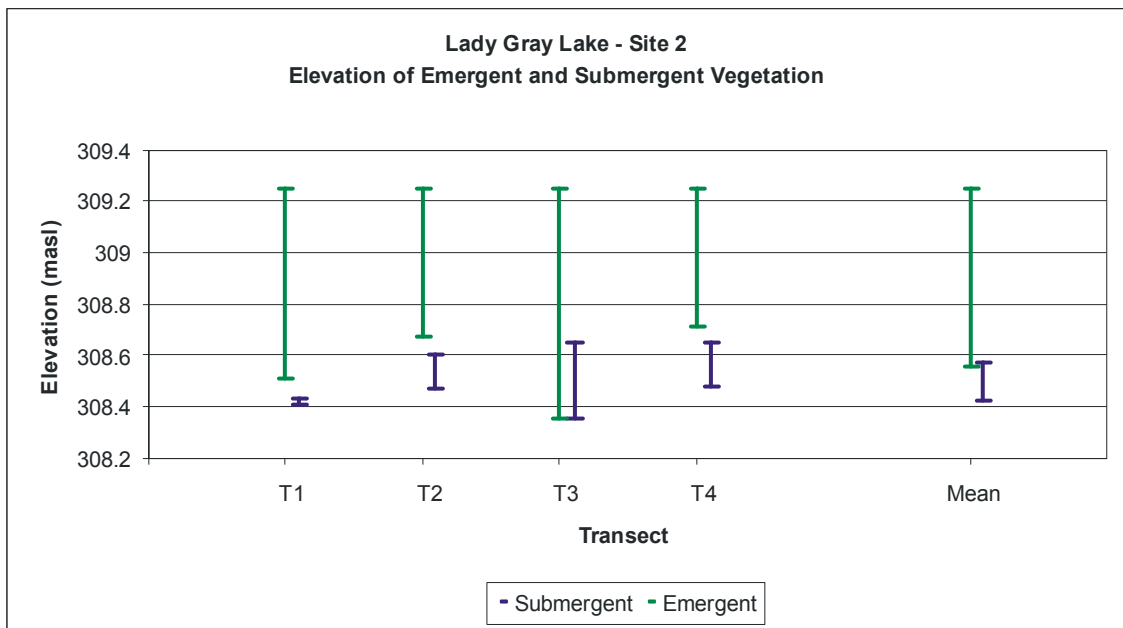


Figure 17. Emergent and submergent elevation range for transects at Site 2.

The bathymetric profile of each transect was also graphed in Figure 18 and the mean elevation range for both emergent and submergent vegetation at Site 2 was noted on the graph.

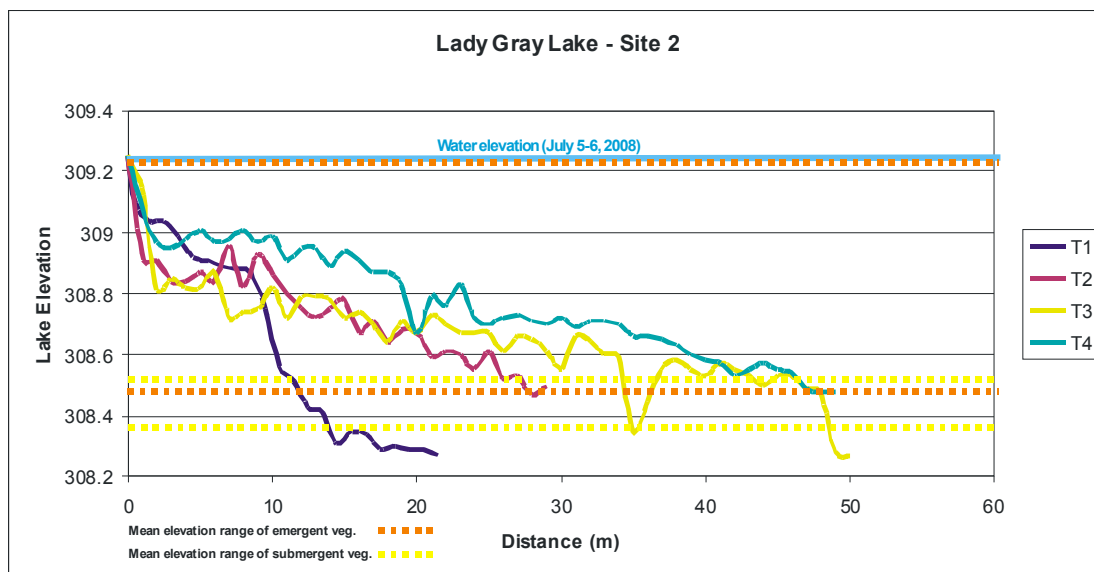


Figure 18. Site 2 transect profiles and mean elevation ranges for emergent and submergent vegetation.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 2 are listed below:

Emergent:

- Maximum: 309.25 masl
- Minimum: 308.35 masl
- Mean range: 309.25 masl to 308.56 masl

Submergent:

- Maximum: 308.65 masl
- Minimum: 308.35 masl
- Mean range: 308.58 masl to 308.42 masl

In the shallow area where transects were not completed, depth measurements were taken at transition zones between vegetation types and at the locations where a species ended (Figure 16). The mean depths and corresponding elevation ranges at which each species was present are noted below:

- Emergent sedge: 0 – 0.6 m (309.25 masl to 308.65 masl)
- Sedge platform: 0 m – 0.4 m (309.25 masl to 308.85 masl)
- Bull rush: 0.8 m – 1.4 m (308.45 masl to 307.85 masl)
- Pond lily: 1.2 m – 2 m (308.05 masl to 307.25 masl)

Fish sampling was completed through 4 sets using the 9 m beach seine. A total of 3 northern pike were captured. Another 8 northern pike were observed swimming in the vegetation around the site. The size of the pike ranged from 6 cm to 42 cm in length.

LG - Site 3

Site 3 was located near the mid to upstream end of Lady Grey Lake in a very shallow area of the lake. The entire area of the lake where this site, as well as Sites 4-7, was located was no more than 2.5 m deep at most, even 150 m from shore.

Site 3 was similar to 1 and 2 and was a large vegetated bay area. Due to the size of this site, depth measurements were completed rather than transects. Site 3 is illustrated in Figure 19 along with notes on depths and vegetation types.

The mean depths and elevation ranges at which the main species were present are noted below:

- Sedge platform: 0 m - 0.5 m (309.25 masl to 308.75 masl)
- Bull rush: 0.7 m – 0.9 m (308.55 masl to 308.35 masl)
- Pond lily: 0.9 m - 1.2 m (308.35 masl to 308.05 masl)
- Swamp horsetail: 0.5 m – 0.7 m (308.75 masl to 308.55 masl)

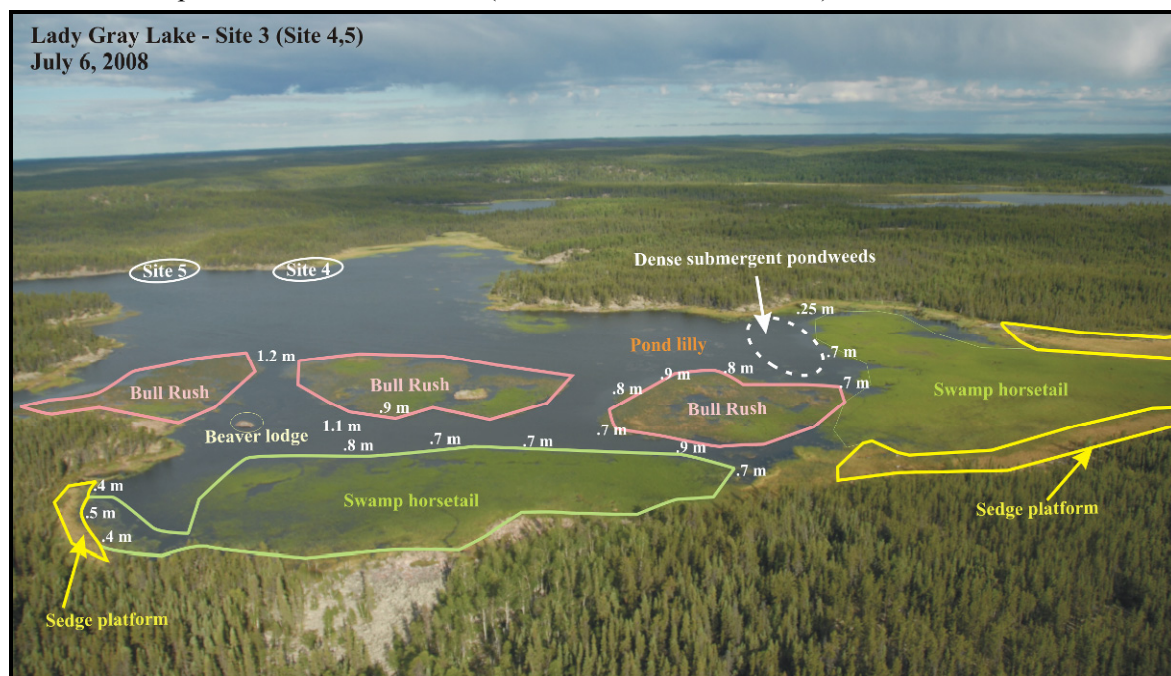


Figure 19 – Site 3 Lady Gray Lake.

Fish sampling was completed at this site using visual observations. A total of 12 pike were observed amongst the bull rushes and equisetum.

LG - Sites 4-6

Sites 4-6 were characterized by a bedrock shoreline with little or no vegetation present. Fish sampling was completed at these locations. No fish were captured along the rocky shorelines

of Lady Gray Lake, most likely due to increased exposure and a lack of vegetation and cover. The locations of Sites 4 and 5 are noted in Figure 19 above.

LG - Site 7

Site 7 was a shallow bench of vegetation located on the side of a small island. This site was unique as it was more exposed to wind and waves from the lake and it also had a consistently rocky substrate, rather than the organic substrates of Sites 1-3. A total of 5 transects were completed at Site 7. No aerial photograph was available to illustrate Site 7.

The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 7 which is illustrated in Figure 20.

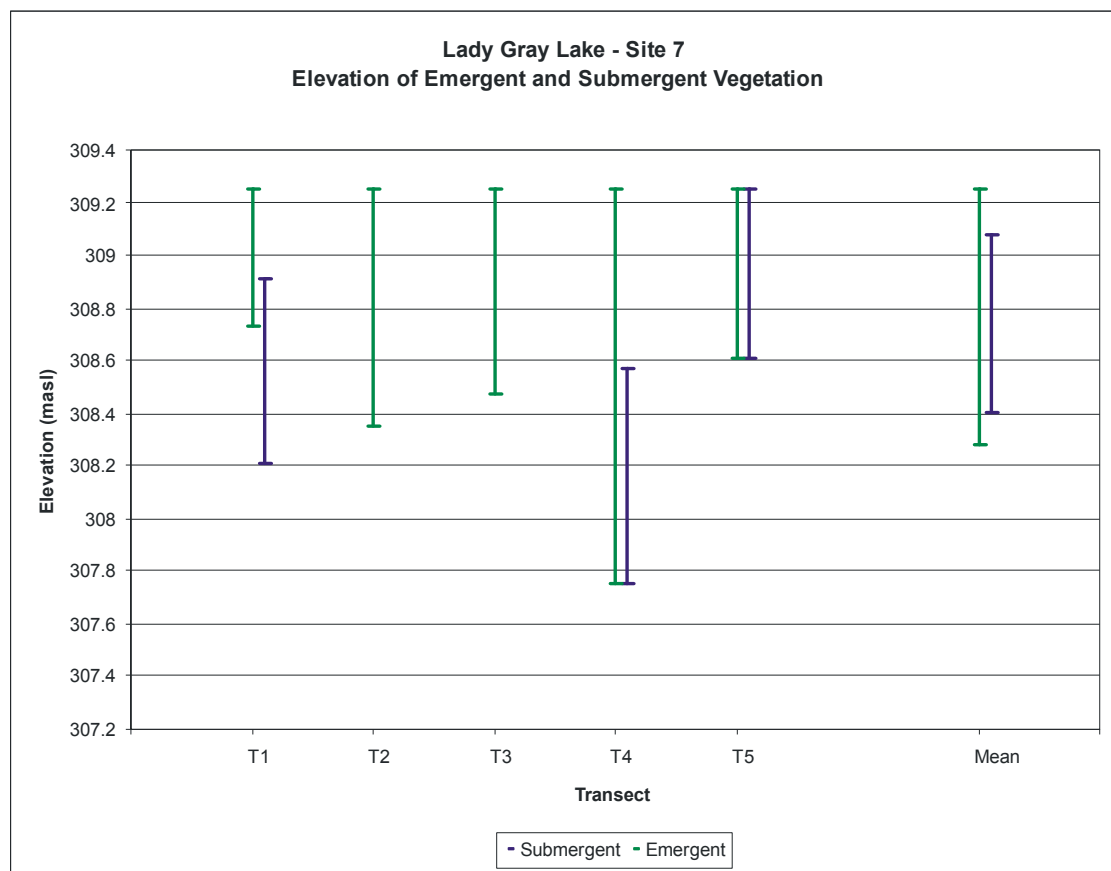


Figure 20. Emergent and submergent elevation ranges for transects at Site 7.

The bathymetric profile of each transect was also graphed (Figure 21) and the mean elevation range for both emergent and submergent vegetation at Site 7 was noted on the graph.

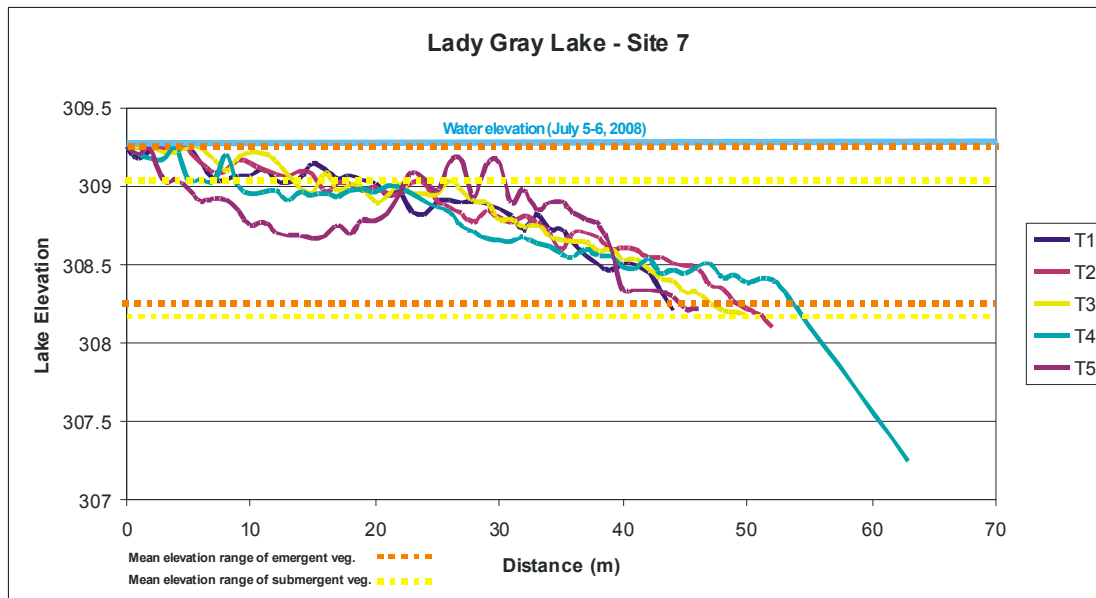


Figure 21. Site 7 transect profiles and mean elevation ranges for emergent and submergent vegetation.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 7 are listed below:

Emergent:

- Maximum: 309.25 masl
- Minimum: 307.75 masl
- Mean range: 309.25 masl to 308.28 masl

Submergent:

- Maximum: 309.25 masl
- Minimum: 307.75 masl
- Mean range: 309.08 masl to 308.41 masl

Fish sampling was completed at this site using visual observations. A total of 13 pike were observed while transects were being completed.

APPENDIX B – NONACHO LAKE, SITE SPECIFIC DATA.

- Waterline elevation in Nonacho Lake July 9-11 2008 – 323.4 masl.

Nonacho Lake (NL) – Site 1

Site 1 on Nonacho Lake was located a short distance upstream from the Nonacho Control structure. This was a wetland site composed of a floating mat of woody vegetation; therefore, there was no opportunity to conduct transects at this site. Figure 22 and Figure 23 illustrate Site 1 on Nonacho Lake.



Figure 22. Open water in front of wetland where northern pike were captured.



Figure 23. Floating mat of woody vegetation.

Fish sampling was completed at this site using angling. Three large pike were captured just off the edge of the floating mat of vegetation. The area under the vegetation provides excellent cover for pike.

NL - Site 2

Site 2 on Nonacho Lake was located in the southwest arm of the lake towards the Nonacho Control structure. This shallow habitat was created with the flooding of Nonacho Lake and contains a large amount of woody debris and dead trees. A deep organic substrate is present in the vegetated area.

Vegetation at this site was composed mainly of emergent water sedge (*Carex aquatilis*) and beaked sedge (*Carex Utriculata*). Sparse submergent vegetation was present; however, it is anticipated that more submergent vegetation would be present in this area later in the growing season. Figure 24 and Figure 25 illustrate the type of habitat present at Site 2 on Nonacho Lake.



Figure 24. Emergent sedge at Site 2



Figure 25. Transect 1 at Site 2.

A total of three transects were completed at this site to determine the elevation range at which the emergent sedge and submergent vegetation communities were growing.

The elevation range of emergent and submergent vegetation for each transect was determined along with the mean elevation range for Site 2, which is illustrated in Figure 26.

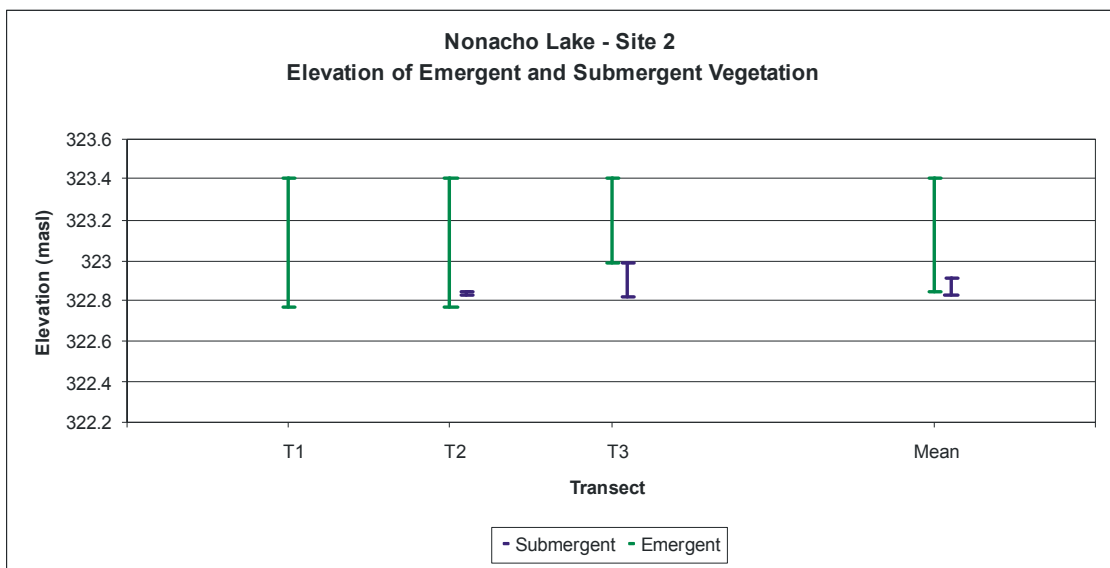


Figure 26. Emergent and submergent elevation ranges for transects at Site 2.

The bathymetric profile of each transect was also graphed (Figure 27) and the mean elevation range for both emergent and submergent vegetation at Site 2 was noted on the graph.

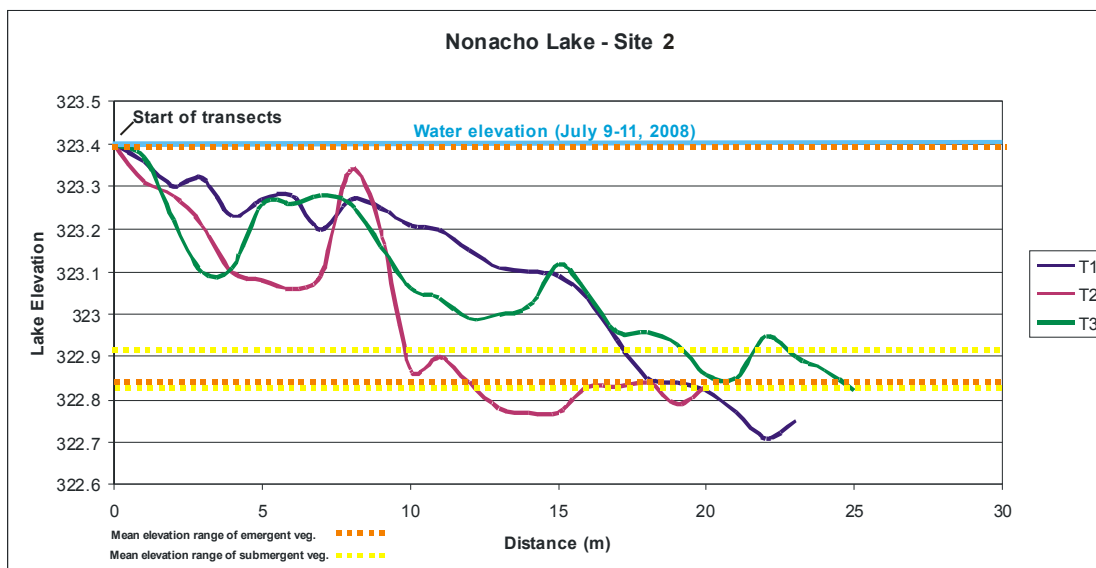


Figure 27. Site 2 transect profiles and mean elevations of emergent and submergent vegetation.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 2 are listed below:

Emergent

- Maximum: 323.4 masl
- Minimum: 322.77 masl
- Mean range: 323.4 masl to 322.84 masl

Submergent

- Maximum: 322.99 masl
- Minimum: 322.82 masl
- Mean range: 322.91 masl to 322.83 masl

Fish sampling was completed at this site using angling and visual observations. One pike approximately 45 cm in size was caught just outside of the vegetated area. Several smaller pike were seen amongst the sedges, seeking cover and food. This site provided excellent rearing and spawning habitat for northern pike.

NL - Site 3

Site 3 on Nonacho Lake is located in the southwest arm of the lake in a large bay area which is separated from the main lake by a narrow inlet. It is likely that this area was not connected to the main lake before the Nonacho Dam was in place. Water depths in this area did not exceed approximately 2.5 m. Figure 28 illustrates transect 1 and the emergent vegetation present at Site 3 on Nonacho Lake.



Figure 28. Transect 1 at Site 3.

Emergent vegetation was present around the entire bay, extending out from small sedge platforms in most areas.

The elevation range of the emergent vegetation for the transect, is illustrated in Figure 29.

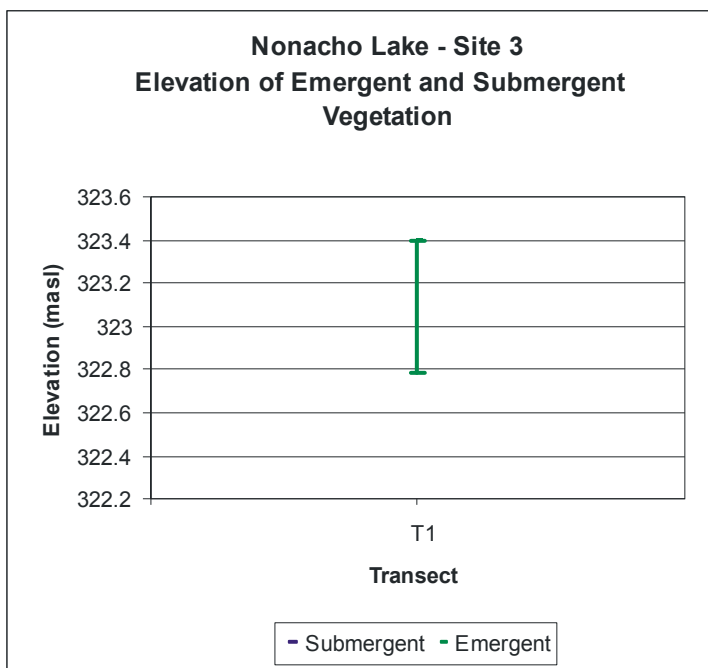


Figure 29. Emergent vegetation elevation range for the transect at Site 3.

The bathymetric profile of the transect and elevation range of the emergent vegetation is illustrated in Figure 30.

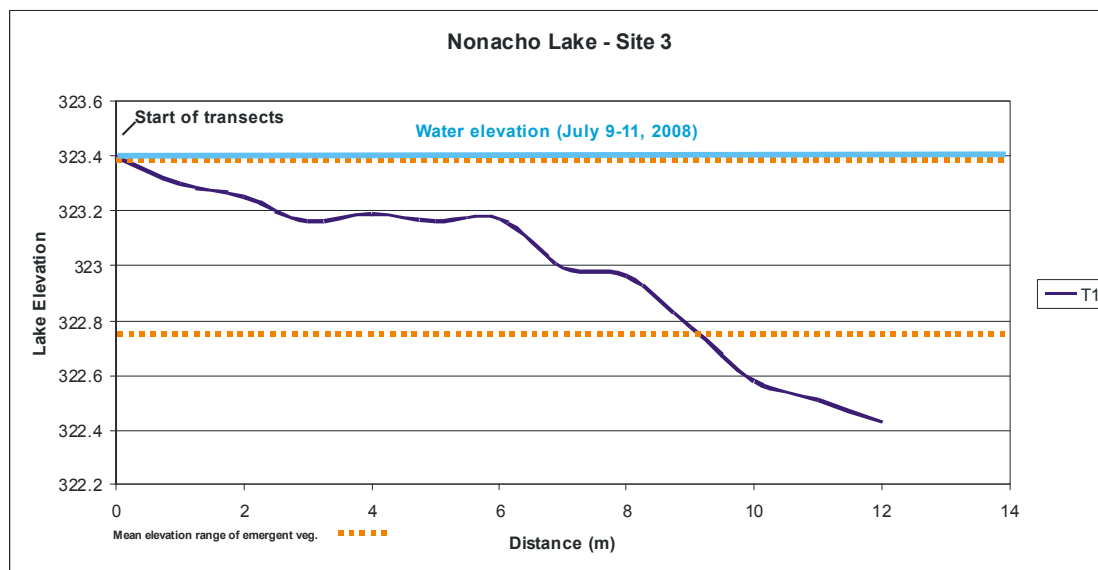


Figure 30. Site 3 transect profile and elevation range of emergent vegetation.

The maximum and minimum elevation range of the emergent vegetation recorded along the transect location at Site 3 are listed below:

Emergent:

- Maximum: 323.4 masl

- Minimum: 322.78 masl

Fish sampling was completed at this site using angling and visual observations. No fish were caught while angling, and one moderate sized pike was observed near a clump of woody debris. This site provides excellent rearing and feeding habitat for northern pike.

NL - Site 4

No transects were completed at this site as little emergent vegetation extended out past the sedge platforms and the submergent vegetation was only in the seedling stage. The gravel substrate leading out from the shoreline was covered in dense submergent vegetation seedlings which could be seen out into the water to elevations of 321.4 masl. Figure 31 illustrates the gravel shoreline found at Site 4, while Figure 32 illustrates a juvenile pike captured in the 9 m beach seine along the shoreline.



Figure 31. The shoreline of Site 4.



Figure 32. Juvenile pike captured in the beach seine at Site 4.

Site 4 was located near the south end of the northwest arm of the lake. This site was characterized by sand and gravel shoreline and a backwatered bay area containing sedge platforms and a deeper pool area with dense submergent vegetation.

Fish sampling was completed at this site using angling, visual observations and the beach seine. Off shore in the deeper waters adjacent to the vegetated area, 1 pike and 1 lake trout were captured using angling. Juvenile and adult pike were found to be numerous at this site. The larger pike were lurking in the deeper pool area of the wetland, while the juvenile pike were schooling in the sedges off the shoreline. A school of pike fry along with 10 larger pike were observed in the vegetated area just off shore from the sedge platform. Only 1 pike fry was captured in the seine net (pictured above). The site characteristics and numerous pike observed indicate that this area provides excellent pike rearing and feeding habitat.

NL - Site 5

Site 5 on Nonacho Lake was located further up the northwest arm of the lake. This site is composed mainly of emergent water sedge and woody debris, on a deep organic substrate. Figure 33 and Figure 34 illustrate the characteristics of Site 5.



Figure 33. Dense emergent vegetation at Site 5.



Figure 34. Transect at Site 5.

Three transects were completed at this site, in the emergent and submergent shoreline vegetation. The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 5 which is illustrated in Figure 35.

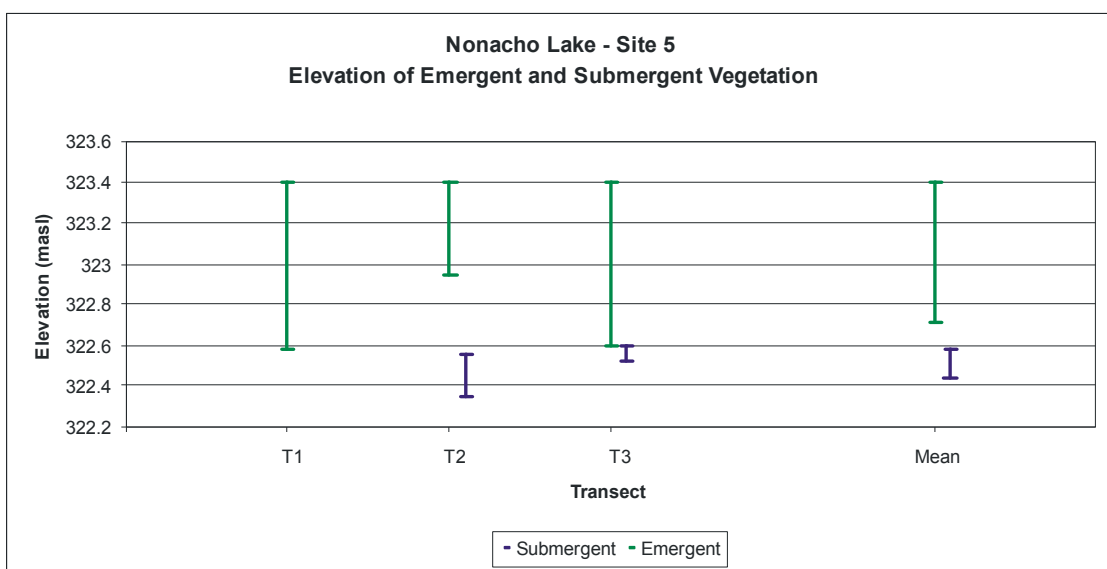


Figure 35. Emergent and submergent elevation ranges for transects at Site 5.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 5 are listed below:

Emergent:

- Maximum: 323.4 masl
- Minimum: 322.60 masl
- Mean range: 323.4 masl to 322.9 masl

Submergent:

- Maximum: 322.6 masl
- Minimum: 322.35 masl
- Mean range: 322.58 masl to 322.43 masl

The bathymetric profile of each transect was also graphed (Figure 36) and the mean elevation range for both emergent and submergent vegetation at Site 5 was noted on the graph.

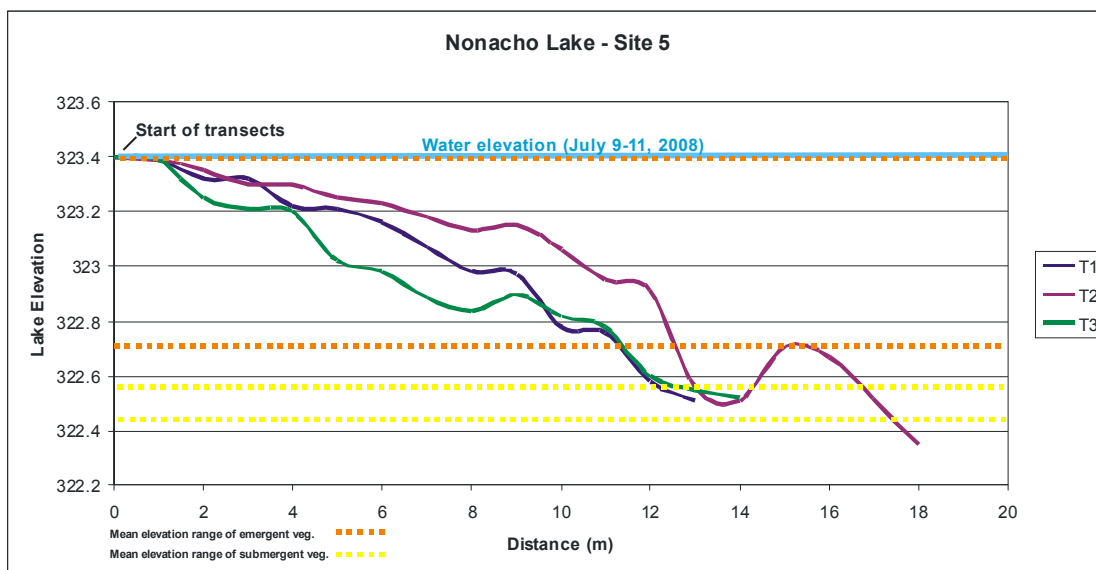


Figure 36. Site 5 transect profiles and mean elevation range for emergent and submergent vegetation.

Fish sampling was completed at this site using angling and visual observations. No fish were caught angling; however, three adult pike and 1 juvenile pike were observed in the emergent sedge. The site characteristics indicate that the area provides excellent pike rearing and feeding habitat.

NL - Site 6

Site 6 was located in the north central area of the lake along an exposed shoreline. This site was characterized by a shallow backwatered area and a raised rocky berm which shelters the vegetated area from the main lake.

A more variable vegetation community at this site was mainly composed water sedge, marsh cinquefoil, pondweed species and mares tail (Figure 37 and Figure 38).



Figure 37. Completing transect at Site 6.



Figure 38. Transect at Site 6.

Three transects were completed at this site to determine the elevation range of the emergent and submergent species.

The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 6 which is illustrated in Figure 39.

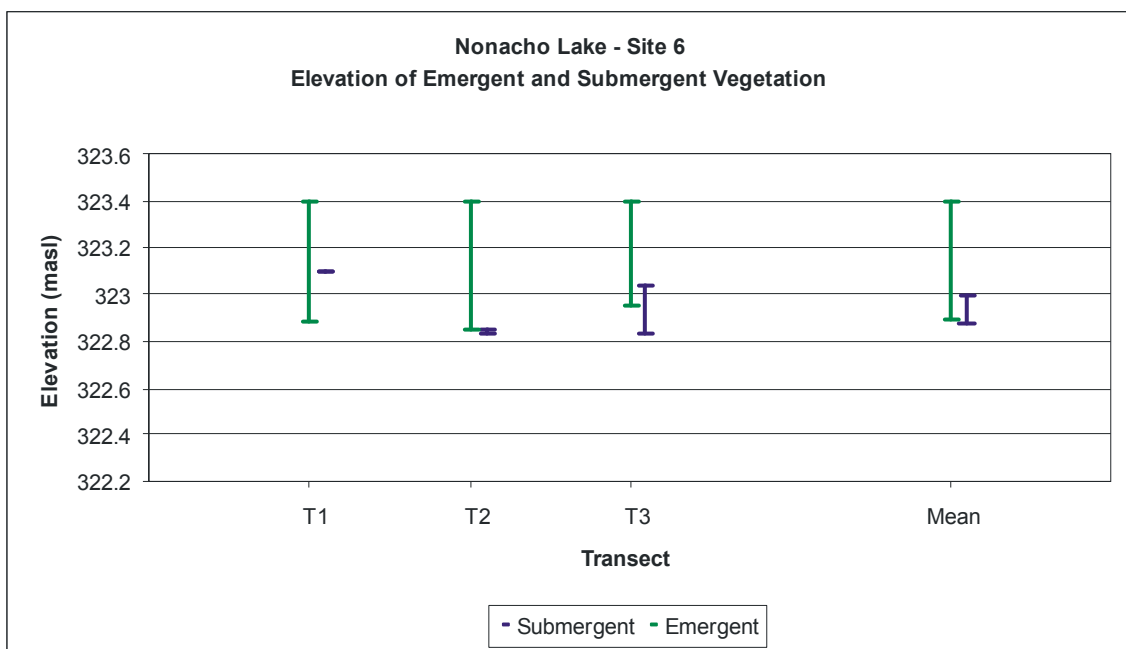


Figure 39. Emergent and submergent elevation ranges for transects at Site 6.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 6 are listed below:

Emergent:

- Maximum: 323.4 masl

- Minimum: 322.85 masl
- Mean range: 323.4 masl to 322.9 masl

Submergent:

- Maximum: 323.04 masl
- Minimum: 322.83 masl
- Mean range: 322.99 masl to 322.88 masl

The bathymetric profile of each transect was also graphed (Figure 40) and the mean elevation range for both emergent and submergent vegetation at Site 6 was noted on the graph.

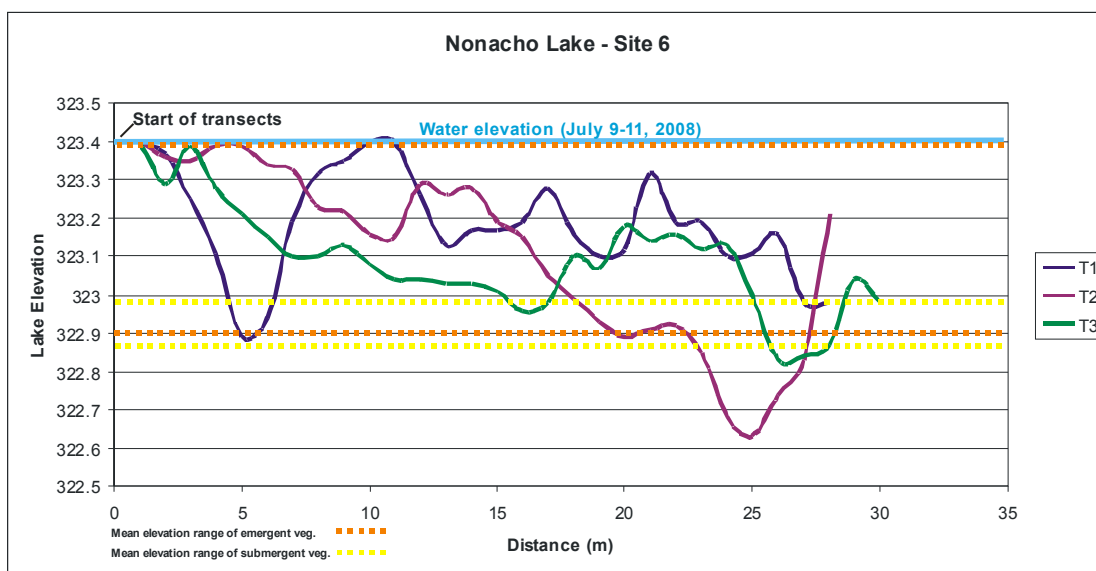


Figure 40. Site 6 transect profiles and elevation ranges of emergent and submergent vegetation.

Fish sampling was completed using angling, although no fish were caught using this method. Several pike were observed in the emergent vegetation while completing transects.

NL - Site 7

Site 7 was located in the north central area of the lake. The area is a large sedge platform which stretches along a shallow shoreline for approximately 300 m (Figure 41).



Figure 41. Large sedge platform at Site 7.



Figure 42. Northern pike captured using angling at Site 7.

No transects were completed at this site as no emergent or submergent vegetation extended out past the sedge platform.

Fish sampling was completed in the open water adjacent to the sedge platform using angling. One 30 cm pike was captured and is pictured above in Figure 42. The majority of this vegetated area was a sedge platform where only the rooted area was wet. Not enough water was present to allow pike to utilize the majority of this vegetated area.

NL - Site 8

Site 8 on Nonacho Lake was located in the north central area of the lake on an exposed shoreline (Figure 43). Shallow sand bars extended several hundred metres into the open water adjacent to the emergent sedge along the shore (Figure 44).



Figure 43. Exposed sandy shoreline.



Figure 44. Emergent sedge extends out into the lake on a shallow bench.

Vegetation at this site was mainly composed of water sedge on a fine sandy substrate. No transects were completed at this site, however, depth measurements were taken and the emergent sedge community extended from the water's edge (323.4 masl) out into the lake to an elevation of 322.67 masl.

No fish sampling was completed at this site, and no pike were visually observed. At the time of assessment, the water was turbid due to wave action, and visibility was low. This site had characteristics and similarities to other sites where pike were observed, which indicates that this site would also provide good pike rearing and spawning habitat.

NL - Site 9

Site 9 on Nonacho Lake was a very large site encompassing a bay area separated from the main lake by a narrow inlet. This bay area was most likely an independent water body prior to the installation of the Nonacho Dam. The shoreline of this shallow bay was characterized by large flat sedge platforms and floating mats of vegetation and woody plants (Figure 45). Emergent sedge was also found in several areas along the shoreline extending out from the shore at the edge of the sedge platform (Figure 46). The main emergent species found in this area included water sedge, beaked sedge and cattails (*Typha*).



Figure 45. Sedge platform at Site 9.



Figure 46. Transect through the emergent vegetation at Site 9.

Two transects were completed in an area where emergent vegetation extended out from the shoreline. The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 3 which is illustrated in Figure 47.

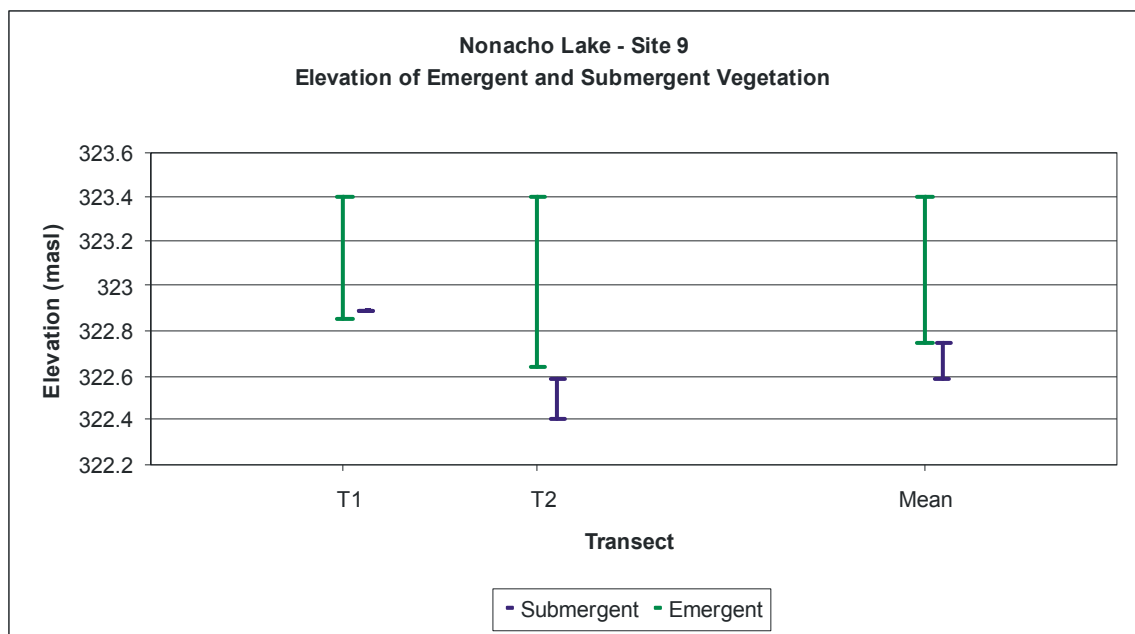


Figure 47. Emergent and submergent elevation ranges for transects at Site 9.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 3 are listed below:

Emergent:

- Maximum: 323.4 masl
- Minimum: 322.64 masl
- Mean range: 323.4 masl to 322.74 masl

Submergent:

- Maximum: 322.59 masl
- Minimum: 322.4 masl
- Mean range: 322.74 masl to 322.59 masl

The bathymetric profile of each transect was also graphed (Figure 48) and the mean elevation range for both emergent and submergent vegetation at Site 3 was noted on the graph.

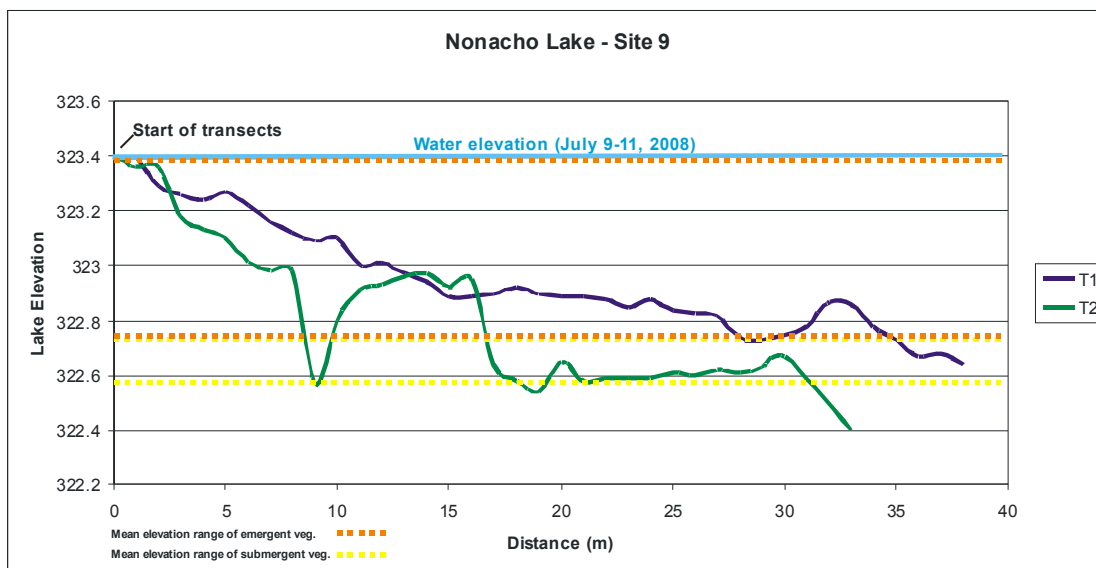


Figure 48. Site 9 transect profiles and elevation range of emergent and submergent vegetation.

Fish sampling was completed over a large area of the site using angling. Several pike were captured while trolling along the edge of the sedge platforms and through the submergent pondweed communities. Numerous adult pike were observed in the emergent sedge and cattails while completing transects. A large school of pike fry were also identified. The entire shallow bay area provides a significant amount of pike habitat.

NL - Site 10

At this site, only visual observations were taken. This site was very similar to previous sites and therefore, no specific measurements were taken.

NL - Site 11

At this site, only visual observations were made. This site was very similar to previous sites; therefore, no specific measurements were taken.

NL - Site 12

Site 12 on Nonacho Lake was located in the south west arm of the lake upstream from Tronka Chua Gap. A deep organic substrate and large amounts of woody debris and dead trees were present in this area (Figure 49). Emergent vegetation extended out from the shallow shoreline around a small bay area (Figure 50).



Figure 49. Dead trees and debris extend out into the wetland area.



Figure 50. Transect through emergent vegetation.

Vegetation at this site was mainly composed of water sedge and marsh cinquefoil. Some submergent pond weed extended out past the extent of the sedge. A total of three transects were completed at this site.

The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for site 12 (Figure 51).

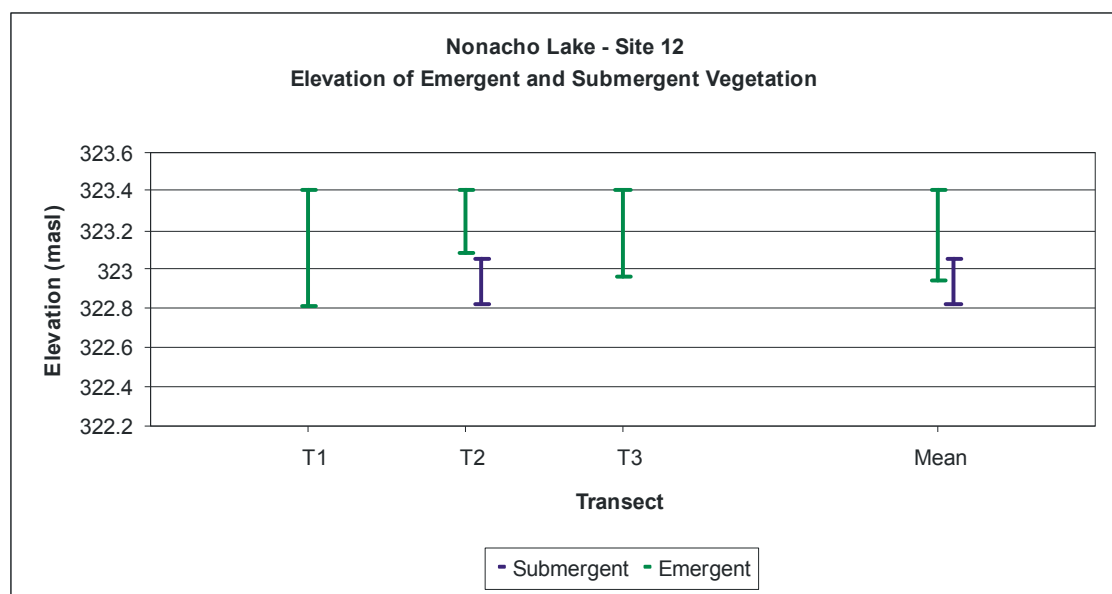


Figure 51. Emergent and submergent elevation ranges for transects at Site 12.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 12 are listed below:

Emergent:

- Maximum: 323.4 masl
- Minimum: 323.08 masl
- Mean range: 323.4 masl to 322.95 masl

Submergent:

- Maximum: 323.05 masl
- Minimum: 322.82 masl
- Mean range: 323.05 masl to 322.82 masl

The bathymetric profile of each transect was also graphed in Figure 52, and the mean elevation range for both emergent and submergent vegetation at Site 3 was noted on the graph.

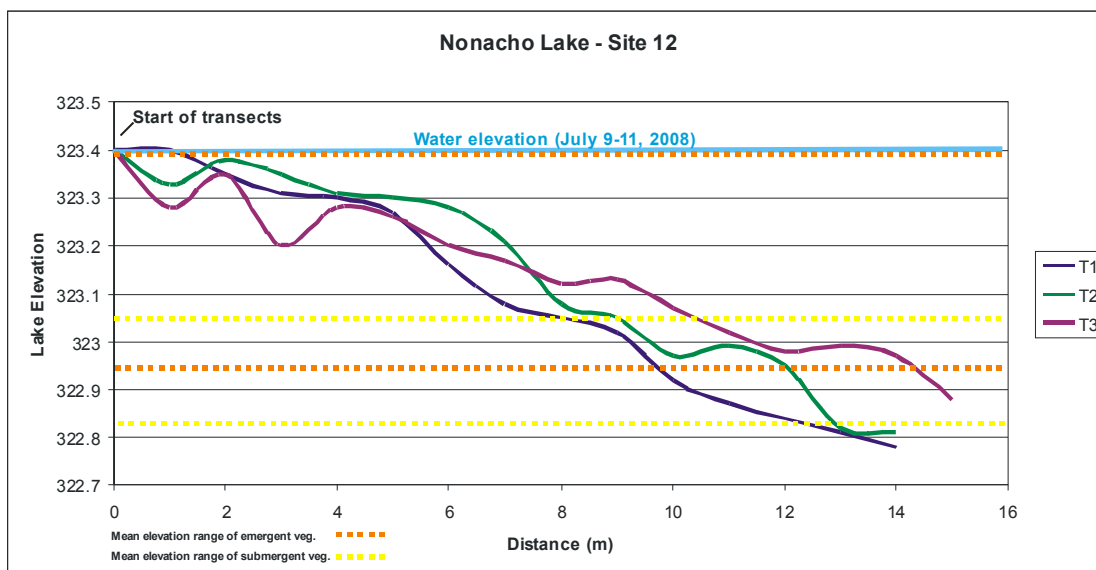


Figure 52. Site 12 transect profiles and mean elevation range of emergent and submergent vegetation.

Fish sampling at this site was completed using angling. No fish were caught or observed at this site; however, the characteristics of this site indicate that it could provide preferred northern pike rearing and spawning habitat.

NL - Site 13

At this site, only visual observations were made. This site was very similar to previous sites; therefore, no specific measurements were taken.

NL - Site 14

Site 14 on Nonacho Lake was located in the south west arm of the lake. This site is also located in a bay area sheltered from the main lake by a small inlet.

A small band of emergent sedge extended out from the shoreline around this bay area. The main species at this site was water sedge. A minimal amount of submergent pondweed was also present, but was not noted on the transect profiles (Figure 53 and Figure 54).



Figure 53. Sheltered bench habitat with submergent vegetation.



Figure 54. Emergent sedge extending out from the shoreline.

A total of three transects were completed at this site. The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for Site 14 which is illustrated in Figure 55.

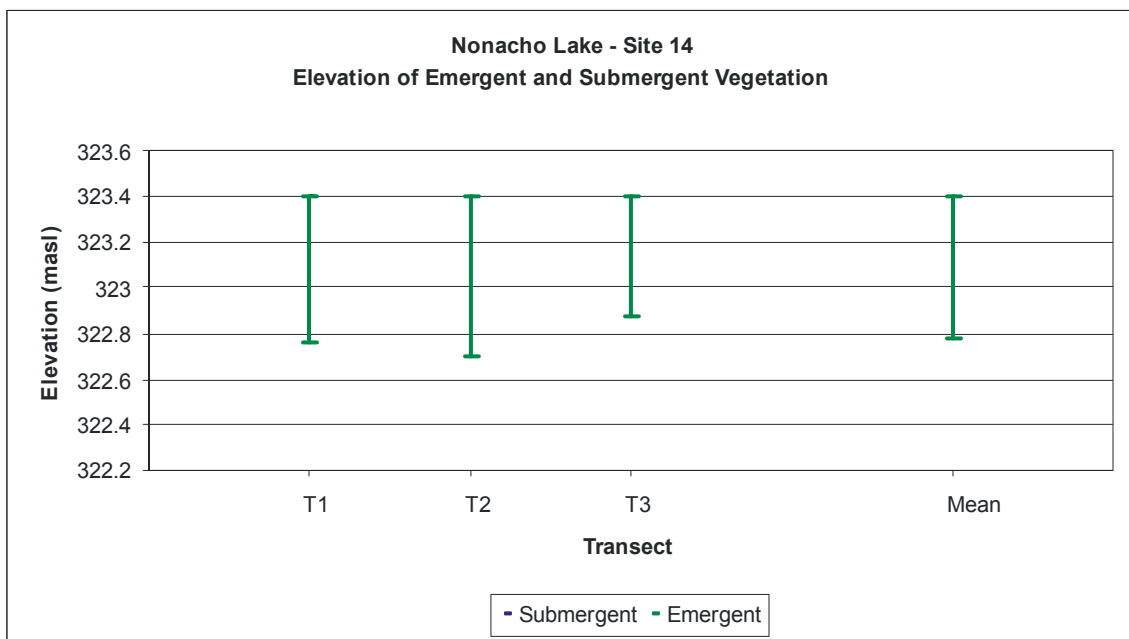


Figure 55. Emergent and submergent elevation ranges for transects at Site 14.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Site 14 are listed below:

Emergent

- Maximum: 323.4 masl
- Minimum: 322.70 masl
- Mean range: 323.4 masl to 322.78 masl

The bathymetric profile of each transect was also graphed and the mean elevation range for both emergent and submergent vegetation at Site 14 was noted in Figure 56.

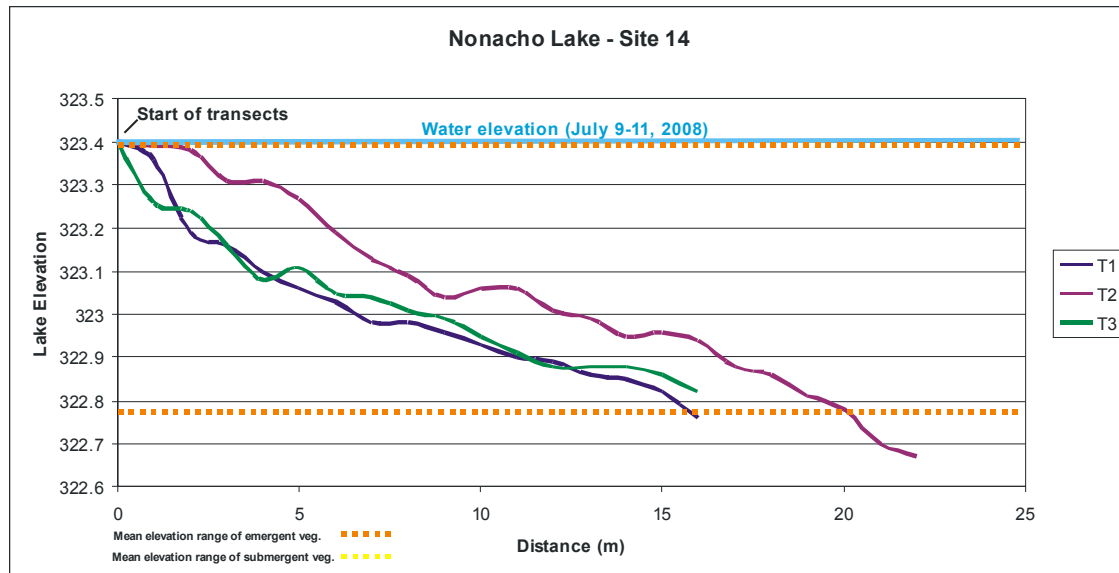


Figure 56. Site 14 transect profiles and mean elevation ranges of emergent and submergent vegetation.

Angling was completed in the open water adjacent to this site; however, no fish were captured or visually observed. The site appears to provide a large amount of pike spawning and rearing habitat. It is possible that no pike were observed at the time of assessment due to high winds and turbid water.

APPENDIX C – TRUDEL CREEK, SITE SPECIFIC DATA

- Waterline elevation at Sites 1 and 2, August 20-21, 2008 – 219.71 masl.
- Waterline elevation at Sites 3 through 5, August 20-21, 2008 – 229.17 masl.

Site 1 and 2 – Trudel Lake

Sites 1 and 2 were both located in Trudel Lake which is in the mid-reach of Trudel Creek. Site 1 is at the upper end of the lake and Site 2 at the lower end of the lake. These sites are both characterized by low gradient shorelines and fine substrates. Site 1 is illustrated in Figure 57 and Figure 58. Site 2 is illustrated in Figure 59 and Figure 60.



Figure 57. Site 1, at the upstream end of Trudel Lake.



Figure 58. Site 1, transect 2.



Figure 59. Site 2.



Figure 60. Site 2.

At Site 1, a total of 3 transects were completed. One transect was completed at Site 2. The elevation range of emergent and submergent vegetation for each transect was determined,

along with the mean elevation range for Trudel Lake, which included both Site 1 and 2. These data are illustrated in Figure 61.

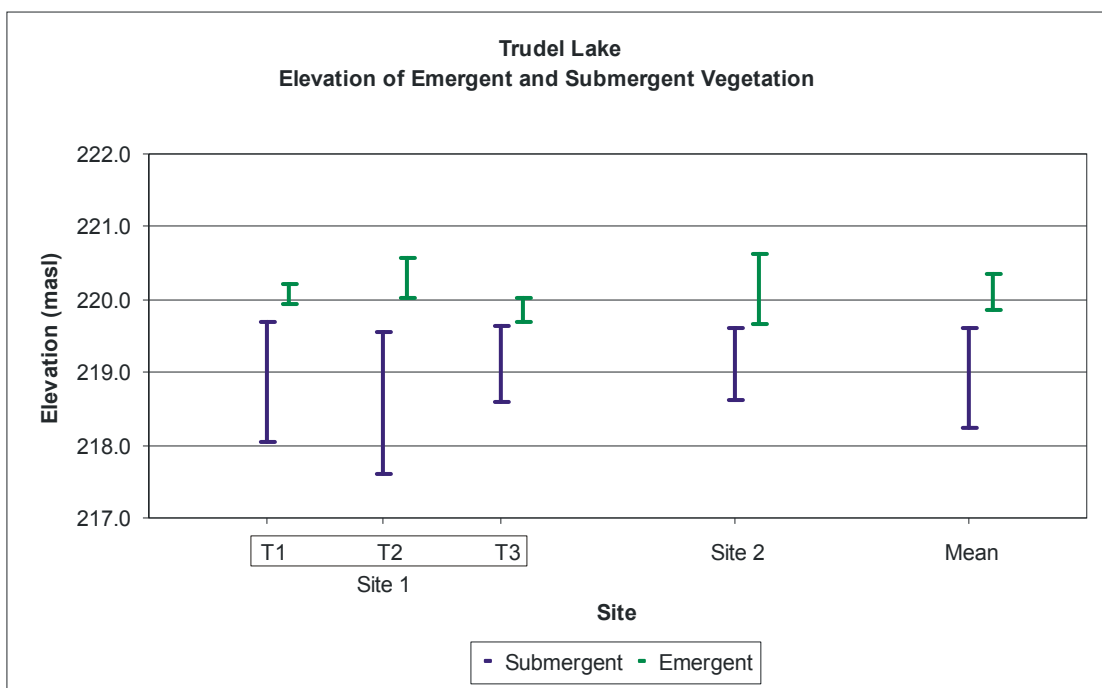


Figure 61. Elevation Ranges of Emergent and Submergent Vegetation at Sites 1 and 2 in Trudel Lake.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations in Trudel Lake are listed below:

Emergent

- Maximum: 220.63 masl
- Minimum: 219.68 masl
- Mean range: 220.36 masl to 219.84

Submergent

- Maximum: 219.71 masl
- Minimum: 217.61 masl
- Mean range: 219.64 masl to 218.23 masl

The bathymetric profiles of each transect at Sites 1 and 2 were also graphed and the mean elevation range for both emergent and submergent vegetation was noted in Figure 62.

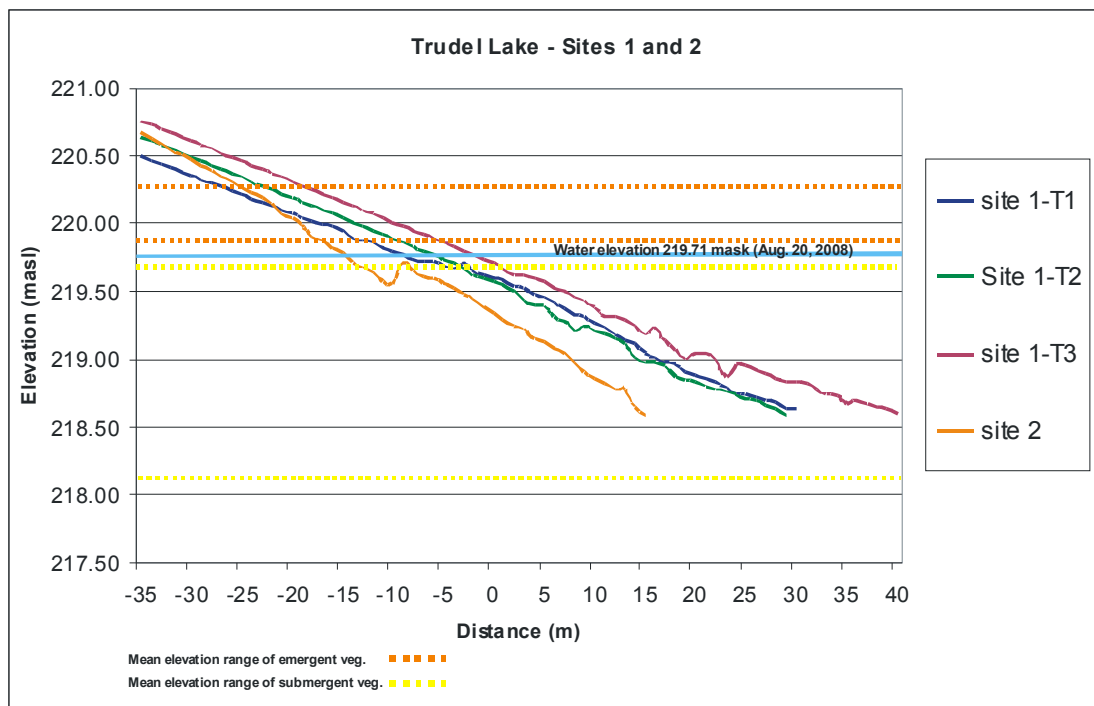


Figure 62. Site 1 and 2 transect profiles and mean elevation ranges of emergent and submergent vegetation.

Specific details pertaining to Site 1 and 2 are as follows:

Site 1

Site 1 was located in a shallow bay at the south end of Trudel Lake (Figure 63). Vegetation cover along shore and in shallow water areas extended less than 1.0 m in depth below the waterline elevation at the time of assessment. Vegetation was patchy and consisted primarily of submergent species such as awlwort (*Subularia aquatica*) and narrow-leaved bur-reed (*Sparganium angustifolium*) with trace occurrences of clasping-leaf pondweed (*Potamogeton perfoliatus*).

Clasping- leaf pondweed as well as various-leaved pondweed (*Potamogeton perfoliatus*) were the primary species present at between 1.0 and 3.0 m below the waterline elevation and occurred in relatively dense patches approximately 15 – 30 m from the waters edge. Substrates in this area were dominated by fines with small cobbles scattered throughout.

Emergent species including beaked sedge (*Carex utriculata*), Pacific water parsley (*Oenanthe sarmentosa*), horsetails (*Equisetum* spp.), and various grass species dominated the herbaceous vegetation community in areas that were less frequently inundated.



Figure 63. Site 1 – Sheltered bay on south end of Trudel Lake.

Site 2

Site 2 was located at the north end of Trudel Lake (Figure 64). Vegetation cover in shallow water areas was patchy. Primary species included awlwort (*Subularia aquatica*) and narrow-leaved bur-reed (*Sparganium angustifolium*). Pondweed (*Potamogeton* spp.) occurred in dense patches slightly offshore at 1.5 and 2.5 m below waterline elevation at the time of assessment. Substrates in this area were dominated by fines with small cobbles scattered throughout.

Emergent species including beaked sedge (*Carex utriculata*), horsetails (*Equisetum* spp.) and various grass species were dominant in inland areas that were less frequently inundated. Pacific water parsley (*Oenanthe sarmentosa*) was sparse.

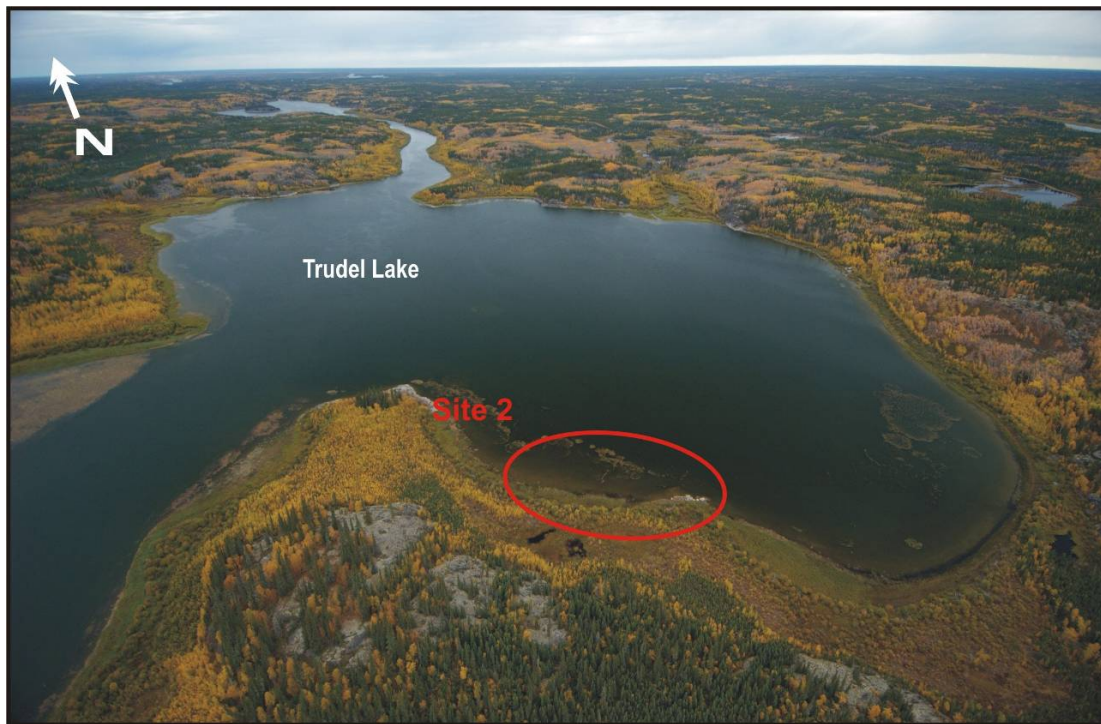


Figure 64. Site 2 – Sheltered bay on north end of Trudel Lake.

Site 3, 4 and 5 – Unnamed Lake and Upper Trudel Creek

Site 3 was located in the upper reach of Trudel Creek, and Sites 4 and 5 were located in Unnamed Lake. Site 3 was located on a bar characterized by a low gradient shoreline and fine substrates. Sites 4 and 5 also had low gradient shorelines leading into the shallow waters of Unnamed Lake. Site 3 is illustrated in Figure 65 and Site 4 in Figure 66.



Figure 65. Bench type shoreline at Site 3 on upper Trudel Creek.



Figure 66. Transect at site 4 on Unnamed Lake.

One transect was completed at each of Sites 3, 4 and 5. The elevation range of emergent and submergent vegetation for each transect was determined, along with the mean elevation range for these three sites. This data is illustrated in Figure 67.

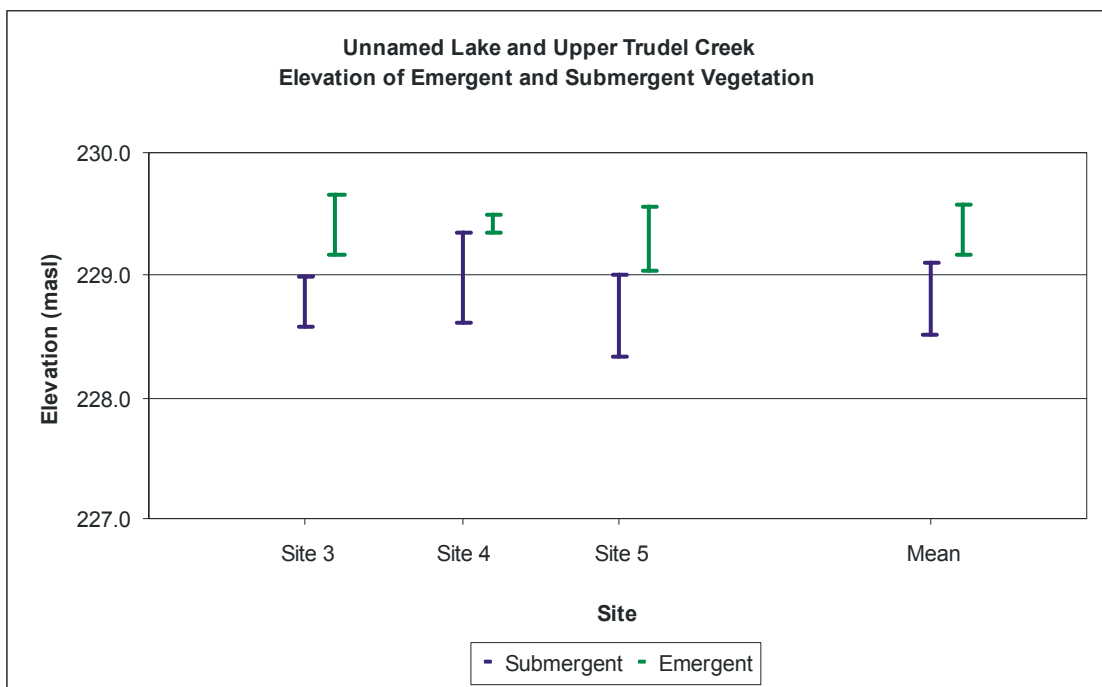


Figure 67. Elevation Ranges of Emergent and Submergent Vegetation at Sites 3, 4 and 5 in Unnamed Lake and Upper Trudel Creek.

The maximum, minimum and mean elevation ranges of emergent and submergent vegetation recorded along transect locations at Sites 3, 4 and 5 are listed below:

Emergent

- Maximum: 229.67 masl
- Minimum: 229.04 masl
- Mean range: 229.58 masl to 229.18 masl

Submergent

- Maximum: 228.99 masl
- Minimum: 228.33 masl
- Mean range: 229.11 masl to 228.51 masl

The bathymetric profile of each transect at Site 3, 4 and 5 were also graphed and the mean elevation range for both emergent and submergent vegetation was noted in Figure 68.

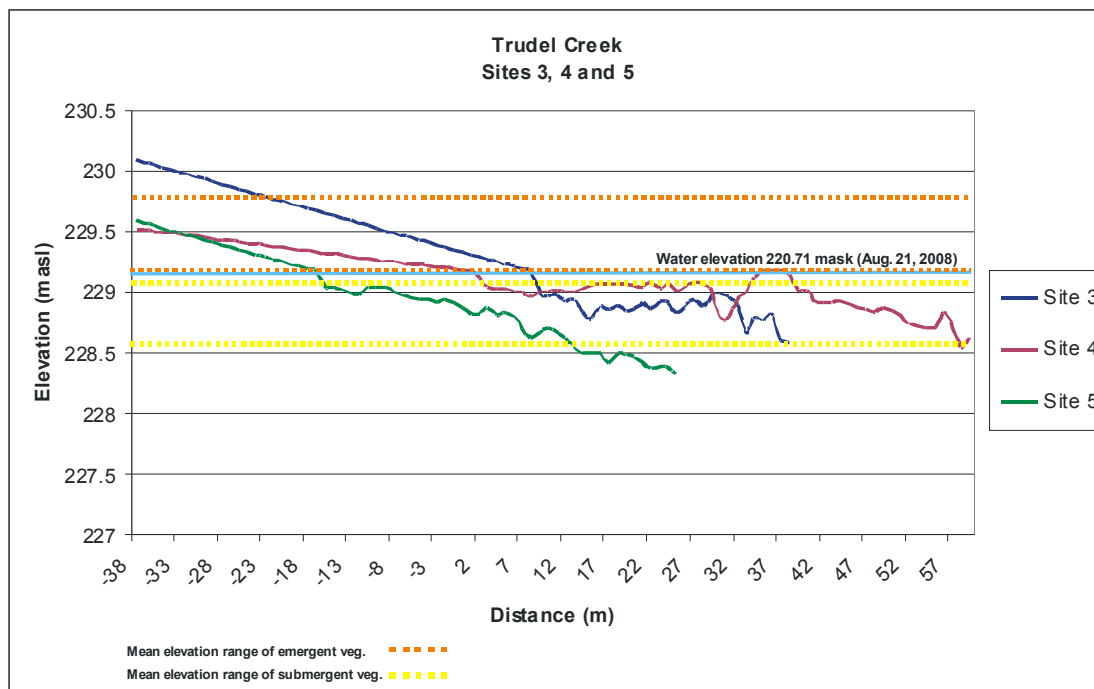


Figure 68. Site 3, 4 and 5 transect profiles and mean elevation ranges of emergent and submergent vegetation.

Specific details pertaining to Sites 3, 4 and 5 are as follows:

Site 3

Site 3 was located on a relatively shallow sediment bench in upper Trudel Creek (Figure 69), just downstream the South Valley Spillway. Vegetation growth ended abruptly at the end of the sediment bar. Vegetation cover in shallow water areas was fairly uniform. Dominant species included awlwort (*Subularia aquatica*), large leaved white water-crowfoot (*Ranunculus aquatilis*), common Mare's tail (*Hippuris vulgaris*), narrow-leaved bur-reed (*Sparganium angustifolium*), milfoil species (*Myriophyllum* spp.), rushes (*Juncus* spp.), horsetails (*Equisetum* spp.), arum-leaved arrowhead (*Sagittaria cuneata*), water-starwort sp. (*Callitriche* sp.) and pondweeds (*Potamogeton* spp.). Substrates in this area were dominated by fines with small cobbles scattered throughout.

Inland areas that appeared to be less frequently inundated supported the typical sedge/grass community observed at Sites 1 and 2. Primary species included beaked sedge (*Carex utriculata*), grasses and horsetails (*Equisetum* spp.). Pacific water parsley (*Oenanthe sarmentosa*) was present as a minor component.



Figure 69. Site 3 – Sediment bench downstream of South Valley Spillway.

Site 4

Site 4 was located in a shallow bay at the north arm of Unnamed Lake (Figure 70). One vegetation transect was completed at this site. Vegetation cover in shallow water areas was fairly uniform. Dominant species included awlwort (*Subularia aquatica*) and common Mare's tail (*Hippuris vulgaris*), with a minor component of pondweed (*Potamogeton* spp.). Pondweed dominated open water areas throughout the bay at approximately 0.5 m to 2.0 m below the waterline elevation at the time of assessment. Inland areas that were less frequently inundated supported the typical sedge/grass community observed at previous sites. Primary species included beaked sedge (*Carex utriculata*), horsetails (*Equisetum* spp.) and various grass species. Pacific water parsley (*Oenanthe sarmentosa*) was present as minor component. Substrates in this area were dominated by fines with small cobbles scattered throughout.

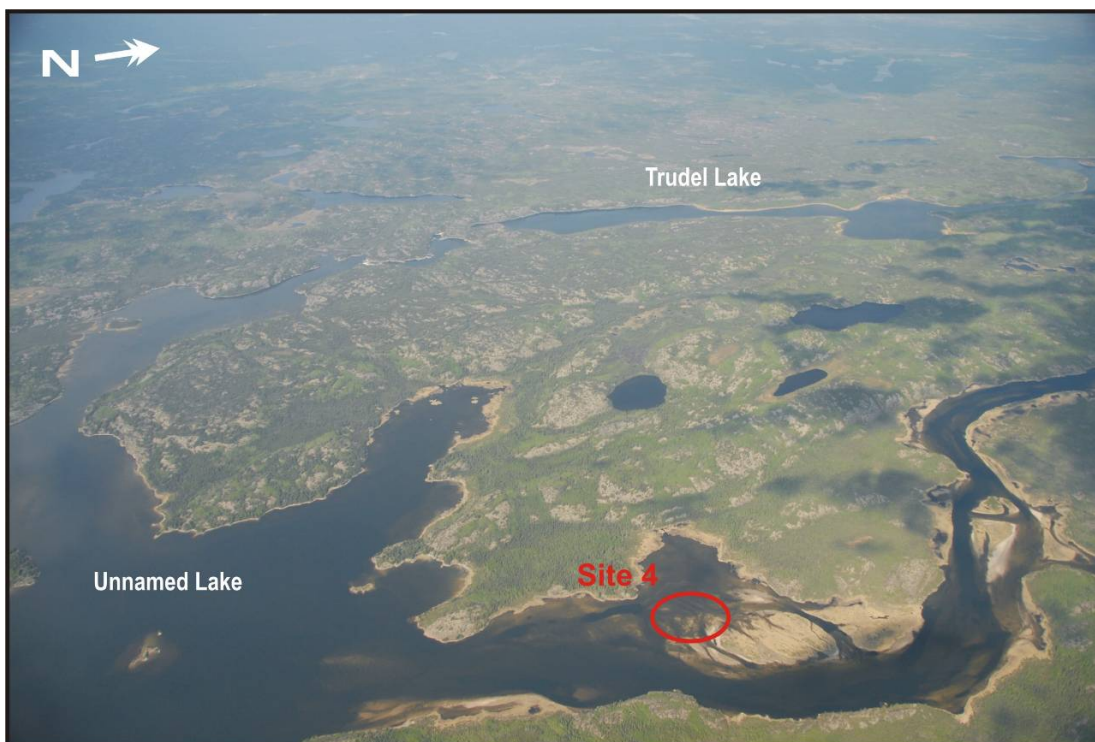


Figure 70. Site 4 – Shallow bay in north arm of Unnamed Lake.

Site 5

Site 5 was located in a shallow bay near the west arm of Unnamed Lake (Figure 71). One vegetation transect was conducted. Vegetation cover in shallow water areas near shore was fairly uniform. Dominant species included awlwort (*Subularia aquatica*), narrow-leaved bur-reed (*Sparganium angustifolium*) and rush species (*Juncus* spp.), with a minor component of arum-leaved arrowhead (*Sagittaria cuneata*) and pondweeds (*Potamogeton* spp.) present in patches. Dense patches of pondweed and water smartweed (*Polygonum amphibium*) were observed in the open water offshore up to approximately 2.5 m below the waterline elevation at the time of assessment. Substrates were predominately fines with small cobbles scattered throughout.

Areas that were less frequently inundated supported the typical sedge/grass community observed at the previous sites. Primary species included beaked sedge (*Carex utriculata*), horsetails (*Equisetum* spp.), and various grass species. Pacific water parsley (*Oenanthe sarmentosa*) was present as a minor component. Large woody debris was abundant at this site. Substrates in this area were dominated by fines with small cobbles scattered throughout.

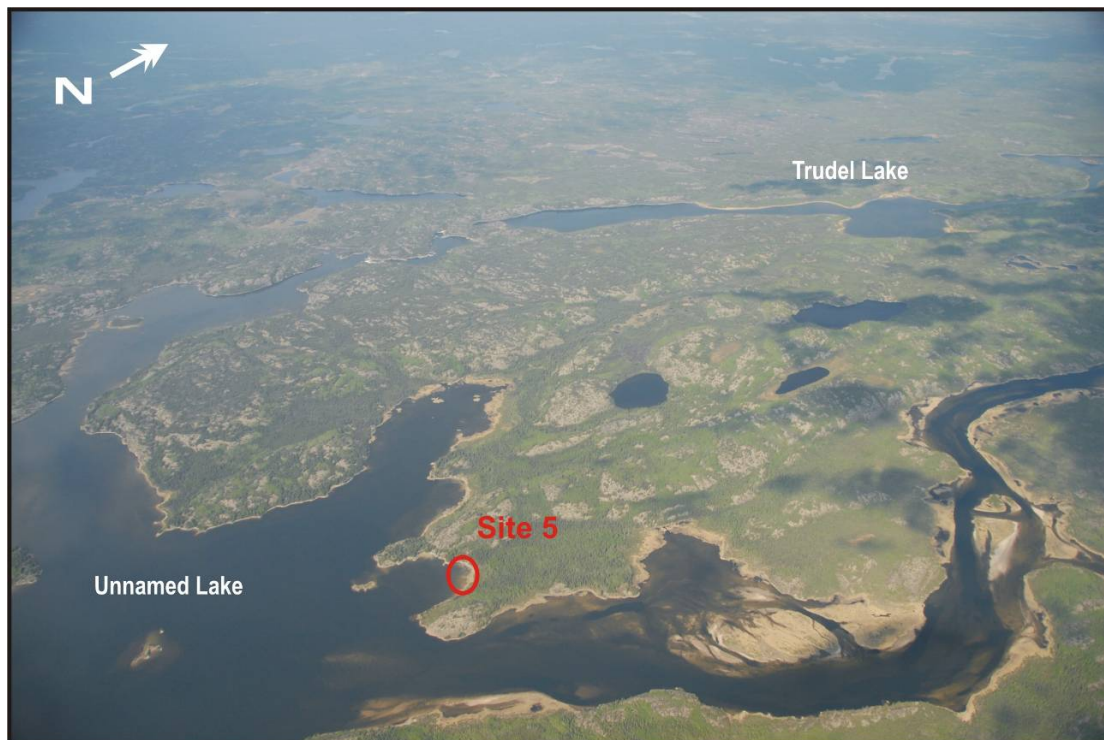


Figure 71. Site 5 is located near the west arm of Unnamed Lake.