Keeyask Generation Project

Environmental Impact Statement

Supporting Volume

Terrestrial Environment

Hydropower Limited Partnership

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SECTION 5

AMPHIBIANS AND REPTILES

KEEYASK
Hydropower Limited Partnership

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5.0 AMPHIBIANS AND REPTILES

5.1 INTRODUCTION

The Regional Study Area is north of the documented ranges for **reptile** species in Manitoba (Preston 1982). However, while reptiles were not anticipated to occur within the area, field investigations for reptiles did occur in conjunction with other wildlife surveys (*e.g.*, bird and **amphibian** surveys). Since no reptile species are expected to occur within the Regional Study Area and none were found during environmental studies, reptiles are not considered any further in this assessment.

Amphibian studies within the Amphibian Local Study Area (Zone 3, Section 1, Map 1.7-1) focused on three amphibian species, the boreal chorus frog (*Pseudacris triseriata*), wood frog (*Rana sylvicata*) and northern leopard frog (*Lithobates pipiens;* formerly known as *Rana pipiens*; Figure 5B-1: Distributions of Boreal Chorus Frog, Wood Frogs and Northern Leopard Frogs in Manitoba; Preston 1982). These three species are the only amphibians with breeding ranges that occur within the Amphibian Regional Study Area (Map 1-1: Geographic Zones Used for Terrestrial Study Areas). However, due to limited knowledge of amphibian ranges in less populated areas of Manitoba, frog distribution ranges are often poorly defined. Consequently, it is possible that amphibian species other than those previously mentioned may occur in the Regional Study Area.

A brief discussion of the study area, information sources and methods used for the assessment are provided in Section 5.2. The historic and current conditions of the study area's amphibian community are described in Section 5.3. Project effects, including construction, operation, residual and cumulative effects, and mitigation are described in Section 5.6 along with environmental monitoring and follow-up programs.

5.2 APPROACH AND METHODOLOGY

5.2.1 Overview to Approach

Information on amphibian populations inhabiting the Regional Study Area was gathered primarily through sampling at various locations located within the Local Study Area (along and adjacent to Gull Lake, as well as the north and south access roads), from published literature, from amphibian experts and from local people residing in the area. The Stephens Lake proxy site consists of a portion of **terrestrial** and **aquatic** habitat located within an existing reservoir. The area is considered representative of how the future Gull Lake reservoir would be if the Project were developed.

5.2.2 Study Area

Amphibian surveys occurred within the Regional Study Area (predominantly within the Local Study Area), and within the Stephens Lake proxy site (Map 5-1: Amphibian Survey Locations). All amphibian survey locations overlapped with either boat based or ground based bird surveys (Map 5-1: Amphibian Survey Locations). Sampling within the Regional Study Area was focused in areas along Gull Lake as well

as the north and south access roads. It is felt that Project-related development (*e.g.*, land clearing) could potentially have the greatest effects on amphibian communities in these locations. Ground-based sampling for amphibians also occurred along the north arm of Stephens Lake, in an area that serves as a proxy site for Gull Lake (Map 5-1: Amphibian Survey Locations).

The assessment of Project-related effects on amphibian communities was based mainly on two scales, the local effects area (Zone 3) and the regional effects area (Zone 4; Table 5.2-1). The Regional Study Area was also used to put effects on amphibian populations and habitats into perspective from a regional context.

Table 5.2-1: Study Zones Used in the Assessment of Project-Related Effects on Amphibians

Key Topics	Study Zones (from smallest to largest)			
	Zone 2	Zone 3	Zone 4	Zone 5
Priority Amphibians		L	R	

Codes in the table indicate which of the study zones was used as the local study area (L), and the regional study area (R).

5.2.3 Information Sources

5.2.3.1 Aboriginal Traditional Knowledge

Aboriginal traditional knowledge (ATK) obtained from First Nations field assistants and other local persons indicates that several species of amphibians exist within the study area, and that reptiles are rare or absent (Beardy *pers. comm.* 2005; Beardy *pers. comm.* 2006). Elders indicate that northern leopard frogs were once abundant, but disappeared from the area in the late 1970s (Beardy *pers. comm.* 2005). This information is consistent with global declines in northern leopard frog populations observed during the mid-1970s. Listed as a species of special concern, small populations of the northern leopard frog have since returned to parts of its former range (*e.g.*, southern Manitoba). However, the degree in which it has returned to its former range in northern Manitoba is unknown.

Elders indicate that amphibians are not harvested by Tataskweyak Cree Nation (TCN), War Lake First Nation (WLFN), York Factory First Nation (YFFN) and Fox Lake Cree Nation (FLCN) Members.

5.2.3.2 Existing Published Information

Independent amphibian studies are currently being undertaken by the Department of Biology at Maryville College, Tennessee, throughout northern Manitoba and Nunavut. Researchers are studying wood frog distribution and reproduction, and have provided support and background information to field study team members. Additional literature used in the assessment of amphibians includes "The Amphibians and Reptiles of Manitoba" (Preston 1982).

5.2.3.3 Environmental Impact Assessment Studies

Amphibian communities utilizing the Local Study Area and Stephens Lake proxy area were surveyed over an eight year period (*i.e.*, 2001–2007), with seven years using standard amphibian survey protocols consistent with those used by Manitoba Conservation (Nature Watch Canada 2002) See Appendix 5A for a complete description of amphibian survey methods used during studies.

The amphibian field program consisted of:

- ground based surveys; and
- boat-based surveys (between Gull Rapids and Birthday Rapids).

Each spring, amphibians were surveyed along terrestrial **transects** located within the Regional Study Area (Map 5-1: Amphibian Survey Locations). Recording units were used between 2009 and 2011 to identify the presence of amphibian breeding activity at wetlands, inland lakes and creeks located in remote areas. Boat-based surveys were conducted along the edges of the Nelson River and Gull Lake from 2001 through 2003.

Terrestrial-based surveys for frogs occurred at 197 stops in 2001, 226 stops in 2002, 337 stops in 2003, and 58 stops in 2004 (Map 5-1: Amphibian Survey Locations). Terrestrial transects were primarily located within and adjacent to areas that could be affected by the Project, and provided representative samples within the various habitat types (Section 2.3.1.3.5) that characterize the Local Study Area. Frog surveys were also conducted along proposed access road routes and adjacent areas near Gull Lake and Stephens Lake in 2005 (62 stops), 2006 (118 stops) and 2007 (126 stops). Transect locations were selected using a combination of topographic mapping, **Biophysical Land Classification** data (Western Land Resource Group 2001) and habitat classification data (Section 2.3.1.3.5).

In 2009-2011, remote recording units were deployed at wetlands, creeks, and inland lakes not previously sampled during point count surveys. Information gathered was used to augment the 2001-2007 amphibian dataset.

In 2001through 2003, boat-based surveys for frogs took place at 69 surveys stops on Gull Lake and on the Nelson River, between Birthday Rapids and Gull Rapids (Map 5-1: Amphibian Survey Locations). Surveys occurred in the spring, and focused on identifying locations of breeding areas along riparian zones (*e.g.*, shallow, well-vegetated creek mouths).

5.2.4 Assessment Methods

Impacts of the Project on amphibians are assessed using field data and habitat mapping to illustrate both confirmed and potential, high-quality frog breeding habitat (*e.g.*, vegetated ponds lacking connectivity with fish-bearing waters). While amphibian foraging and dispersal habitat can include large expanses of wet woods, the assessment of Project-related effects on amphibian communities focused on breeding habitat, a limiting factor determining the distribution and abundance of wood frogs, boreal chorus frogs and northern leopard frogs.

5.3 ENVIRONMENTAL SETTING

5.3.1 Historic Conditions

Boreal chorus frogs breed and overwinter in the Regional Study Area. This species is reported to occur as far north as Churchill, with observations made at Gillam and in the Nelson River estuary (Preston 1982; Manitoba Hydro 1997). Although they have discussed observations of amphibian species, First Nation community members have not mentioned the boreal chorus frog specifically.

Wood frogs also breed and overwinter in the Regional Study Area. Historic accounts of this species have been made at York Factory and Gillam (Preston 1982) and as far north as Keewatin, Nunavut (Harper 1963). Although they have discussed observations of amphibian species, First Nation community members have not mentioned the wood frog specifically.

A review of historical and existing environmental conditions for northern leopard frog is provided in Section 5.4.

Although no salamander species currently or historically have had breeding ranges that include the Regional Study Area, Aboriginal traditional knowledge indicates that historically (*e.g.*, 1980s, 1990s) an unknown species of salamander inhabited creeks and rivers downstream of the Kettle Generating Station.

5.3.2 Existing Environmental Current Conditions

5.3.2.1 Overview

In Manitoba, boreal chorus frogs and wood frogs are the most abundant and widespread of the 15 amphibian species native to Manitoba (Koonz 1992). In the Regional Study Area, boreal chorus frogs and wood frogs were common where suitable breeding habitat exists (*e.g.*, shallow vegetated ponds without fish). While northern leopard frogs were not observed during environmental studies, there former range includes the Regional Study Area. Recent First Nation accounts of this species include one northern leopard frog observation outside of the Regional Study Area, at the Limestone Lagoon near the Limestone Generating Station in 2004 (Beardy *pers comm.* 2005). It is possible that small, isolated populations of northern leopard frog had returned to their former northern range; however, there have been no other more recently reported cases of leopard frogs in the area.

In the Regional Study Area, wood frogs and boreal chorus frogs spend the winter on the forest floor under leaf litter and woody debris at or near the ground surface; northern leopard frogs hibernate in lake-bottom mud. Frogs emerged from hibernation in the early spring (March–April), often moving short distances across snow and ice from their hibernacula to breeding areas, which may include seasonal pools, shallow ponds, and lake edges (Preston 1982; Government of BC 2002). In northern climates, northern leopard frogs and wood frogs have short breeding seasons that may last for a few days in April– or May, depending upon weather conditions. Boreal chorus frogs have a longer breeding period that may last weeks, beginning in May and lasting through June.

In the boreal forest, both boreal chorus (Section 3.3.2.6) and wood frog use similar types of breeding ponds (*i.e.*, wooded) during the spring breeding season. Northern leopard frogs prefer ponds surrounded by grassy or sedge-dominated areas but will also use lightly wooded breeding ponds shared by other frog species. By July, all species of frogs are usually finished breeding and move into wetland edges or adjacent damp forests to forage. Since frogs are susceptible to desiccation, foraging activities for most adult frog species occurs within 100 m of water (Gibbs 2000). Tadpoles undergo **metamorphosis,** develop into frogs and disperse into adjacent wetland margins and forests by about August (Government of BC 2002). Juvenile frogs disperse up to about 1 km in search of new ponds (Berven and Grudzien 1990).

Global populations of amphibians have been in decline for the past three decades due to a number of factors including habitat loss, air and water-borne pollutants, disease and climate change (Carey 2000). Amphibians have very thin permeable skin and thus are vulnerable to desiccation and the uptake of environmental pollutants within the aquatic and terrestrial habitats upon which their lifecycles depend. As a result, studies of amphibians have become increasingly important because they are considered indicators of ecological change (CARCNET 2012). The role of amphibians in the boreal forest ecosystem food chain is illustrated in Figure 5B-2: Role of Amphibians in a Boreal Forest Riparian Ecosystem Food Chain.

5.3.2.2 Abundance and Distribution within the Local Study Area

Suitable amphibian breeding habitat occurs throughout the Regional Study Area (Map 5-2: Frog Observations). Amphibian breeding habitat is associated with wet peatland areas where there are numerous shallow, small (less than or equal to five ha) ponds and isolated waterbodies (*e.g.*, small lakes, wetlands, ponds).

The number of frog observations recorded in riparian and upland forests of the Local Study Area (*i.e.*, 2001–2007) and Stephens Lake proxy area (*i.e.*, 2007) were annually variable, likely as a result of the following factors: variations in the areas surveyed, variations in the peak calling period for the boreal chorus frog and variations in spring weather conditions and system water levels. When frogs were observed during the course of environmental studies, they tended to consist of small groups of several individuals. Smaller numbers of solitary frogs were also observed, particularly along forested transects during the summer dispersal and foraging period.

Frogs were observed at ten land-based transects and ten boat-based survey stops during the 2001–2004 field programs in the Gull Lake/Nelson River zone of the Local Study Area. Locations of frog observations (either auditory or visual) are illustrated in Map 5-2: Frog Observations. Due in part to their longer breeding period, boreal chorus frogs were detected more frequently than wood frogs, which have a brief breeding period (*i.e.*, typically a few days) each spring.

Frogs were most often located in or near areas that support permanent water (*e.g.*, ponds, fens) that did not support predatory fish. Frogs were also observed in the shallow pools and the waters of sedge/grass-filled bays and inlets along the Nelson River. Damp forests and recent burns near breeding ponds provide forage habitat for frogs.

Foraging frogs were noted along the north access road route, notably in some of the low-lying wet areas located along the esker and within the shrub and grass-dominated wet areas along the top of the esker

(*i.e.*, along cutlines). Wetlands and creeks near the proposed route provide suitable breeding habitat for both wood and boreal chorus frogs (Manitoba Hydro 2009).

Along the south access road, frogs were observed breeding in small, grassy ponds located on mineral soils adjacent to the Butnau Dyke, and in small ponds located near creeks (Map 5-2: Frog Observations).

5.3.3 Current Trends

Frogs and their populations are suitable environmental indicators of **habitat** change and **ecosystem** imbalance (*e.g.*, Wyman 1990; Blaustein and Wake 1990, 1995; Gartshore *et al.* 1995). A general pattern of decline in frog populations has been observed worldwide over the past 40 years. Between 32% (Conservation International 2004) and 48% (Stuart *et al.* 2004) of amphibian species are currently threatened with extinction. This number includes some 2,000 species (*e.g.*, including boreal chorus frog, wood frog and northern leopard frog) worldwide. These declines appear to be most prevalent in tropical areas, and among stream-associated species (Stuart *et al.* 2004) but are occurring worldwide in numerous habitat types.

The degree of loss, degradation or fragmentation of amphibian habitat is anticipated to be minimal in the future environment without the Project as no large-scale forestry activities, expansion of road networks, mineral exploration activities or large-scale expansion of human habitation are planned for the Keeyask Regional Study Area. If the Project does not proceed, long-term changes in amphibian habitat would likely be attributable to natural forest community succession, forest fires, or small-scale human influence (*e.g.*, resource use by local people such as fishing, hunting and trapping). Previous exploration lines cut by various corporations or individuals would revegetate over time, unless kept open by local resource users.

Forest fire is a naturally occurring process within the boreal forest that affects amphibians and the aquatic and terrestrial ecosystems they inhabit. Forest fires can have positive short-term effects on the amphibian population as the burning of vegetation surrounding wetlands can create a more open canopy and thereby increase sun penetration to the water. This allows for faster spring warming of the water, thereby facilitating earlier breeding and rapid juvenile development. Fire can also increase nutrient loading in the water and lead to increased surface water flows.

Due to their unique lifecycles, certain organic and inorganic compounds are known to be toxic to amphibian species. Amphibians inhabit aquatic and terrestrial habitats, and have highly permeable skin and sensitive eggs that can rapidly absorb toxic substances. They change from primarily herbivorous tadpoles to carnivorous adults and are generally restricted to small home ranges (CARCNET 2012). These traits make amphibians vulnerable to compounds such as agricultural or industrial chemicals and heavy metals. Although the amount of agricultural and industrial chemicals reaching the study area is likely small, mercury is a naturally occurring toxin that, at elevated levels, may affect frogs' reproductive organs and eggs (Preston *pers. comm.* 1996). The concentration of mercury and/or other anthropogenic chemicals in soils, surface water and groundwater within the study area are likely to remain the same if the Project does not proceed.

The effects of ultra-violet (B) radiation on developmental stages of amphibians are currently the subject of much conjecture. Increases in UVB radiation resulting from depletion of the ozone layer have been

observed to adversely affect the growth and survival of amphibian eggs (Blaustein *et al.* 1994). UVB radiation may have more of an effect on species that breed late into the spring (*e.g.*, boreal chorus frogs), as compared to species (*e.g.*, wood frog) that have short breeding seasons that begin early in the spring. Differences are due to the seasonal increase in UVB radiation that occurs throughout the spring (due to the earth's orbit; Corn and Muths 2004).

Exposure of frog eggs to UVB rays is also influenced by water depth and the concentration of dissolved organic matter within breeding ponds (Corn and Muths 2004). Frog species that attach their egg masses near the surface, where exposure to sunlight is greater, were found to be at a greater risk to damaging UVB rays than those attached well below the surface (Kiesecker *et al.* 2001). Ponds with higher levels of dissolved organic matter were found to provide eggs with better protection from UVB radiation (Corn and Muths 2004). Studies involving boreal chorus frogs have concluded that the role of UVB radiation in the decline of frog populations is complicated by other confounding factors including climate, pathogens and contaminants (Corn and Muths 2004). Further in-field studies are required to help understand the role of UVB radiation in frog population declines (Palen *et al.* 2005).

5.4 PRIORITY AMPHIBIANS

5.4.1 Species Potentially Occurring in the Region

Priority amphibians include federally and/or provincially listed species, species listed by COSEWIC and provincially rare species. The only priority amphibian species with potential to occur within the Regional Study Area is the northern leopard frog, a species classified by SARA (*Schedule 1*) and COSEWIC (2007) as being of special concern due to population declines throughout most of Western Canada. No other rare, threatened or endangered amphibian occurs or potentially occurs within the Regional Study Area (COSEWIC 2007).

The northern leopard frog typically breeds in mid-April to early June in Manitoba, when the water temperature of breeding ponds approaches 10°C. Leopard frogs migrate from overwintering areas (*e.g.*, bottom of deep ponds, lakes) to small, warm, shallow (less than 2 m deep) breeding ponds where they engage in courtship activities from the water's surface. Each female breeds once, lays her eggs in 15 to 65 cm of water in a mass of 1,000 to 5,000 eggs before leaving the breeding pond. The mating period for northern leopard frogs is short, lasting two to seven days depending upon weather conditions (Government of BC 2002).

Northern leopard frog eggs hatch in approximately nine days and the tadpoles typically undergo metamorphosis in about late July. While tadpoles are largely herbivorous, adults are indiscriminate carnivores. They may have a home range of up to 600 m^2 and prefer grassy meadows, often spending time in damp patches of soil or in damp, dark crevices if they are in forested habitat. In August, leopard frogs return to lakes, deep ponds, rivers and creeks to overwinter (Government of BC 2002).

5.4.2 Historical Records of Rare/Priority

Historically the northern leopard frog was known to breed and overwinter in the Regional Study Area. Preston (1982) includes historic observations of northern leopard frog at Gillam and Southern Indian Lake, which seems to mark the northern-most known extent of this species' range. In the mid-1970s, this once abundant and widespread species experienced a global decline in populations. Declines were notable throughout Manitoba including the Regional Study Area. Prior to the population decline in the mid 1970s, up to 50,000 kg of northern leopard frogs per year were shipped from Manitoba for use in biology classrooms (Koonz 1992). Massive unexplained die-offs of Manitoba's northern leopard frogs were first observed in 1975, and shipping of the frogs for scientific use ceased. By the 1990s, northern leopard frogs had generally returned to their traditional ranges, but densities have not rebounded.

5.4.3 Current Locations of Priority Amphibians

Although the breeding range of the northern leopard frog includes the Regional Study Area, they were not observed during environmental surveys. In 2004, a FLCN Member observed northern leopard frogs east of the Regional Study Area near Limestone Generating Station (Beardy *pers. comm.* 2005). Since the mid-1970s, small southern prairie populations have re-established, however the degree to which this species has returned to its northern historical range is unknown.

5.5 VALUED ECOSYSTEM COMPONENTS

None of the amphibian species inhabiting the Regional Study Area were identified as VECs.

5.6 PROJECT EFFECTS, MITIGATION AND MONITORING

Throughout the Local Study Area, small populations of boreal chorus frogs and wood frogs breed within ponds, flooded creek mouths, bays and inlets. They forage in grassy, wet areas (*e.g.*, along cutlines, wetland margins, moist forest). If the Project was developed, the small and widely dispersed frog populations occurring within the Project Footprint area would experience a long-term loss of some breeding, foraging and overwintering habitat.

5.6.1 Construction

5.6.1.1 Habitat Changes

Land clearing activities associated with the development of the reservoir, generating station, south access road, borrow areas and other infrastructure, including the expansion of the construction camp, could result in the loss and degradation of some foraging, breeding and overwintering frog habitat. Winter land-clearing activities could also result in the loss of some amphibians hibernating along wetland edges. Land clearing will occur in areas along wetlands, creeks and lakes where boreal chorus frogs and wood frogs hibernate under leaf litter. Winter clearing and construction practices, which occur during the hibernation

of frogs that typically occurs within or adjacent to courtship ponds, will considerably reduce the potential effect on amphibians. Hand clearing of vegetation within areas that frogs hibernate will further reduce the impact on these areas and potentially lessen frog mortality considerably during winter clearing and construction activities.

Construction activities, such as those related to heavy equipment, may cause some mortality of frogs during the summer and early fall. However, most frogs are expected to inhabit forested areas and sites near courtship ponds during the summer, thereby avoiding most open construction sites.

If the Project is developed, frog habitat within the reservoir footprint will be temporarily degraded through land clearing before being completely lost as the reservoir fills (*i.e.*, operations). In parts of the reservoir area (internal to dykes), and in areas external to dykes, disposable unclassified excavated materials will be stockpiled in low-lying areas. In order to minimize additional adverse effects on local amphibian populations, areas selected for material stockpiling will avoid amphibian breeding habitat to the extent practicable (PD SV, Chapter 4). Overall, it is anticipated that construction disturbance and degradation of habitats would cause a decline in the abundance of frogs using portions of the Local Study Area where development occurs (McLeod and Gates 1998; Welsh and Oliver 1998; Ross *et al.* 2000).

Development of the south access road would result in the long-term loss of some potential frog habitat. Loss of vegetative cover along the ROW would be short-term, as the area would be reseeded and/or eventually recolonized by various plant species; this would provide some marginal foraging habitat for amphibians. Depending upon drainage patterns, amphibians may be drawn to the south access road ditches during the breeding period. Although water collected within ditches is generally ephemeral in nature, it may provide amphibians with some breeding habitat.

The south access road ROW may fragment some potential amphibian habitat, and may create a barrier that could result in reduced frog movements between habitats (Gibbs 1998; Yanes *et al.* 1995). Map 5-2: Frog Observations shows where potential amphibian habitat occurs in relation to the south access road footprint. While the access road route may fragment some frog-breeding habitat, the effect of fragmentation on the local amphibian population is anticipated to be negligible as the local frog population consists of many small subpopulations scattered throughout the Local and Regional Study Areas. Sub-populations fragmented by the south access road would have other nearby areas within which to disperse to when searching for suitable breeding habitats.

5.6.1.2 Project-related Disturbances and Access Effects

Use of access roads by construction vehicles and heavy equipment may result in the mortality of a small proportion of the local frog population. Frogs could be at an increased risk to vehicle collisions in areas where amphibian habitat occurs near roads. As adults leave breeding ponds to forage in wet forests and juveniles migrate from ponds to summering habitat, they are at risk to collisions with construction vehicles as they cross roads. However, due to the low abundance and widespread distribution of amphibians within the Local Study Area, concentrated dispersals of high densities of frogs near roads or any other infrastructure sites are not anticipated.

Pollution (*e.g.*, toxic chemicals, petroleum, salts and sediment) from vehicle emissions and road runoff are other factors that may influence the health of local frog populations utilizing wetlands or creeks adjacent

to roads (Carr and Fahrig 2001). Increases in the acidity of breeding ponds from vehicle pollution can lead to decreases in egg mass densities, reduce hatching success and increase overall mortality of wood frogs embryos (Gascon and Planas 1986; Freda and McDonald 1993). The overall effects of construction vehicle traffic (*e.g.*, pollution, collision risk) on amphibian populations are anticipated to be within the range of natural variability for the species present in the Regional Study Area.

During the construction phase, petroleum (*e.g.*, gasoline, diesel, and heating oil) spills or leaks may contaminate surrounding waterbodies and/or soils in areas where frogs forage, breed, and overwinter. While the effect of such events on frogs would generally be small and site specific if they occur on terrestrial habitat, these effects have the potential to be larger if hazardous materials spill or leak into a waterbody that supports frog populations. The potential for adverse effects of spills on amphibians can be minimized through implementation of measures outlined in the EnvPP (*e.g.*, proper containment and storage of fuels away from waterbodies [>100 m] and other potentially sensitive sites, usage of designated fuelling/maintenance areas, and prompt spill cleanup).

5.6.1.3 Mitigation

Measures to minimize Project effects on amphibians were considered during Project planning (*e.g.,* excavated material placement areas avoided amphibian breeding ponds; PD SV). Additional mitigation measures to minimize degradation/loss of amphibians and amphibian habitat will include the following:

- Hand clearing methods will be used within 30 m of wetlands during the winter period to reduce amphibian mortality associated with compaction of ground cover;
- Where construction activity occurs near wetlands and slow-moving creeks, silt fences will be implemented to limit soil erosion into waterbodies; and
- Retention of some slash piles and coarse woody debris (*i.e.*, snags and logs) on the forest floor would also benefit boreal chorus frogs by providing cover (Ross *et al.* 2000).

5.6.1.4 Overview of Construction Effects

Boreal chorus frogs and wood frogs are widespread throughout the Local Study Area, occurring as small populations where suitable breeding conditions exist (*e.g.*, in ponds, and fens with open water). Even with the implementation of mitigation measures, there would be some boreal chorus and wood frog mortality and some amphibian habitat that would be lost or degraded as a result of land clearing and construction activities. Since habitat for boreal chorus frogs exists throughout the Regional Study Area, construction related effects on boreal chorus and wood frog populations within the Regional Study Area are expected to be within the range of natural variability.

5.6.2 Operation

5.6.2.1 Habitat Changes

Creation of the reservoir would increase the total amount of shoreline edge; however, this habitat is likely to consist of newly submerged vegetation and turbid and poorly oxygenated waters. Such habitat is suboptimal for amphibians in general. Over time, settling of sediments and reestablishment of sedges and other aquatic plants may lead to the recolonization of shoreline areas by amphibians.

It is expected that inundation of the reservoir would result in the long-term loss of frogs and frog habitat. Local amphibian populations would experience a loss of habitat associated with creek mouths and sedge-filled bays and inlets of the Nelson River and Gull Lake, and in wetlands, creeks, and lake margins located in areas inland. Operational effects of the Project on frog populations are expected to be low, especially considering that considerable suitable frog habitat occurs throughout the Local and Regional Study Area.

Once filled, the reservoir could affect local groundwater levels and peatland stability along shorelines and in areas further inland. Within the zone of peatland disintegration, some frog habitat may be lost (*i.e.*, erode into the reservoir) over the long-term. However, a rise in groundwater levels due to reservoir filling may result in an increase in wetland areas located inland from the reservoir. Over time, these new wetlands may become suitable breeding ponds for frogs. The establishment of new frog breeding habitat over the long-term may partially offset some the amphibian-breeding habitat lost during reservoir operations.

5.6.2.2 Project-related Disturbances and Access Effects

Traffic along the north and south access roads may contribute to a small number of frog fatalities as frogs attempt to cross the access roads in areas where breeding habitat occurs. Due to the low abundance and widespread distribution of amphibians within the Local Study Area, concentrated frog dispersal patterns across roads or other infrastructure sites are not expected.

5.6.2.3 Mitigation

Mitigation measures used to minimize loss of amphibian habitat will include the following:

- Mitigation for wetland function is being implemented through the development of wetlands in the Local Study Area (Section 6.5.3.4). Some of these wetland developments may provide habitat for amphibians; and
- Some of the decommissioned borrow areas will provide suitable wetland habitat for amphibians.

5.6.2.4 Overview of Operation Effects

The residual effects associated with Project operation are not expected to be fully offset by the development of new amphibian habitat, such as ponding along access roads and dykes and the enhancement of newly formed wetlands. Traffic along the north and south access roads may contribute to some frog fatalities as frogs attempt to cross the access roads—particularly in areas where the road

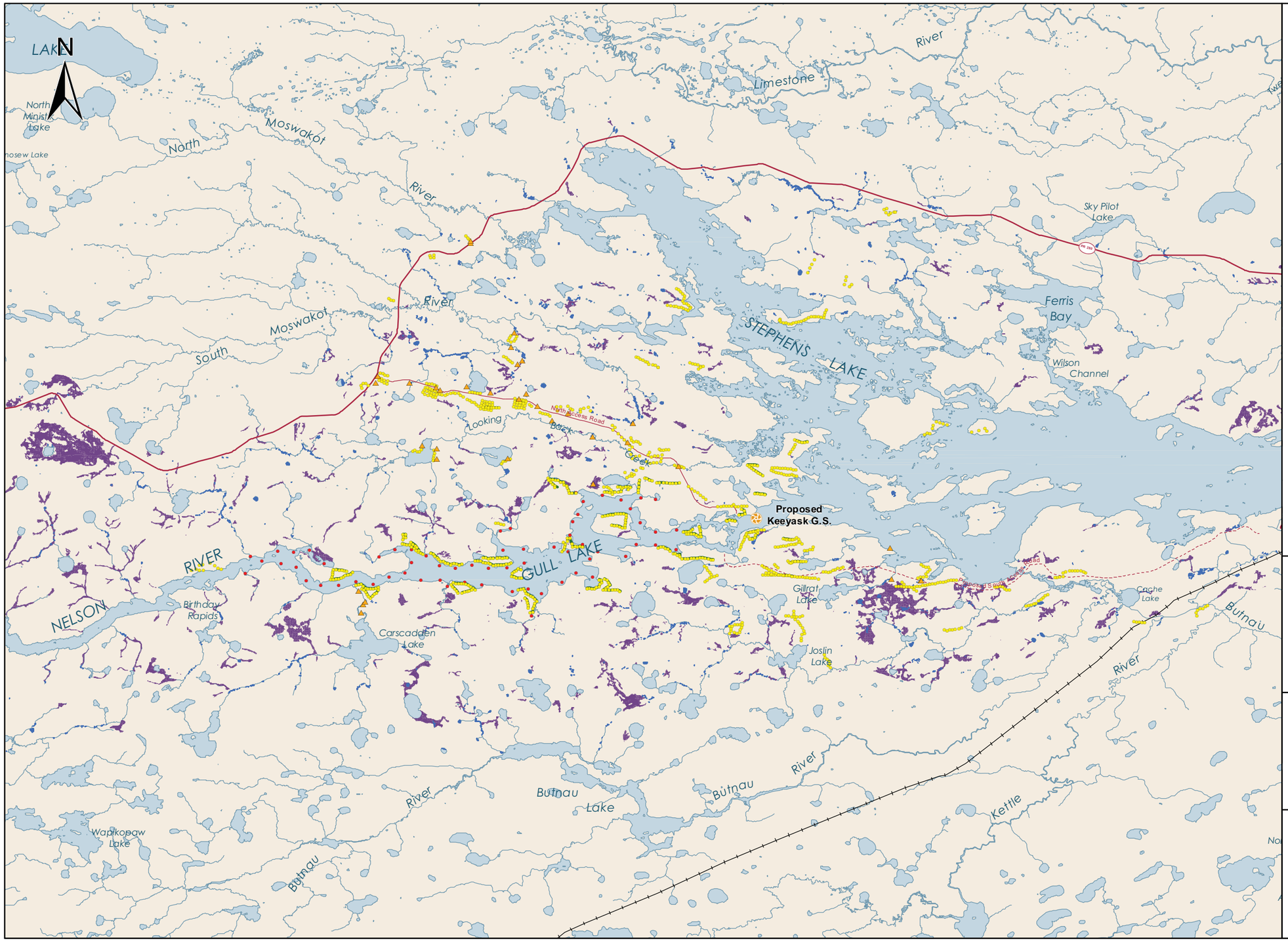
forms a permeable barrier between breeding habitat and summering habitat. However, the number of incidences of frog mortality associated with vehicle traffic are anticipated to be few and occur sporadically at different sites along the access roads. Operational effects of the Project on regional frog populations are expected to be low.

5.6.3 Environmental Monitoring and Follow-up

Monitoring will be implemented to verify the long-term effects of the Project on amphibians. As illustrated in Table 5.6-1, the recommended monitoring and follow-up will occur for wood frog, boreal chorus frog and, if present, northern leopard frog (priority amphibian listed as a species of concern under the federal *Species at Risk Act* (SARA). Details of monitoring will be presented in the Terrestrial Effects Monitoring Plan.

Table 5.6-1: Monitoring and Follow-up Program for Amphibians

Supporting Topic or VEC	Issue/Rationale	Monitoring/Adaptive Management	Timelines
Priority Amphibians (Supporting Topic)	• To verify predicted effects of the Project on amphibians.	• Monitor changes in the distribution of amphibians within the Regional Study Area.	Annually during the first three years of operation and periodically until shoreline wetland habitat re-establishes.



Legend

- Land-Based Amphibian Survey Stops
- Boat-Based Amphibian Survey Stops
- Remote Recording Sites
- Generating Station (Planned)
- Proposed Access Road
- Access Road
- Highway
- Rail

Potential Amphibian Habitat

- Peatlands That Often Include Patches of Water
- Isolated Water Bodies <= 5ha

Projection: NAD 1983, UTM Zone 15
Data Source: Manitoba Hydro, ECOSTEM Ltd, Government of Canada, Stantec Consulting

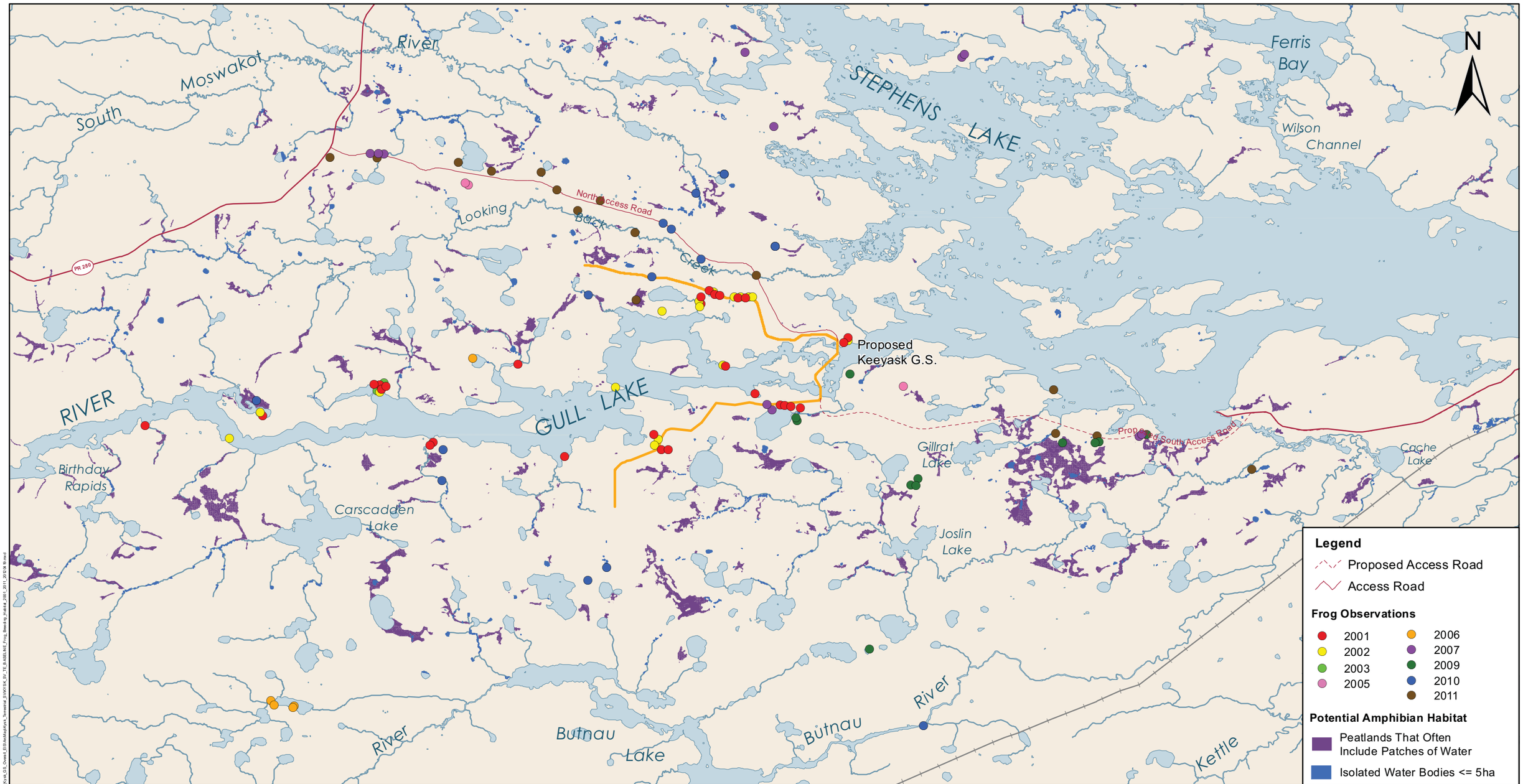
0 5 10 km
0 3.25 6.5 mi

Amphibian Survey Locations

KEEYASK
Hydropower Limited Partnership

Map 5-1

File Location: G:_GIS_Project_Folder\00_Hydro\1114200\17_Xyla_GIS_Overall_EIS\Arc\Map\Xyla_Terrestrial_3NWYSK_3V_TE_BASELINE_Frog_Survey_2001_2011_20150819.mxd



KEEYASK Hydropower Limited Partnership

0 2.25 4.5 Kilometers

0 2.5 5 Miles

Projection: NAD 1983, UTM Zone 15
Data Source: Manitoba Hydro, Government of Canada, ECOSTEM Ltd., Stantec Consulting

Frog Observations

Map 5-2

APPENDIX 5A
AMPHIBIANS SURVEY METHODS

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5.7 APPENDIX 5A – AMPHIBIAN SURVEY METHODS

Terrestrial-Based Surveys

Observers walked along preset transect routes and stopped at survey points that were spaced 150 m apart. Amphibians observed between stops were also recorded. Visual and/or auditory evidence of amphibians was recorded for a three-minute period at each 75-m radius survey stop. The following coding system was used to indicate frog presence and relative abundance on the basis of the number of frogs heard within the observation period:

- 0= no frogs can be heard;
- 1= individuals can be counted, no overlapping calls;
- 2= individual calls are distinguishable but overlapping; and
- 3= full chorus, calls are continuous and overlapping (number cannot be estimated with precision).

Additional information recorded during frog surveys included:

- location (transect name and UTM coordinates);
- date and time;
- weather information (temperature, wind direction and speed, cloud cover and precipitation); and
- habitat description (using the DAFOR scale, dominant plant species, understory and ground cover vegetative species were described); this on-site information was utilized to complement the habitat information described in Volume 6, Section 2.

Boat-Based Surveys

Visual and auditory evidence of amphibians was recorded for a three-minute period at each boat survey stop. For boat-based surveys, the data gathered are considered qualitative as boat surveys were designed for purposes other than quantifying calling frogs.

Reconnaissance

Opportunistic amphibian observations made during the travels of the field team throughout the study area were also recorded and added into the data for analysis.

Field personnel involved in other terrestrial studies (mammals; terrestrial habitat) were requested to record any observations of amphibians made during the course of their investigations. Information was included in the amphibian results.

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APPENDIX 5B
FIGURES

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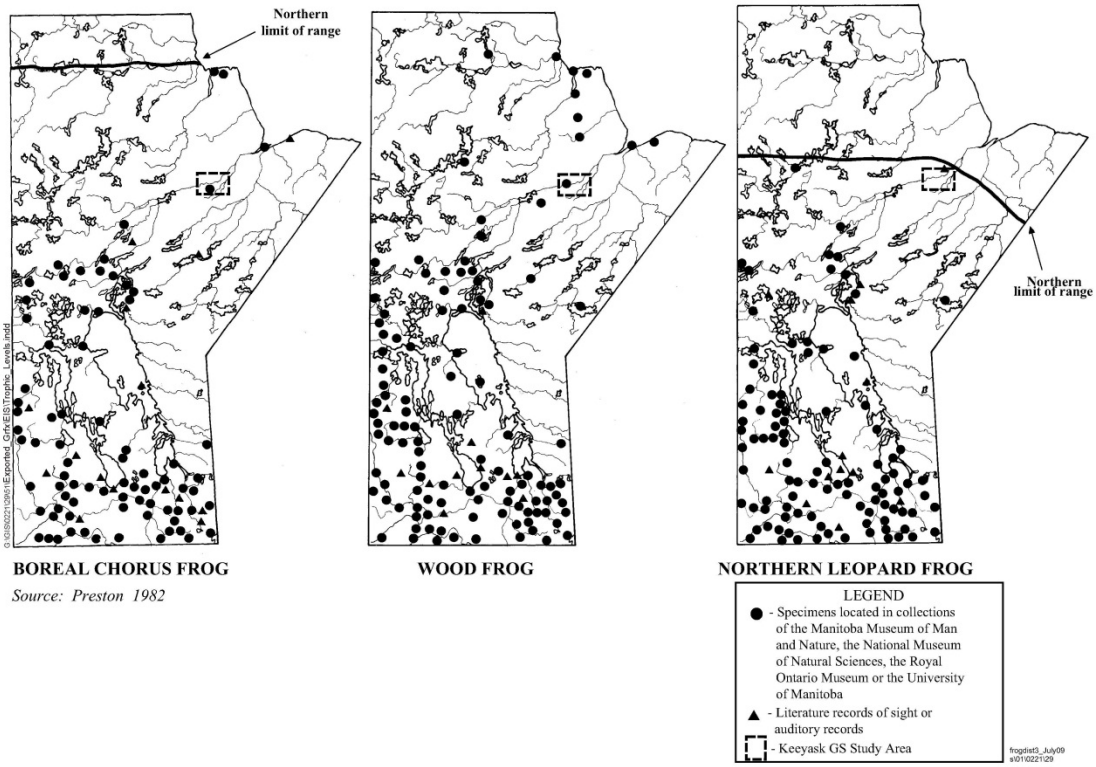
5.8 APPENDIX 5B – FIGURES

Figure 5B-1: Distributions of Boreal Chorus Frog, Wood Frogs and Northern Leopard Frogs in Manitoba



Source: Preston 1982

Figure 5B-2: Role of Amphibians in a Boreal Forest Riparian Ecosystem Food Chain