Southern Lakes
Terrestrial Environment Baseline Studies

2010 Rare Plant Surveys

(Photo: P. Williston)

Prepared for:

Yukon Energy Corporation
and
AECOM Canada Ltd.

Prepared by:

Patrick Williston, M.Sc., R.P. Bio.
Gentian Botanical Research
Smithers, BC

In association with:

ARDEA BIOLOGICAL CONSULTING
Smithers, BC

March 2012

AECOM
2251 2nd Avenue
Whitehorse, YT, Canada Y1A 5W1
www.aecom.com

867 633 6474 tel
867 633 6321 fax

March 23, 2012

Hector Campbell
Director, Resource Planning & Regulatory Affairs
Yukon Energy Corporation
2 Miles Canyon Road, Box 5920
Whitehorse, Yukon
Y1A 6S7

Dear Hector:

Project No: 60146345 – Task 2.4.7.4

Regarding: Marsh Lake Fall-Winter Storage Concept – Summary Report of 2010 Rare Plant Surveys

Please find attached the above noted report prepared by Ardea Biological Consulting on behalf of AECOM.

We trust this report meets your current needs. If you have any questions regarding this report, or if we can be of further assistance, please do not hesitate to contact the undersigned.

Sincerely,
AECOM Canada Ltd.

Forest Pearson
Sr. Geological Engineer
Forest.Pearson@aecom.com

OM:om
Encl.
cc:

Executive Summary

The Marsh Lake Area was surveyed for rare vascular plants in 2010 using standard field methods. In total, 68 plant species were documented from 8 localities during three days of surveys, July 18-20. Forty-three specimens were collected and preserved to document the regional flora.

The Marsh Lake Area supports at least 3 vascular plants on the Yukon Tracking and Watch Lists: *Crassula aquatica*, *Subularia aquatica*, and *Isoetes echinospora*. These plants occupied level or gently sloping, silty and sandy substrates in shallow, clear water, in what is probably the warmer reaches of cold water bodies. *Crassula aquatica* and *Subularia aquatica* were found along the north shore of the west end of Nares Lake, and *Crassula aquatica* and *Isoetes echinospora* were recorded along the west shore of Lewes Marsh.

Aquatic plants are among the least documented of vascular plants because they tend to be difficult to collect. It is possible that the rare plants noted in this report are more common than records suggest, though these species may be vulnerable to disturbance as all three plants are threatened or extirpated in at least some part of their historic range.

Three unusual wetland plant communities were observed in the Marsh Lake Area: rafting vegetation, willow pedestals, and a peat-filled wetland. The prevalence of these wetland plant communities in the Yukon Territory is unknown and their importance to the regional ecology appears to be undetermined.

In 2010, only a relatively small representative area was surveyed. Further investigations would likely yield additional locations for these, and possibly other rare aquatic plants in the Marsh Lake Area. To compliment shoreline and canoe surveys conducted to date, snorkel sampling is recommended as an additional way characterize the rare aquatic flora.

Suggested Citation:

Williston, P. 2012. Southern Lakes Terrestrial Environment Baseline Studies - 2010 Rare Plant Surveys. Unpublished report prepared for AECOM Canada Ltd. and Yukon Energy Corporation by Ardea Biological Consulting Ltd., Smithers, BC. 9 pp. + appendices.

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

Acknowledgements

This work was made possible with the support of the AECOM Whitehorse staff; Forest Pearson, Kathleen Woods and Kai Woloshyn; who supported our broad program of terrestrial studies within AECOM and with Yukon Energy Corporation. We would like to thank Joel MacFabe for his help boating us around during our field work.

Disclaimer

This report has been prepared by the authors under the direction of Ardea Biological Consulting Ltd. (Ardea) for Yukon Energy Corporation and AECOM Canada Ltd. (the Clients) to provide baseline ecological information for the Marsh Lake Water Storage Concept. The information contained in this report have been obtained and prepared in accordance with generally accepted biological survey standards and is intended for the exclusive use of the Clients. The information contained in this report is dependent on the conditions at the time and any recommendations or conclusions are based on the author's best judgement at the time of preparation. The Clients acknowledge that ecological conditions can change over time and that the conclusions and recommendations outlined in this report are time sensitive.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. The authors and Ardea accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

Table of Contents

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

List of Figures

List of Tables

INTRODUCTION

Yukon Energy Corporation (YEC) has engaged AECOM Canada Ltd. (AECOM) to assist with implementation of key energy development and enhancement projects as identified in YEC's 20-Year Resource Plan. One of the proposed projects is the Marsh Lake Storage Concept, which proposes to apply to the Yukon Water Board to increase the winter full supply level by 0.3 m and lower the low supply level by 0.1 m to increase winter flows downstream to the Whitehorse Rapids Generating Station. The concept would use the existing Lewes Dam control structure to release water from November to early May, which would be the same as the current release regime.

Ardea Biological Consulting Ltd. (Ardea) was contracted by AECOM to complete terrestrial baseline studies within Marsh Lake, Tagish Lake, Nares Lake and Bennett Lake, which comprise the Southern Lakes area. As part of the terrestrial baseline environment studies, rare plant studies were conducted using a combination of boat-based and ground-based survey techniques. The main purpose of this work was to determine which rare plant species were found within wetland habitats in the Southern Lakes and what vegetation communities contained these rare plant species. Surveys and observations were carried out by Patrick Williston (Gentian Botanical Research) with assistance from Anne-Marie Roberts (A. Roberts Ecological Consulting).

Rare Plants in the Yukon

The Yukon Territory is a large and sparsely populated region with vast areas that have never been intensively examined by plant collectors. Fortunately, the Yukon has an excellent territorial flora (Cody 1996), and valuable additions to the Yukon plant list have been published in recent years (Cody *et al.* 1998, 2000, 2001, 2002, 2003, 2004, and 2005). As compared to Europe and more populated parts of North America, the Yukon is fertile ground for discovery. Contemporary field surveys continue to contribute important new location information that is used to refine the known distributions of rare and uncommon species.

Aquatic plants are among the least documented of vascular plants because they tend to be difficult to collect. They often grow beyond arm's reach of the shoreline, and even with a canoe, they are frequently more than 1 meter underwater, too far to reach without a retrieval device. Furthermore, aquatic plants tend to have reduced leaves and flowers and are easily overlooked, particularly the smaller ones. For these reasons it is difficult to discern rare aquatic plants from those that are simply seldom collected.

The first effort to list and map the rare plants of the Yukon Territory was by Douglas, Argus, Dickson and Brunton (1981). In 2003, the Yukon Conservation Data Centre (Yukon CDC) began tracking known locations of rare plants. Collating years of field work and collections, the Yukon CDC refined and updated Douglas's list to develop a Tracking List and Watch List. The 2010 Tracking List includes 127 plant species for which there is a conservation concern. The Watch List currently numbers 207 species for which there is insufficient information to determine whether or not the plants are at risk.

The Yukon Territory, adjacent Alaska and northwest British Columbia are home to an important endemic flora: plants not found elsewhere on the planet. Many of these plants are regionally common and are not at risk of extinction; however, several endemic species are rare and we note the endemic species encountered in the study area because healthy populations in the Yukon Territory are critical for their global conservation.

STUDY AREA

The Southern Lakes Study Area for the 2010 field studies is situated within the Yukon River watershed and extends along the Yukon River south of Whitehorse, into Marsh Lake, Tagish Lake and Bennett Lake, but does not extend into Atlin Lake. It includes the rivers, lakes, shorelines and major adjacent wetlands bodies in both the Yukon and Northern British Columbia that are influenced by the fluctuating water levels found in these water bodies ().

The Southern Lakes Study Area is located largely within the Yukon Southern Lakes Ecoregion; however, southern portions of the study area also overlap the Yukon-Stikine Highlands Ecoregion (YEWG 2004) and the Boreal Mountains and Plateaus Ecoregion of British Columbia (Demarchi 1995). The majority of the study area is located within the rain shadow of the St. Elias and Coast Mountains and is therefore a relatively dry region with precipitation averaging 200 to 325 mm annually (YEWG 2004). Mean annual temperatures are -1^{o} C to -2^{o} C across most of this area, with mean temperatures in July ranging from 12^{o} C to 14^{o} C and mean temperatures in January averaging about -21^{o} C (YEWG 2004). The south-western section of the study area around Carcross and Bennett Lake is within the Yukon Stikine Highlands Ecoregion and the southern portions of Tagish Lake, which is within the BC Boreal Mountain and Plateaus Ecoregion and is heavily influenced by Pacific maritime weather systems. This area receives moderate levels of precipitation and slightly cooler annual temperatures than the rest of the study area. Average annual rainfall reported for Atlin is 192.5 mm and average snowfall is 154.8 cm. Summer day temperatures average 13° C to 17° C and winter temperatures range between -10 °C and -20 °C (Environment Canada 2010).

The study area is characterized by broad glacial valleys with several large lakes and rivers traversing the valley floors. It lies in a sporadic discontinuous permafrost zone, where permafrost underlies less than 25% of the landscape. Soils tend to be alkaline and wetlands are mainly fens (YEWG 2004). Vegetation within this area is dominated by coniferous forests of white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta*). Portions of the study area also encompass large wetlands dominated by willows and/or sedges.

METHODS

Prior to conducting fieldwork in the Southern Lakes Study Area, the Yukon Conservation Data Centre Tracking List and Watch List (Yukon CDC 2010) were obtained from Randi Mulder, Data Manager for the Yukon CDC. Further consultation was conducted with Bruce Bennett, a Yukon government botanist with a wealth of knowledge and experience in the Yukon Territory (Bennett pers. comm. 2010). *The Rare Vascular Plants of the Yukon* (Douglas *et al.* 1981) and *The Rare Vascular Plants of British Columbia* (Douglas *et al.* 2002) were also examined. Because the study area is composed of lake and river margin habitat, special attention was paid to rare aquatic plants suspected of occurring in the area: *Isoetes* spp., *Crassula aquatica* and *Montia fontana*.

The methodology for the rare plant survey followed recommendations outlined by the Alberta Native Plant Council (2000). When possible, rare plant populations were described in terms of numbers of individuals or area occupied, though this was not practical for most aquatic plant records because we could not delineate the size of submerged populations. In most rare plant locations, a standard Ground Inspection Form was completed, which includes a summary of the habitat characteristics (location, elevation, slope, aspect, soil texture) and the associated plants. Geographic locations were identified in UTM units (datum NAD 83) using a hand-held GPS. Photographs were taken of rare species when possible. Specimens were identified using *Flora of the Yukon Territory* (Cody 1996) and *Flora of Alaska and Neighboring Territories: a Manual of*

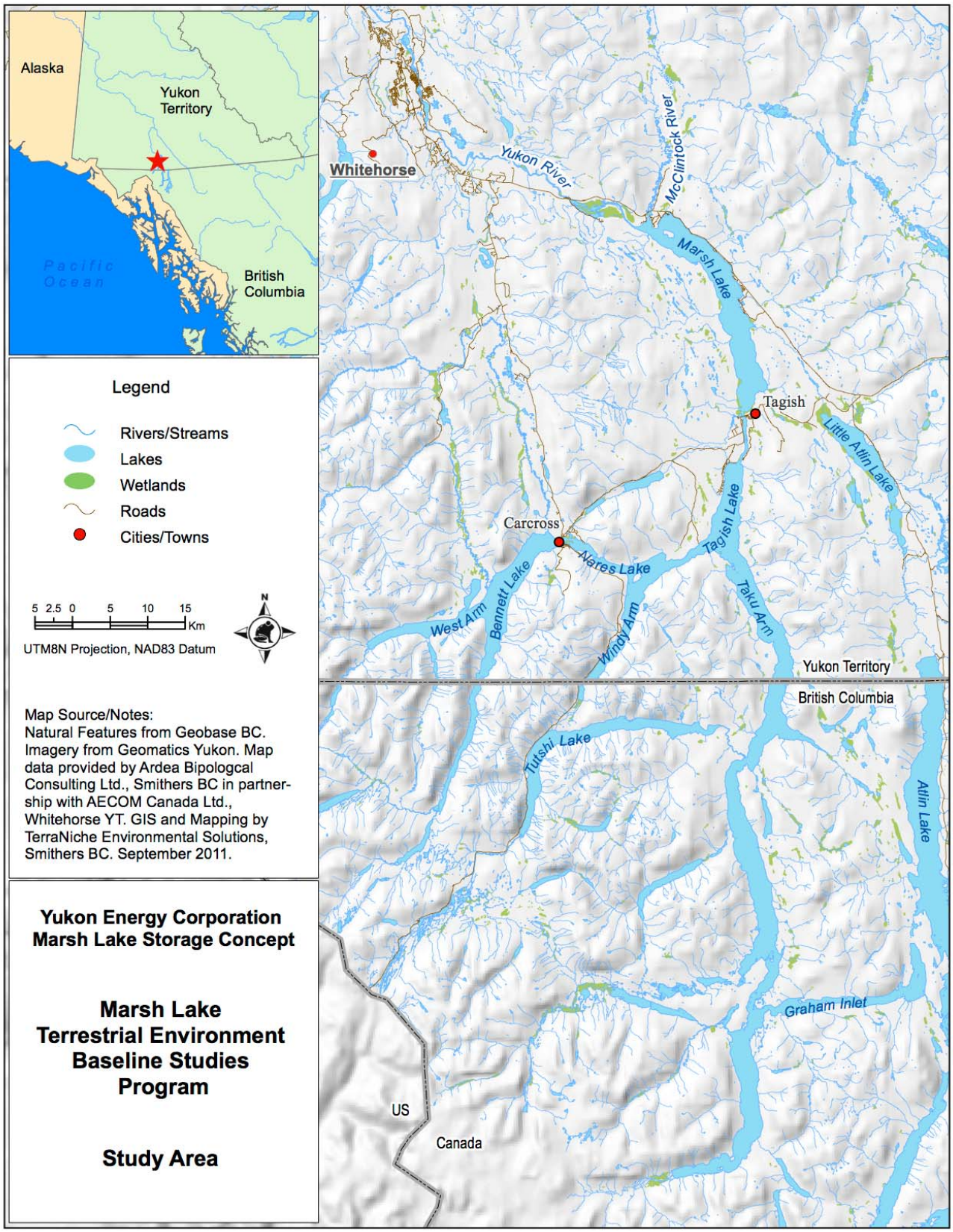

Figure 1. Southern Lakes Study Area.

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

the Vascular Plants (Hultén 1968). We compared the distribution maps of Yukon plants in Hultén (1968), Douglas *et al.* (1981) and Cody (1996), to provide context for the new locations of rare species discovered in this study.

RESULTS

In total, 68 plant species were documented from 8 localities during three days of surveys, July 18-20, 2010 (Appendices B and C). Forty-three specimens were collected and preserved to document the regional flora. These specimens have been prepared to be sent to the University of British Columbia Herbarium, which is the largest repository of plant collections in western Canada. At the herbarium, the plants will serve as a permanent record of the flora of the study area at the time of the survey.

In 2010, three species on the Yukon CDC Tracking List and Watch List were recorded from the Marsh Lake Area: *Crassula aquatica*, *Subularia aquatica*, and *Isoetes echinospora* (Table 1, Appendix A).

Table 1. Rare plants recorded in the Marsh Lake Area in 2010.

Species	Tracking[1]	Watch[1]	Douglas[2]
Crassula aquatica[3]		S1	
Subularia aquatica	S2S3		+
Isoetes echinospora		S1	+

[1]Yukon Conservation Data Centre 2010. The classification for rare status is provided in Appendix C.

[2]Douglas *et al.* 1981.

[3]This species was first recorded for the Yukon Territory after Douglas *et al.* (1981) was printed.

Crassula aquatica is a small annual plant (about 2 cm tall) with 2-3 mm long, awl-shaped leaves with opposite leaf arrangement (Figure 2). It has a circumpolar distribution, though records are very few in large parts of its range (Hultén 1968, Cody 1996). For example, in the United Kingdom, *Crassula aquatica* is a protected species with one known locality (PlantNetwork 2011). It is extirpated from Estonia; near threatened in Finland, Sweden and Japan; endangered in Norway; and critically endangered in Slovakia (National Red Lists 2011). In Canada and the USA, *Crassula aquatica* is rare throughout most of its range, and it has been extirpated from Maryland and Pennsylvania (NatureServe 2010).

Subularia aquatica is a small (up to 6 cm tall) annual herb with 20 mm long awl-shaped (subulate) leaves (Figure 3). It has a circumpolar distribution (Hultén 1968), and is a red-listed

Figure 2. *Crassula aquatica*

Figure 3. *Subularia aquatica*

species in Japan, while it is believed to be extirpated from Switzerland (National Red Lists 2011). In Canada it is considered rare in Manitoba, and in the USA it is thought to be extirpated from Vermont (NatureServe 2010).

Isoetes echinospora is endemic to North America where it is widely spread from Labrador to Alaska, and south to California and Pennsylvania (Figure 4). It is a perennial plant, related to the ferns, that reproduces by spores developed at the base of narrow, awl-shaped leaves. The leaves grow up to 12 cm long in the study area. This plant is rare in Alberta and in several states in the USA. It is believed to be extirpated from Ohio (NatureServe 2010).

Figure 4. *Isoetes echinospora.*

At the west end of Nares Lake *Crassula aquatica* and *Subularia aquatica* were collected from the shallow silt bottom of wetlands (NAD 83, 8V 517528E 6670160N, 655 m asl). Plants were observed growing in water between 0.5 and 1.0 m in depth and were relatively common (numbering in the 100s), though sporadic. The rare plants were found along the northern shoreline approximately 500 m east of the airplane hangar. *Subularia aquatica* was also found floating along the shore of the willow island in the middle of the western end of the lake where it is presumed that plants were disturbed by foraging waterfowl. Wetlands along the shoreline of Nares Lake also support large willow flats dominated by the greyleaf willow, *Salix glauca*, and the water sedge, *Carex aquatilis*. These flats, which are occasionally inundated, develop willow mounds or pedestals, some reaching 1 m in height (Figure 5). These pedestals form at the base of old willows, and appear to develop from leaf and stem litter, roots, and trapped silt. Aquatic sedges (mainly *Carex aquatilis* and *Carex utriculata*) are most common in the interstices between the willow mounds. What role willow pedestals might have in the regional ecology or as habitat for animals is not known and should be explored.

Figure 5. Willow pedestal at Nares Lake.

At Lewes Marsh on Marsh Lake, *Isoetes echinospora* and *Crassula aquatica* were collected from the shallow western shoreline under approximately 0.75 m of water in an area where silt filled the interstices between small stones (NAD 83, 8V 518992E 6714409N, 662 m asl). Also of note in Lewes Marsh was the presence of

Figure 6. Rafting vegetation at Lewes Marsh.

rafting vegetation: plants that form a weft of organic fabric, floating untethered in the water (Figure 6). Rafting vegetation tends to develop in aquatic systems with sufficient waterborne nutrition to allow plants to grow without soil. Rafting vegetation develops in lakes with controlled flooding when organic material from the lake margin is released into the water body. Little is known about the ecology of rafting vegetation in Canada. Rafting vegetation is occasionally used by birds for nesting. For example, Yellow-headed Blackbirds use rafting calla lily, *Calla palustris*, for nest-building at Oldman Lake, near Houston, British Columbia (Williston personal observations). Black Terns are known to build floating nests in the Yukon Territory, usually from rafts of dead bulrushes, *Typha latifolia* (Sinclair *et al.* 2003). In 2010, nests were not observed on rafting vegetation in Lewes Marsh.

Rare plants were not observed in the wetlands at Tagish Narrows in 2010, though an uncommon species, *Utricularia intermedia*, was locally abundant in places. This plant was considered rare by Douglas *et al.* (1981) but has had sufficient new records to be removed from current tracking and watch lists. Tagish Narrows did, however, support a peat-filled wetland (Figure 7), approximately 12 hectares in size. This wetland featured large pans of fractured peat, derived from sedges (*Carex aquatilis* and *Carex utriculata*) and mosses (*Drepanocladus* sp.), with abundant aquatic snails and foraging Lesser Yellowlegs, but no rare plants (NAD 83, 8V 539834E 6687119N, 651 m asl). The role of peat wetlands in the aquatic ecology of the Marsh Lake Area may warrant further investigation.

Figure 7. Peat-filled wetland at Tagish Narrows.

There were no endemic aquatic plants in the Marsh Lakes Area recorded in 2010. *Salix barclayi*, *Salix commutata*, *Senecio streptanthifolius, Stellaris calycantha, Euphrasia subarctica,* and *Fragaria virginiana* ssp. *glauca* were recorded from a white spruce island in Lewes Marsh. These plants are endemic to mountainous western North America and are rather broadly endemic; they are not considered at risk of extirpation.

CONCLUSIONS AND RECOMMENDATIONS

The Marsh Lake Area supports at least 3 vascular plants on the Yukon Tracking and Watch Lists: *Crassula aquatica*, *Subularia aquatica*, and *Isoetes echinospora*. These species occupy level or gently sloping, silty and sandy substrates in shallow, clear water, typically in the warmer reaches of cold water bodies (shallow areas with still or slow moving water). Among the plants that form an association in this habitat are *Rananculus flammula*, *Eleocharis acicularis*, *Isoetes echinospora*, *Subularia aquatica, Crassula aquatica, Callitriche verna*, *Stukenia* spp. and *Potamogeton* spp. Many of these plants are superficially similar in appearance, developing small rosettes of linear or awl-shaped leaves with reduced flowers. Collecting specimens is usually necessary for verification. Though these plants often grow together, the composition of the assemblage at each site varies, making it difficult to predict which plants will be present and at any given site. This plant association appears to be widely spread and can be found from the southern Yukon Territory (61° N) to at least Smithers, British Columbia (55° N), some 800 km south, and probably beyond (Williston personal observations 2010, Minnesota Department of Natural Resources 2011).

Two of the rare species noted here, *Crassula aquatica* and *Subularia aquatica*, are annual plants: they grow from seed and complete their life cycle in a single year. Annual plants are uncommon in the Yukon Territory, presumably because the growing season is short, which tends to favour perennial species that can store energy from year to year. These small, delicate plants are poor competitors with the large perennial sedges that dominate stable wetlands. Shallow areas with seasonal flooding and annual silt deposition may be important habitat features that allow annuals to survive.

The rare plants of the Marsh Lake Area recorded in 2010 are aquatic species with a similar habitat. Though each of the three rare species have seldom been collected in the territory, it is probable that current records under-represent the true distributions of these plants. Aquatic plants in general, are seldom collected; they typically grow beyond the reach of plant collectors. Extra effort is required to find, gather and preserve small aquatic species, and it is difficult to account for these factors when determining rarity. While possibly more common than records show, these plants may yet be vulnerable to human disturbances. As mentioned above, all of these plants are threatened or extirpated in at least some part of their historic range.

Three unusual wetland plant communities were observed in the Marsh Lake Area: rafting vegetation, willow pedestals, and a peat-filled wetland. The prevalence of these wetland plant communities in the Yukon Territory is unknown and their importance to the regional ecology, to our knowledge, is undetermined. Further study is encouraged.

In 2010, only a relatively small representative area was surveyed for rare plants over three days, indicated by eight collection locations. Further investigations would likely yield additional locations for these, and possibly other rare aquatic plants in the Marsh Lake Area. To compliment shoreline and canoe surveys conducted to date, snorkel sampling is recommended, an approach that has been used elsewhere to more fully characterize rare aquatic flora (Wingfield *et al.* 2005).

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

REFERENCES

Alberta Native Plant Council. 2000. ANPC Guidelines for Rare Plant Surveys in Alberta. Available at: http://www.anpc.ab.ca/content/resources.php. (Accessed February 18, 2011).

Bennett, Bruce. 2010. Personal communications: email messages dated May 31st and June 3rd, 2010.

Cody, W.J. 1996. Flora of the Yukon Territory. NRC Research Press. Ottawa. 643 pp.

Cody, W.J., Kennedy, C.E., and B. Bennett. 1998. New records for vascular plants in the Yukon Territory. Canadian Field-Naturalist 112: 289-328.

Cody, W.J., Kennedy, C.E., and B. Bennett. 2000. New records for vascular plants in the Yukon Territory II. Canadian Field-Naturalist 114: 417-443.

Cody, W.J., Kennedy, C.E., and B. Bennett. 2001. New records for vascular plants in the Yukon Territory III. Canadian Field-Naturalist 115: 301-322.

Cody, W.J., Kennedy, C.E., Bennett, B., and V. Loewen. 2002. New records for vascular plants in the Yukon Territory IV. Canadian Field-Naturalist 116: 446-474.

Cody, W.J., Kennedy, C.E., Bennett, B., and J. Staniforth. 2003. New records for vascular plants in the Yukon Territory V. Canadian Field-Naturalist 117: 278-301.

Cody, W.J., Kennedy, C.E., Bennett, B., and P. Caswell. 2004. New records for vascular plants in the Yukon Territory VI. Canadian Field-Naturalist 118: 558-578.

Cody, W.J., Bennett, B.A., and P. Caswell. 2005. New records for vascular plants in the Yukon Territory VII. Canadian Field-Naturalist 119: 417-436.

Demarchi D.A. 1995. Ecoregions of British Columbia. Fourth Edition. British Columbia Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria BC. Map (1:2,000,000).

Douglas, G.W., Argus, G.W., Dickson, H.L., and D. F. Brunton. 1981. The Rare Vascular Plants of the Yukon. Syllogeus No. 28. National Museums of Canada, Ottawa. 61 pp + 31 pl.

Douglas, G.W., Meidinger, D. and J.L. Penny. 2002. Rare Native Vascular Plants of British Columbia. Province of British Columbia, Victoria. 358 pp.

Environmental Canada. 2010. National Climate Data and Information Archive - Environment Canada. Canadian Climate Normals 1971 - 2000. Atlin BC. Available at http://climate.weatheroffice.gc.ca. (Accessed December 2010).

Hultén, Eric. 1968. Flora of Alaska and Neighboring Territories: a Manual of the Vascular Plants. Stanford University Press, Stanford. 1008 pp.

Minnesota Department of Natural Resources. 2011. http://www.dnr.state.mn.us/rsg/index.html

National Red Lists. 2011. http://www.nationalredlist.org

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 3, 2011).

PlantNetwork. 2011. http://plantnetwork.org/ (accessed February 3, 2011).

Wingfield, R., Murphy, K., and M. Gaywood. 2005. Lake habitat suitability for the rare European macrophyte *Najas flexilis* (Willd.) Rostk. & Schmidt. Aquatic Conservation. 15: 227-241.

Sinclair, P. H., W. A. Nixon, C. D. Eckert and N. L. Hughes. 2003. Birds of the Yukon Territory. UBC Press.

Yukon Conservation Data Centre (Yukon CDC). 2010. Tracking List and Watch List. (Contact Randi Mulder, Biodiversity Information Specialist, Environment Yukon)

Yukon Ecoregions Working Group (YEWG). 2004. Ecoregions of the Yukon Territory: Biophysical properties of Yukon landscapes, C.A.S. Smith, J.C. Meikle and C.F. Roots (eds.), Agriculture and Agri-Food Canada, PARC Technical Bulletin No. 04-01, Summerland, British Columbia. 313 pp.

APPENDIX A: LOCATION MAP OF RARE PLANTS OBSERVED IN 2010

1. Lewes Marsh / McClintock Bay

Crassula aquatica

Isoetes echinospora

2. Tagish Narrows / 6-Mile

3. Nares Lake

Subularia aquatica

Crassula aquatica

0 2 4 6 8 Km

UTM 8N Projection NAD 83 Datum

N

Map Source/Notes:
Imagery from Geomatics Yukon. Natural features from Geobase BC. Rare Plant Survey data from Gentian Botanical Research, Smithers BC. All other data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. October 2011.

Legend

- Surveyed Wetlands
- Survey Sites
- Rare Plant Locations
- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads

Yukon Energy Corporation
Marsh Lake Storage Concept

Marsh Lake Terrestrial Environment Baseline Studies Program

Rare Plant Survey Locations and Results

APPENDIX B: VASCULAR PLANTS OBSERVED IN THE MARSH LAKE, NARES LAKE AND TAGISH NARROWS AREA IN 2010

Calamagrostis canadensis	*Euphrasia subarctica*	*Ranunculus scleratus*
Callitriche verna	*Fragaria virginiana* ssp. *glauca*	*Rhinanthus minor*
Callitriche hermaphroditica	*Geum macrophyllum*	*Ribes hudsonianum*
Carex aquatilis	*Glyceria grandis*	*Rorripa palustris*
Carex canescens	*Hippuris vulgaris*	*Rosa acicularis*
Carex capitata	*Isoetes echinospora*	*Rumex maritimus* ssp. *fueginus*
Carex capitata	*Juncus balticus ssp. littoralis*	*Rumex occidentalis*
Carex disperma	*Juncus filiformis*	*Salix barclayi*
Carex magellanica ssp. *irrigua*	*Lemna minor*	*Salix commutata*
Carex media	*Moehringia lateriflora*	*Salix exigua*
Carex saxatilis	*Parnassia palustris* var. *neogaea*	*Salix glauca*
Carex utriculata	*Pedicularis langsdorfii*	*Salix planifolia*
Carex vaginata	*Picea glauca*	*Senecio streptanthifolius*
Crassula aquatica	*Populus balsamifera*	*Sparganium angustifolium*
Deschampsia caespitosa	*Populus tremuloides*	*Sparganium minimum*
Eleocharis acicularis	*Potamogeton gramineus*	*Stellaria calycantha*
Eleocharis palustris	*Potamogeton richardsonii*	*Stellaria longifolia*
Epilobium angustifolium	*Potamogetum friesii*	*Stellaris longipes*
Epilobium ciliatum	*Potamogetum pectinatus*	*Subularia aquatica*
Epilobium palustre	*Potentilla palustris*	*Triglochin maritima*
Equisetum arvense	*Ranunculus aquatilis*	*Utricularia intermedia*
Equisetum pratense	*Ranunculus flammula*	*Utricularia vulgaris*
Equisetum variegatum	*Ranunculus gmelinii* ssp. *gmelinii*	

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

APPENDIX C: VASCULAR PLANT SURVEY LOCATIONS IN THE MARSH LAKE AREA IN 2010

Number	Waypoint	Zone[1]	Easting	Northing	Elevation (m)
1	239	8V	518992	6714409	662
2	241	8V	519272	6714237	662
3	242	8V	517528	6670160	655
4	243	8V	517900	6670624	659
5	244	8V	517252	6670806	658
6	246	8V	539931	6687012	658
7	247	8V	539834	6687119	651
8	248	8V	539670	6687401	656

[1]Datum NAD 83.

APPENDIX D: VASCULAR PLANT RARITY STATUS RANKS1

X **Presumed Extirpated or Extinct -** not located despite intensive searches and no expectation that it will be rediscovered.

H **Historical –** not located in the last 50 years, but some expectation that it may be rediscovered.

S1 **Critically Imperiled –** because of extreme rarity or some factor(s) making it especially susceptible to extirpation or extinction. Typically 5 or fewer extant occurrences or very few remaining individuals.

S2 **Imperiled –** because of rarity or some factor(s) making it very susceptible to extirpation or extinction. Typically 6-20 extant occurrences or few remaining individuals.

S3 **Vulnerable –** because rare and local, found only in a restricted range (even if abundant at some locations), or because of some other factor(s) making it susceptible to extirpation or extinction. Typically 21 to 100 extant occurrences.

S4 **Apparently Secure –** because uncommon but not rare, and usually widespread. Possible cause for long-term concern. Typically more than 100 extant occurrences.

S5 **Secure –** because common to very common, typically widespread and abundant, and essentially under no threat under present conditions.

SNR **Species Not Ranked -** usually because there is insufficient information to determine the rank at this time.

S#S# **Range Rank –** a numeric range (e.g. S2S3) is used to indicate the range of uncertainty about exact status.

E **Exotic –** an introduced species to the province or territory.

[1]Adapted from Douglas, G.W., Meidinger, D. and J.L. Penny. 2002. Rare Native Vascular Plants of British Columbia. Province of British Columbia, Victoria. 358 pp.

ARDEA BIOLOGICAL CONSULTING
2175 Millar Rd. ♦ Smithers, BC ♦ V0J 2N6
Ph. (250 847-9772♦e-mail: Laurence@ardea.ca

APPENDIX E: RARE VASCULAR PLANT SITE CHARACTERISTICS IN THE MARSH LAKE AREA

July 18, 2010.
Crassula aquatica and ***Isoetes echinospora***. Lewes Marsh, Marsh Lake. In silt among stones in approximately 0.75 m of water on the west side of the north end of Marsh Lake. NAD 83; 8V 518992E 6714409N; 662 m asl. With *Carex aquatilis, Carex utriculata, Hippuris vulgaris, Potamogeton richardsonii, Potamogeton gramineus, Utricularia vulgaris,* and *Potentilla palustris*.

July 19, 2010.
Subularia aquatica and ***Crassula aquatica***. Nares Lake. Shallow silt, 0.5-1.0 m, in slow moving water on north side at west end of lake. Approximately 500 m east of Carcross airport hangar. NAD 83; 8V 517528E 6670160N; 655 m asl. With *Eleocharis acicularis*, *Potentilla palustris*, *Carex aquatilis*, *Salix planifolia*, *Hippuris vulgaris*, *Callitriche verna*, *Deschampsia caespitosa*, *Ranunculus aquatilis*, and *Ranunculus flammula*.