Keeyask Infrastructure Project

Terrestrial and Aquatic Monitoring Plan

Amphibian Monitoring

Annual Report 2014-2015

KEEYASK

Hydropower Limited Partnership

December 2015

KEEYASK INFRASTRUCTURE PROJECT

TERRESTRIAL AND AQUATIC MONITORING PLAN

Amphibian Monitoring: Annual Report 2014-2015

Report for

MANITOBA CONSERVATION AND WATER STEWARDSHIP

Prepared on Behalf of the
Keeyask Hydropower Limited Partnership

Prepared By

Stantec Consultants Inc.

December 2015

EXECUTIVE SUMMARY

The Keeyask Hydropower Limited Partnership constructed the Keeyask Infrastructure Project (the Project or KIP) between 2012 to July 2014, after which construction of the Keeyask Generation Project began.

The KIP is located approximately 40 km southwest of Gillam, extending between Provincial Road (PR) 280 and Gull Rapids on the Nelson River. The Project includes a start-up camp and associated infrastructure, a 25 km all-weather access road and the first phase of a main camp. The start-up camp is located near the intersection of PR 280 and the access road, while the first phase of the main camp is located at the end of the access road on the north side of Gull Rapids.

As a KIP licensing condition (Environment Act Licence No. 2952R), the Keeyask Hydropower Limited Partnership is conducting terrestrial effects monitoring during the KIP construction. This report covers the period from April 1, 2014, through to March 31, 2015, and presents results from the final year of construction-related amphibian monitoring for the Project. The report also provides a synthesis of KIP effects during the entire construction phase.

In 2012, the access road was under development, limiting monitoring to wetlands located in areas adjacent to construction sites and in reference sites. In 2013, road-based amphibian surveys were possible along the nearly completed access road. Surveys also occurred along PR280, the Butnau Road and at wetlands located adjacent to construction sites and in reference sites. Surveys conducted in 2013 were repeated in 2014. Data collected were used to verify anticipated construction-related effects on amphibians, and identify any unexpected Project-related effects.

Amphibian species known to breed within the KIP Regional Study Area include: wood frog and boreal chorus frog (Carcnet 2014). In 2014, amphibian surveys were conducted at 16 potential breeding ponds located within and adjacent to the KIP Local Study Area (LSA), and at 30 stops along the access road. Wood frogs and boreal chorus frogs were the only species of amphibian detected. Although the historical breeding range of the northern leopard frog (listed as a species of **special concern**[1] under Schedule 1 of the *Species at Risk Act* [SARA] and the Committee on

[1] Words indicated in **bold** are defined the glossary.

the Status of Endangered Wildlife in Canada [COSEWIC]) included the LSA, none were observed during the KIP monitoring surveys (2013, 2013 or 2014).

Results from the 2014 amphibian monitoring studies indicate that boreal chorus frogs and wood frogs continue to be widely dispersed throughout the KIP LSA. The extensive forest fires that burned through the region during the summer of 2013 did not appear to affect amphibian breeding ponds. Site visits revealed that while the surrounding forests had been burned, the wetlands and wetland margins appeared to be unaffected. Construction activity did not appear to have any measureable effect on frog occupancy of wetlands located adjacent to construction areas. Retention of vegetated buffers and set-backs from active construction sites are factor that contributed to the continued use of breeding ponds by frogs.

ACKNOWLEDGEMENTS

Stantec Consultants Ltd. would like to thank Manitoba Hydro for their support throughout these studies, and the local First Nations partners for contributing to these studies within their resource management areas and areas of community interest. We wish to thank Peter Massan of York Factory First Nation for his assistance during the 2014 field studies. We also wish to express our gratitude to the other Keeyask consulting teams that assisted in providing input and logistical support for this Project. We appreciate the efforts of Mr. Ron Bretecher, Ms. Mary Lang and Ms. Shari Fournier of North/South Consultants Inc. for their organizational assistance.

STUDY TEAM

Angèle Watrin Prodaehl, B.Sc.Hons, P.Biol.	Biologist
Sarah Nathan, B.Sc., MRM.	Biologist
Bob Ezzard, Dip.	Wildlife Technician
Leane Wyenberg, M.Sc.	Biologist
Aaron Campigotto, Adv. Dip	GIS Specialist
Blair McMahon, M.Sc., P.Biol.	Biologist, Associate

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF MAPS

Page

LIST OF APPENDICES

Page

LIST OF ACRONYMS AND ABREVIATIONS

COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	Environmental Assessment
KHLP	Keeyask Hydropower Limited Partnership
KIP	Keeyask Infrastructure Project
LSA	Local Study Area
MESEA	*Manitoba Endangered Species and Ecosystems Act*
PR	Provincial Road
RSA	Regional Study Area
SARA	*Species at Risk Act*

1.0 INTRODUCTION

1.1 OVERVIEW

Construction of the Keeyask Infrastructure Project (KIP), consisting of a start-up camp, a 25-km all-weather road, and the first phase of a main camp on the north side of Gull Rapids, was initiated in January 2012.

The KIP is located approximately 40 km southwest of Gillam, within the Split Lake Resource Management Area, extending between Provincial Road (PR) 280 and Gull Rapids on the Nelson River. The Project includes a start-up camp and associated infrastructure, a 25 km all-weather access road and the first phase of a main camp. The start-up camp is located near the intersection of PR 280 and the access road, while the first phase of the main camp is located at the end of the access road on the north side of Gull Rapids.

As a KIP licensing condition (Environment Act Licence No. 2952R), the Keeyask Hydropower Limited Partnership conducted terrestrial effects monitoring during the KIP construction. This report covers the period between April 1, 2014 and March 31, 2015. The report also provides a synthesis of KIP effects during the entire construction phase.

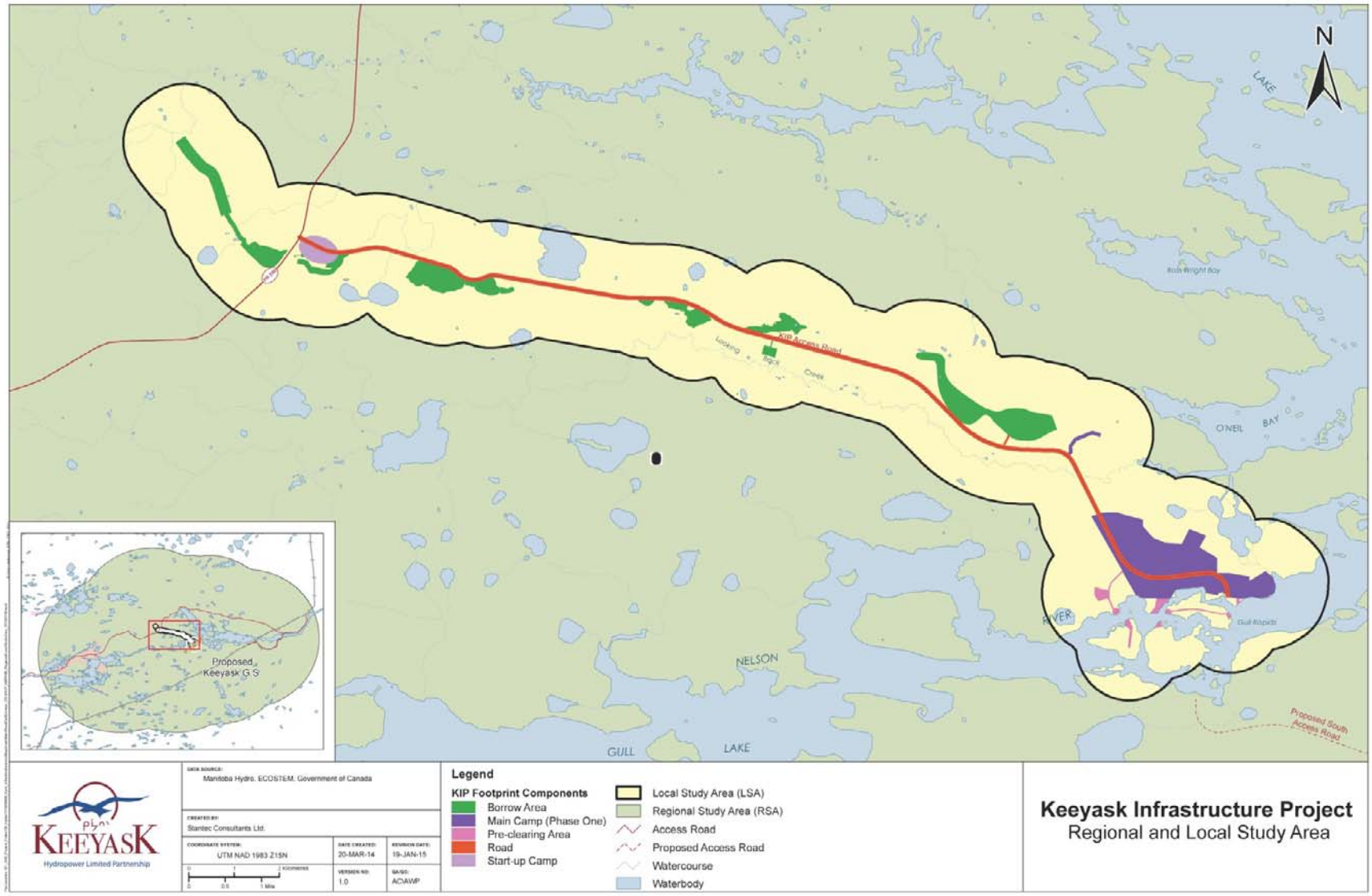
As outlined in the KIP Environmental Assessment (EA) Report (KHLP 2009), an Environmental Monitoring Program was developed to verify Project effects, including those on local amphibian populations. The amphibian monitoring commenced in 2012 and carried through until 2014 and was developed with specific objectives to:

- Verify/test EA predictions regarding the effects of construction activities on local amphibian abundance and distribution.
- Determine if any unexpected impacts on amphibian abundance and distribution are occurring as a result of construction activities.
- Determine if mitigation options are required, as a result of unexpected impacts to amphibians occurring due to construction-related activities.

During late summer in 2013, extensive forest fires burned throughout much of the KIP region (Regional and Local Study Areas shown on Map 1-1), however many of the wetlands were largely unaffected.

Previous baseline studies have indicated the presence of breeding populations of boreal chorus frogs (*Pseudacris triseriata*) and wood frogs (*Rana sylvatica*) within the KIP region (KHLP 2009). Although the historic breeding range of the northern leopard frog (*Lithobates pipiens*) includes the KIP region, none have been observed in recent decades, nor were any observed or detected during amphibian construction monitoring surveys. Northern leopard frog is listed as a species of **special concern** under Schedule 1 of the *Species at Risk Act* (SARA 2015) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009).

Details of 2014 amphibian survey results and surveyed vegetation communities are provided in Appendices B and C. Pertinent photographs, and photographs of representative **habitats** surveyed are provided in Appendix D. Incidental data gathered outside of the amphibian survey period are listed in Appendix E. Weather data recorded during 2014 surveys are provided in Appendix F.



Map 1-1: Keeyask Infrastructure Project Regional and Local Study Area

2.0 METHODS

2.1 SURVEY METHODS

Standardized amphibian survey methods developed by Bird Studies Canada and accepted by government agencies such as Environment Canada and Manitoba Conservation, were used in the collection of KIP amphibian data between 2012 and 2014 (Gartshore et al. 2004, Bird Studies Canada 2008). Amphibian survey methods focused on gathering information on amphibian distribution and abundance at wetland habitat located near construction areas. Wetland condition was also assessed by measuring water quality parameters (Section 2.2). The EA concluded that effects to amphibians would include a decrease in habitat quality in adjacent wetlands due sediment levels and dust from borrow pit excavation and road construction. As a result, survey methods included a combination of auditory evening road-call surveys and wetland surveys. Automated recording units were deployed for monitoring wetland use by amphibians in remote areas.

The amphibian survey locations were selected using an evaluation process that involved examining: topographic mapping, orthophotography, Biological Land Classification data (Westernland Resource Group 2001), habitat classification data (ECOSTEM 2005), and data and mapping from previous years of sampling.

2.1.1 EVENING ROAD-CALL SURVEYS

Road-call surveys were conducted along the access road for the first time in 2013, as the road bed was under construction in 2012 and truck access was not possible. In 2014, surveys along the access road were conducted on May 23 and 28 (Photo D-1). For comparative purposes, reference sites along PR 280 and the Butnau Road were also sampled (Map 2-1).

A total of 60 road-call counts (30 along the access road, as well as 10 along the Butnau Road and 20 along PR 280) were surveyed using a combination of auditory detection and visual observation techniques during the peak calling times (20:00 hr to midnight).

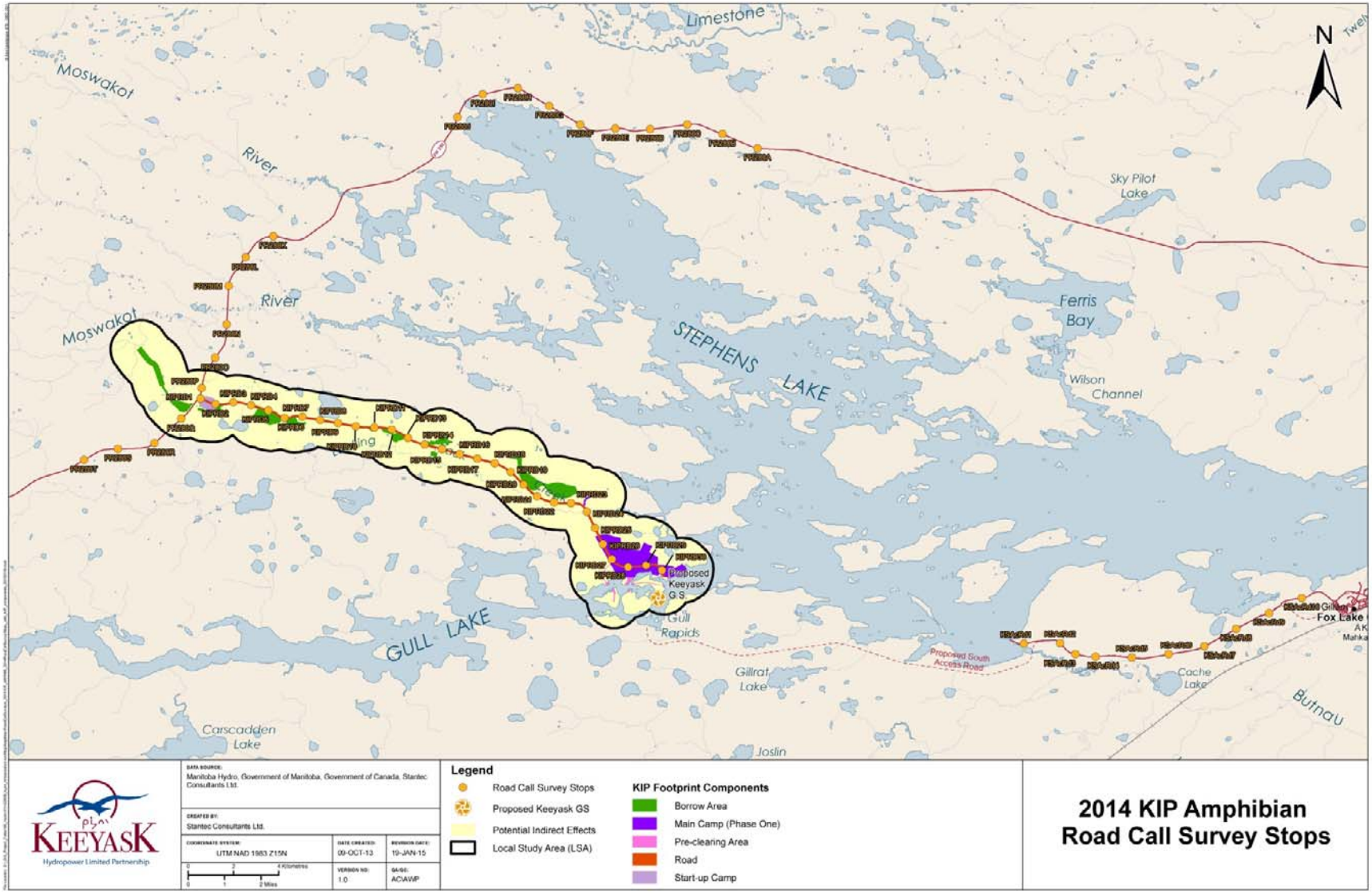
Road-call counts involved two observers stopping at survey points located at 800-m intervals along the road. Each survey was conducted between a half hour after sunset and midnight (BSC 2008; Gartshore et al. 2004). This protocol involves the observers standing at each survey point and listening for a total of three minutes. All amphibians heard or seen within the surrounding

right-of-way (**ROW**) and forest edge habitat were identified to species. At each stop, frog presence/abundance was estimated using the following coding system ("calling code"):

- 0 = no frogs can be heard
- 1 = individuals can be counted, no overlapping calls
- 2 = individual calls are distinguishable but overlapping
- 3 = full chorus, calls are continuous and overlapping (number cannot be estimated without precision)

In addition to recording frog calls and amphibian sightings, the following were recorded during surveys:

- Location of transect and survey point
- Time of day
- Weather information (temperature, wind direction and speed, cloud cover and precipitation)
- Habitat description (dominant plant species, crown cover, understory, ground cover)



Map 2-1 2014 KIP Amphibian Road-call Survey Stops

2.1.2 WETLAND SURVEYS

Wetland surveys occurred in 2012, 2013 and 2014. Between May 23-28, 2014, sixteen wetlands were assessed for frog breeding activity and suitability (Map 2-2). Eight of these had been visited in 2012 and all sixteen of these sites were previously surveyed in 2013 using the same survey methods. As these sites were accessed by helicopter, investigations occurred during the afternoon, as done in 2012 and 2013. Frogs were given at least 10 minutes to acclimate to the presence of the survey crew before the survey period began and calling code was recorded. In addition to recording frog call activity at each wetland, using the above coding method, time spent at wetlands also involved attempts to visually observe amphibians not calling (e.g., female frogs, eggs, or tadpoles) residing within the sampling area.

In order to describe wetland water quality, temperature, **pH**, **TDS and turbidity** were measured at each water body using a LaMotte 2020W multi-meter. These water quality measurements were taken at three locations in each wetland and then combined to calculate an average for the wetland.

Recording units were utilized where site conditions prevented the helicopter from shutting down during site visits, or at sites where no, or few, frogs were heard during the initial visit. If a code 3 (maximum frog breeding activity) was heard during the site visit, the site was recorded as such and considered completed. If calling activity could not be determined during the site visit, or if the calling code was less than 3, a recording unit was left and retrieved the next day, allowing observers to monitor calling activity remotely. For each site where a remote recorder was used, the recording was reviewed by the same observers conducting the site visit, and calling code was definitively established from the recording using the same methods as used during site visits (Appendix D, Photo D-2). It is expected that this method removed any bias from sampling during the day.

2.1.3 OTHER WILDLIFE DATA

Incidental observations such as amphibians observed or heard outside of survey stops and other wildlife observations were recorded when encountered during amphibian surveys (Appendix E, Table E-1). Non-amphibian related observations (e.g., birds, mammals, and species at risk) were passed on to other study teams.

2.2 ANALYSIS METHODS

The survey methods aimed at gathering information on amphibian breeding activity along the access road and associated borrow area that were being affected by construction.

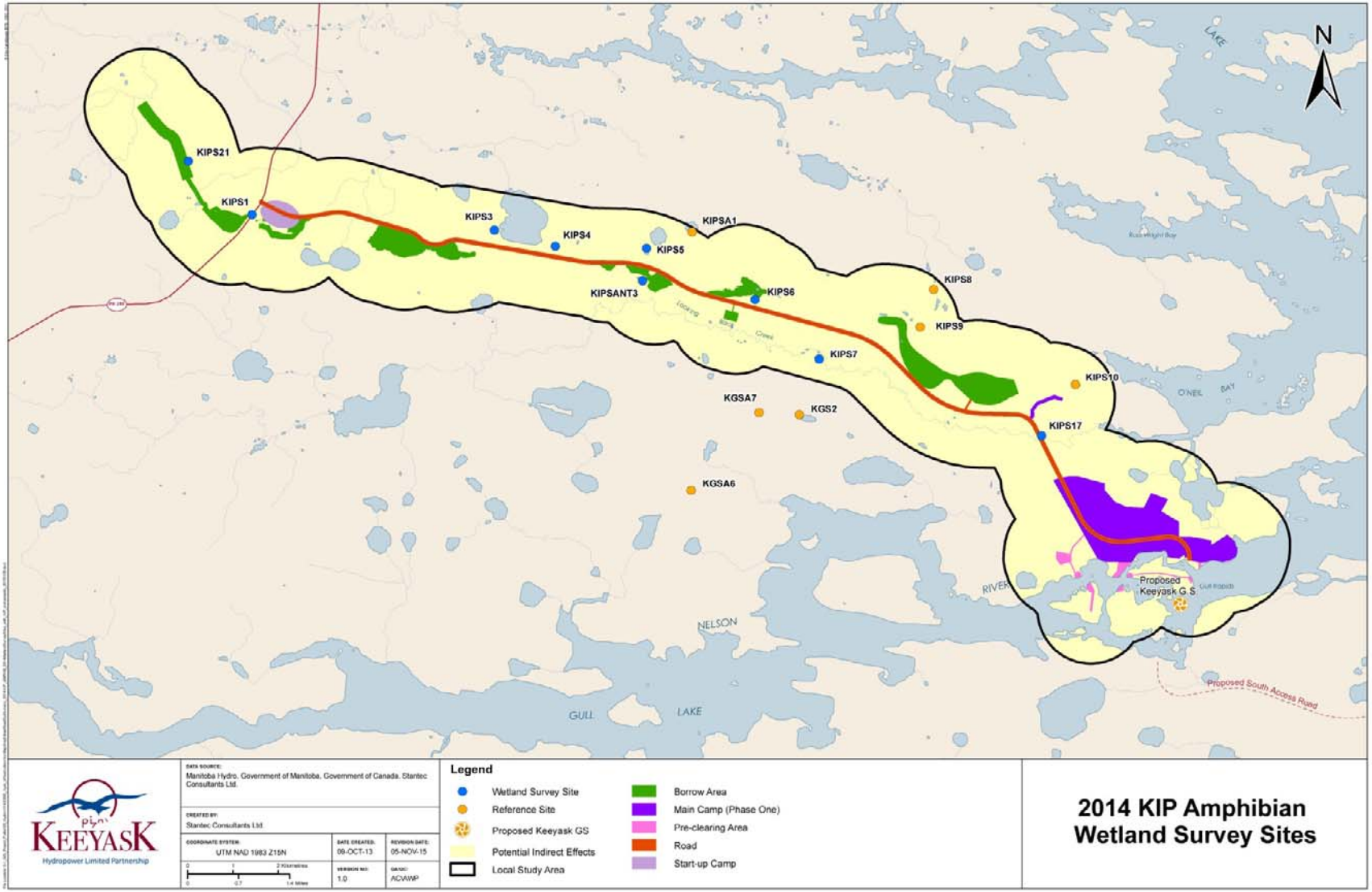
During data analysis the codes were used to further categorize frog abundance at a given site. Amphibian abundance was ranked using the system shown in Table 3-1.

Table 3-1: Amphibian Abundance Ranking System

Rank	Description
None	No amphibian calls recorded during surveys.
Low	No amphibian calls, or some amphibian calls recorded (one species only and less than code 3).
Medium	Significant[1] amphibian calls recorded (at least two species or at least one code 3)
High	Full chorus of multiple species recorded.

[1] Significant according to the Ontario MNR's Eco region 6E Criteria (OMNR, 2000)

The results of these analyses were compared with the results gathered at reference sites such as wetlands located away from the road, or other roadways not associated with KIP.



Map 2-2: 2014 KIP Amphibian Wetland Survey Sites

3.0 RESULTS AND DISCUSSION

3.1 EVENING ROAD-CALL RESULTS

In 2014, amphibians were detected in the wetlands located in the forests adjacent to the road at all but one access road survey stop (i.e., KIPRD12) (Appendix B, Table B-1).

The 2014 survey results yielded high amphibian abundances at 57% of survey sites along the KIP access road and medium abundances at another 26% of the KIP access road sites. In comparison, of reference sites surveyed along Provincial Road 280 (PR280), 90% had high abundances and 10% had medium abundances. Ninety percent of reference sites along the Butnau Road had low amphibian abundances and 10% had no amphibians detected. The low density of amphibian observations along Butnau Road in 2014 may be due to the completion of the wood frog breeding period, as wood frogs had stopped calling by the time Butnau Road-based surveys occurred (Table B-1).

Road-call survey results in 2014 were consistent with results observed in 2013 where 96% of stops along KIP access road and 100% of stops along PR280 supported medium to high amphibian abundance. Despite the ongoing construction activity in 2013 and 2014, amphibians continued to occupy wetlands along the access road.

Table 3-2: Evening Road-call Survey Results

Survey Transect	Date	Amphibian Abundance*			
		None	Low	Medium	High
2014					
KIP Access Road	May 24, 2014	1	4	8	17
Butnau Road	May 28, 2014	1	9	0	0
Provincial Road 280	May 23, 2014	0	0	2	18
2013					
KIP Access Road	May 25 – 26 2013	0	1	6	20
Butnau Road (afternoon)	May 27 2013	0	5	5	0
Butnau Road (evening)	May 27 2013	0	0	2	8
Provincial Road 280	May 24, 2013	0	3	2	15

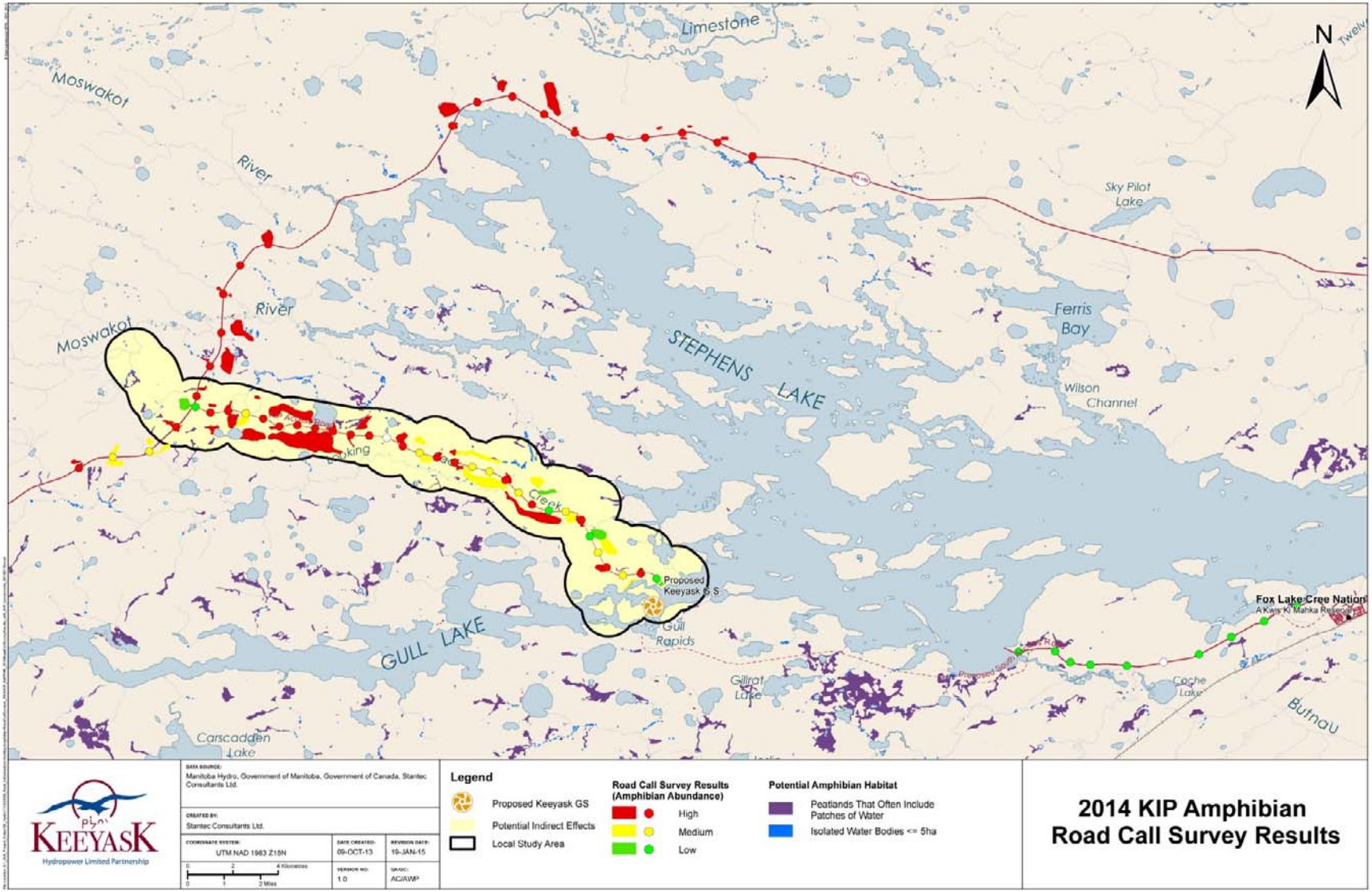
*Rank Description:

None No amphibian calls observed during surveys.

Low No amphibian calls, or some amphibian calls observed (one species only and less than 20 individuals in total, code 2 or less).

Medium Significant[1] amphibian calls observed (at least two species or more than 20 individuals total, code 3).

High Full chorus of multiple species observed.



Map 3-1: 2014 KIP Amphibian Road Call Survey Results

3.2 WETLAND SURVEY RESULTS

3.2.1 SUMMARY FROM 2013 AND 2014

Amphibians were observed at 100% of the 16 wetland sites surveyed in 2014 (Appendix C, Table C-1; Map 3-2). The surveyed sites included 9 potentially affected sites (Table 3-3), as well as 7 currently unaffected reference sites located both within and adjacent to the Local Study Area (LSA). In the 9 potentially affected sites, 44% recorded high frog abundance and 22% had medium frog abundance, while 33% had low frog abundance. For the 7 reference site, 67% of sites supported high amphibian abundances and 43% supported medium abundances.

Results from the 9 potentially affected sites surveyed in 2013 were similar to those observed in 2014. In 2013, 33% of potentially affected sites supported high frog abundance, 56% had medium frog abundance and 11% had low abundance. Of the seven reference sites surveyed in 2013, 57% had high frog abundance, 29% had medium abundance and 14% had low abundance.

3.2.2 WATER QUALITY

At the 16 wetlands surveyed in 2014, water temperature was highly variable (between 8.6 and 21.7 degrees Celsius; Appendix C, Table C-2; Figure 3-1) and pH ranged from 6.5 to 8.6 (Appendix C, Table C-2; Figure 3-1).

The amount of total dissolved solids measured was also highly variable, ranging from 6.7 to 198 ppm, with TDS above 100 at four sites: KIPS17, KIPS4, KIPS9, and especially KIPS1 where TDS was 198 ppm (Appendix C, Table C-2; Figure 3-2). With the exception of KIPS4, frog abundance was high at all of these wetlands. The high TDS at the four wetlands was likely caused by the 2013 fires. It was evident that fires had burned right up to the edge of these wetlands, which would result in high amounts of ash fall into the water (at higher concentrations from the general floating ash that was everywhere). A high TDS reading is caused by elevated ions dissolved in the water from both natural and anthropogenic sources, such as salts, nitrates, dissolved metals and calcium carbonate (Health Canada 2007).

Turbidity, a measure of suspended particles in a fluid, was generally between 1 and 4 NTU at all wetlands, with a slightly higher value of 6.8 NTU at KIPS4 and even higher value at KIPSANT3 (i.e., 37.7 NTU; Appendix C, Table C-2; Figure 3-1). KIPSANT3 was highly disturbed and the cloudiness of the water was visibly evident. No frogs were heard during the initial site visit, but

low abundances of frogs were heard on the recording unit. It is possible that the low abundance of frogs recorded on the recording unit were calling from the unaffected wetland over a ridge from KIPSANT3, and not from KIPSANT3 itself. While there are no published tolerance thresholds for wood frogs or boreal chorus frogs, it is of note that a turbidity value of 37.7 NTU is below the tolerance threshold for northern leopard frogs (i.e., 40-42 NTU; Wind 2002). This northern leopard frog threshold functions as a surrogate for the other two species as all three species require land and water to survive, have thin skins that can absorb contaminants, have overlapping ranges, and coexist in the same wetlands in other parts of their range.

A comparison of the frog abundance and water quality data (Figure 3-1) indicates a slight negative correlation between temperature and frog abundance, however there are several exceptions to this apparent trend. For example, KGSA7 had high frog abundance, despite having a considerably lower temperature than other wetlands and KIPANT3 had a high temperature, but low frog abundance.

3.2.3 CHANGES TO INDIVIDUAL WETLANDS

During baseline surveys in 2011, five wetlands located in potentially affected areas, were surveyed and found to support breeding frogs. These same wetlands, plus an additional three (also located in potentially affected areas) were surveyed in 2012 (Stantec 2013). All continued to support breeding frogs during the first year of construction (i.e., 2012; Table 3-4). In 2013, the second year of construction, six of the eight wetlands surveyed the previous year continued to support breeding frogs. Two wetlands did not support frogs in 2013: KIPS2 and KIPS21. KIPS2 was in-filled as part of construction, and KIPS21 (see below) was affected by increased sediment concentration. In 2014 the remaining seven original wetlands, including KIPS21, continued to support breeding frogs through the last year of road construction.

Wetland KIPS21 is a small wetland located near a borrow area (see Figure 3-2). In 2012, prior to borrow area development, this wetland supported medium amphibian abundance. In 2013, the wetland did not support amphibians and showed signs of elevated sediment concentration resulting from development of an adjacent borrow area (Stantec 2014). In 2014, Wetland KIPS21 appeared to have recovered from the elevated sediment concentration effects observed in 2013, as turbidity visibly decreased in 2014 and was similar to reference wetlands sampled in the

area (Figure 3-1; Appendix D, Photo D-4 and D-5). KIPS21 supported a high number of boreal chorus frogs and a small number of wood frogs.

Table 3-3: Wetland Monitoring Survey Results

Study Area	Number of Wetlands	Number of Wetlands with no Amphibians	Amphibian Abundance		
			Low (no amphibians or <2 Species AND Code <3)	Medium (2 or more Species OR Code =3)	High (2 or more Species AND Code =3)
2014					
KIP	9	0	3	2	4
Reference Sites	7	0	0	3	4
2013					
KIP	9	0	1	5	3
Reference Sites	7	0	1	2	4
2012					
KIP	8	0	3	4	1
2011					
KIP	5	0	1	2	2

*Rank Description:

None No amphibian calls recorded during surveys.

Low No amphibian calls, or some amphibian calls recorded (one species only and less than 20 individuals in total, code 2 or less).

Medium Significant[1] amphibian calls observed (at least two species or more than 20 individuals total, code 3).

High Full chorus of multiple species observed.

Table 3-4: Results of Annual Monitoring of Amphibian Abundance

Site Name	Amphibian Abundance Rank			
	2011	**2012**	**2013**	**2014**
KIPS21	NA	Medium	None (site impacted by elevated sediment concentration)	High
KIPS2	High	High	None (site removed by construction)	None (site removed by construction)
KIPS3	Medium	Medium	High	High
KIPS4	Low	Medium	Medium	Low
KIPS-ANT3	NA	High	Medium	Medium
KIPS6	Medium	High	High	High
KIPS9	NA	Medium	Medium	High
KIPS17	Low	Low	Medium	High

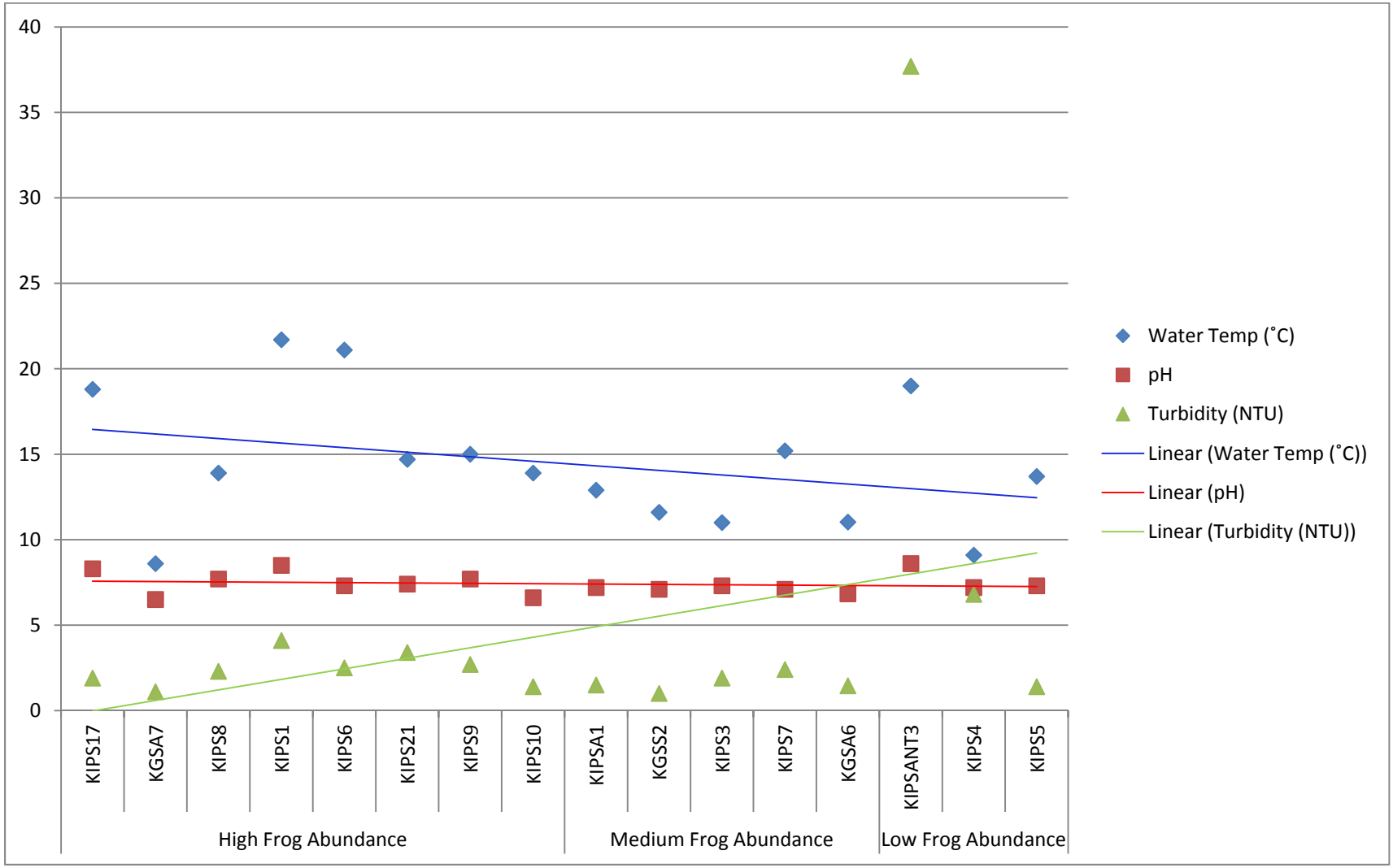


Figure 3-1: 2014 Water Quality Parameters by Site

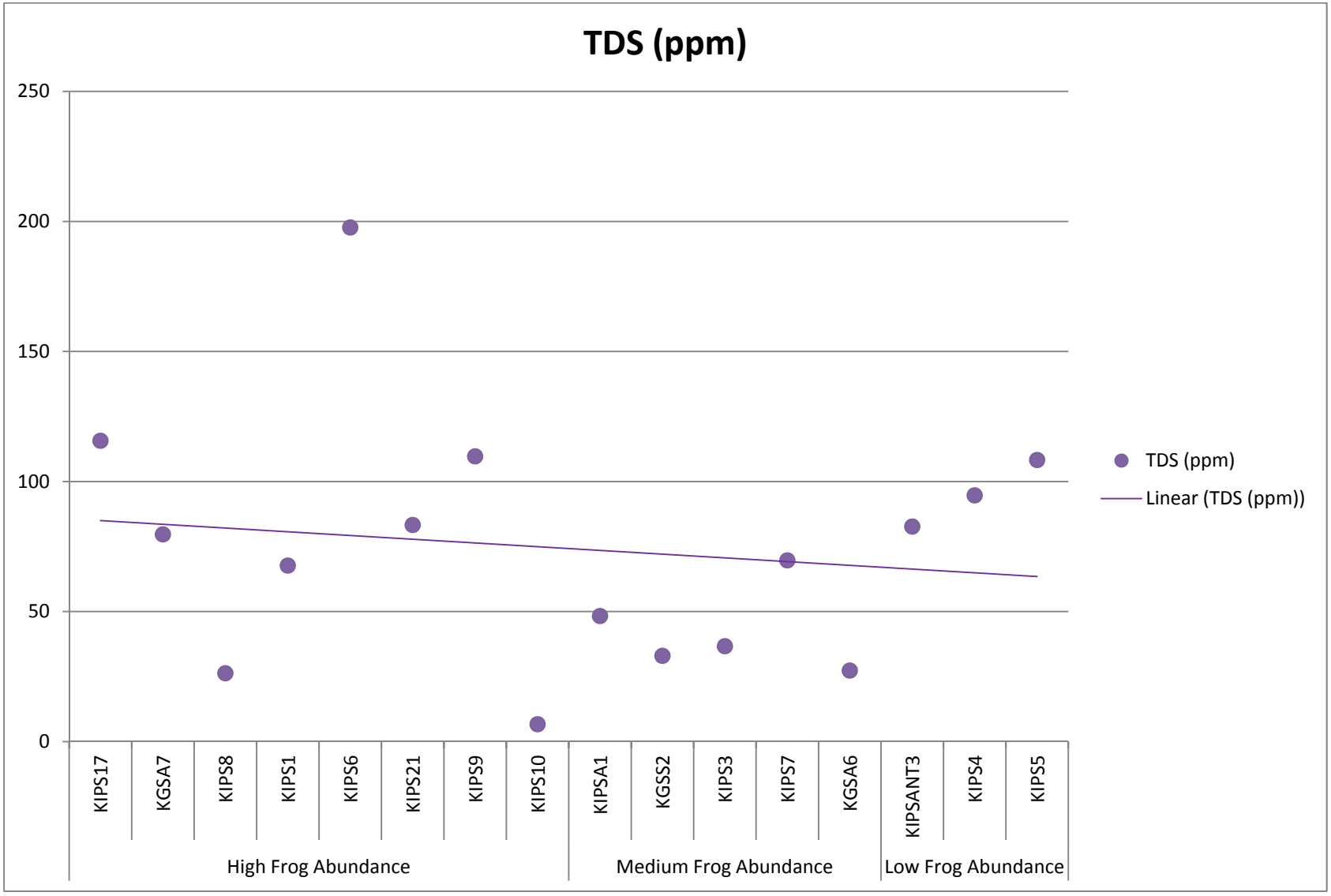
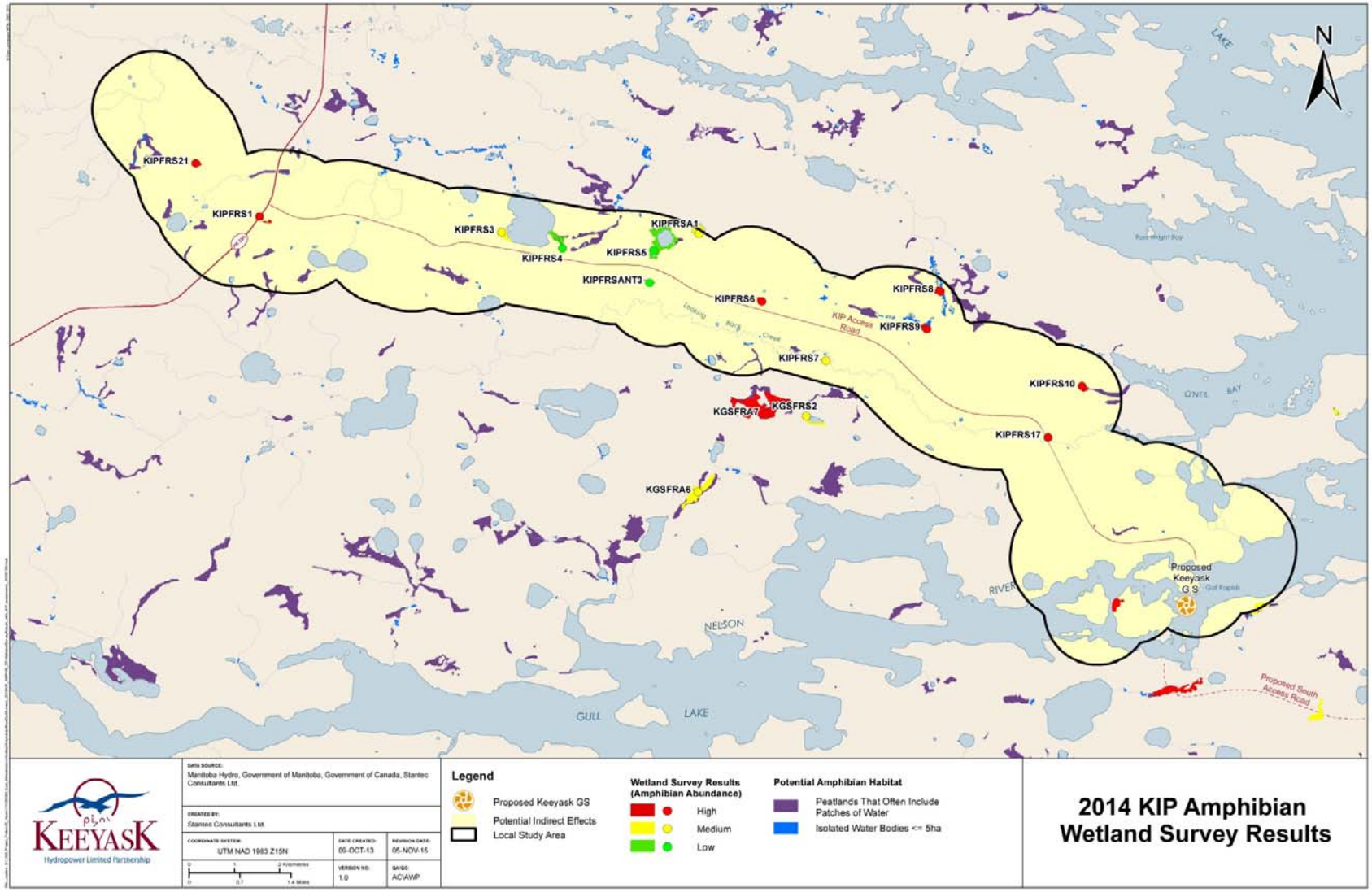


Figure 3-2: 2014 Total Dissolved Solids by Site



Map 3-2: 2014 KIP Amphibian Wetland Survey Results

3.3 INCIDENTALS

A number of frog observations were noted in late spring during remote recorder sampling for species at risk (Appendix E, Table E-1). These observations indicate that some breeding activity does continue into late spring; however a comparison of calling codes between June and May confirms that the bulk of amphibian breeding occurs in late May, with wood frog activity dropping off by the May 28th road-call surveys along Butnau Road.

The number of frogs observed foraging during other wildlife surveys in late spring was lower than in previous years. This may be due to the effect of 2013's forest fire activity on upland habitat. While wetlands did not appear to be affected by fires, the leaf litter in the surrounding uplands was burned, limiting the amount of thermal and escape cover available to foraging and dispersing frogs.

4.0 CONCLUSIONS

As predicted in the EA, construction activity had a small, local effect on amphibian habitat availability. Retention of vegetated buffers around wetlands, lakes, and creeks effectively reduced the Project's affect on important breeding and overwintering amphibian habitat. Removal of amphibian foraging habitat was limited to the Project Footprint and only one small wetland, KIPS2, was in-filled as a result of construction. Predictions in the EA were for low magnitude effects of fragmentation on amphibian breeding and overwintering habitat. Results from the 2012-2014 amphibian monitoring studies found no measureable effect of habitat fragmentation on amphibians. Boreal chorus frogs and wood frogs continue to be widely dispersed throughout the KIP LSA.

Elevated sediment concentration in one wetland (KIPS21) was observed in 2013. Amphibians were absent from this wetland in 2013, but quickly recolonized the area as the wetland measurably improved between 2013 and 2014. Predictions in the EA included that amphibian mortality could occur during construction of the KIP. KIP had little to no effect on amphibian mortality as amphibian mortality was not observed or reported during monitoring studies.

5.0 REFERENCES

5.1 LITERATURE CITED

Bird Studies Canada. 2008. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 13 pp.

Canadian Amphibian and Reptile Research Network. 2014. http://www/carcnet.ca/english/amphibians/species_accounts [Accessed July 4, 2014].

COSEWIC. 2009. COSEWIC assessment and update status report on the northern leopard frog Lithobates pipiens (Southern Mountain population) in Canada. http://www.cosewic.gc.ca/ [Accessed August 6, 2013].

ECOSTEM Ltd. 2005. Unpublished preliminary habitat classification mapping provided to Tetr*ES* Consultants in May 2005.

Gartshore, M.E., M.J. Oldham, R. van der Ham, F.W. Schueler, C.A. Bishop, and G.C. Barrett. 2004. Amphibian Road Call Counts Participants Manual. Environment Canada, Ontario Region. 14 pp.

Health Canada. 2007. Guidelines for Canadian Drinking Water Quality: Chemical and Physical Parameters. http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/sum_guide-res_recom/chemical-chimiques_e.html#4.

Keeyask Hydropower Limited Partnership (KHLP). 2012. Keeyask Infrastructure Project Terrestrial and Aquatic Monitoring Plan.

Keeyask Hydropower Limited Partnership (KHLP). 2009. Keeyask Infrastructure Project Environmental Assessment Report. Report submitted to Environmental Assessment and Licensing Branch, Manitoba Conservation. Available at: http://keeyask.com/wp/wp-content/uploads/2013/06/02-EA-Report-and-Appendices-Part-01.pdf

Manitoba Herps Atlas (MHA). 2015. Accessed online at: www.naturenorth.com/Herps/Manitoba_Herps_Atlas.html on 11 February 2015.

Manitoba Endangered Species and Ecosystems Act (MESEA). 2014. Available at: https://www.gov.mb.ca/conservation/wildlife/legislation/endang_act.html Lasted amended Feb 20, 2015 [Accessed on Feb 23, 2015]

Ontario Ministry of Natural Resources (OMNR). 2000. Significant wildlife habitat technical guide. 151p.

Roe JH, Georges A. Heterogeneous wetland complexes, buffer zones, and travel corridors: landscape management for freshwater reptiles. Biol Conserv. 2007;135:67–76.

Semlitsch RD, Bodie JR. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conserv Biol. 2003;17:1219–1228.

Species at Risk Act (SARA). 2014. Available at: http://laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html. Last amended Nov 26, 2014. [Accessed on Feb 20, 2015]

Stantec Consultants Ltd. 2013. Keeyask Infrastructure Project Report # 12-03: Amphibian 2012 Field Studies Report. Prepared for Keeyask Hydropower Limited Partnership for Manitoba Conservation and Water Stewardship.

Stantec Consultants Ltd. 2014. Keeyask Infrastructure Project Report # 13-02: Terrestrial and Aquatic Monitoring Plan: Amphibian Monitoring: Annual Report 2013. Prepared on Behalf of the Keeyask Hydropower Limited Partnership for Manitoba Conservation and Water Stewardship.

Westernland Resource Group. 2001. Biological Land Classification data and mapping. University of Manitoba. Winnipeg, Manitoba.

Wind, E. 2002. Northern Leopard Frog (Rana pipiens) Husbandry Manual. A Report produced for the Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC, and Columbia Basin Trust, Nakusp, BC. 65 pp.

5.2 PERSONAL COMMUNICATIONS

Beardy, Stanley. First Nations Guide, Community of Bird. Conversation with Angèle Watrin Prodaehl, Stantec Consultants, Gillam area, Manitoba, June 7, 2006.

APPENDIX A
GLOSSARY

Habitat – the place where a plant or animal lives; often related to a function such as feeding, nesting, etc.

pH- A measure of the acidity or alkalinity of a liquid, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale commonly in use ranges from 0 to 14.

Reference site – an unaffected area used as a benchmark or comparison for another more affected site in order to measure degree of change.

ROW – a "right-of-way," the strip of land through which roadways, railroads, or power lines are built, operated and maintained.

Special Concern – a wildlife species that may become **threatened** or endangered because of a combination of biological characteristics and identified threats.

Threatened – a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

TDS (Total Dissolved Solids) – A measure of the amount of material dissolved in liquid, essentially measuring the clarity and purity of the liquid.

Turbidity - Muddiness created by stirring up sediment or having foreign particles suspended in the water

APPENDIX B
ROAD SURVEY DATA

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
KIP Access Road					
May 24 2014	KIPRD	Wood Frog	2	200	NORTH
May 24 2014	KIPRD02	Boreal Chorus Frog	3	100	NORTH
		Wood Frog	2	500	SOUTH
		Wood Frog	2	500	SOUTH
May 24 2014	KIPRD03	Boreal Chorus Frog	3	100	NORTH
		Wood Frog	2	300	SE
		Wood Frog	2	300	SE
May 24 2014	KIPRD04	Boreal Chorus Frog	2	20	NORTH
		Wood Frog	2	300	SOUTH
May 24 2014	KIPRD05	Boreal Chorus Frog	1	>1000	NORTH
		Wood Frog	3	100	SOUTH
		Wood Frog	2	150	SOUTH
May 24 2014	KIPRD06	Boreal Chorus Frog	1	500	NORTH
		Wood Frog	3	30	EAST
		Boreal Chorus Frog	2	500	SOUTH
		Wood Frog	1	500	SOUTH
May 22 2014	KIPRD07	Boreal Chorus Frog	2	500	NORTH
		Wood Frog	3	80	SOUTH
		Wood Frog	1	80	SOUTH
May 24 2014	KIPRD08	Boreal Chorus Frog	2	200	NORTH
		Wood Frog	3	200	NORTH
		Wood Frog	3		
May 24 2014	KIPRD09	Boreal Chorus Frog	2	300	ENE
		Wood Frog	3	300	NE

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
May 24 2014	KIPRD10	Boreal Chorus Frog	2	80	SOUTH
		Wood Frog	3	80	SOUTH
May 24 2014	KIPRD11	Boreal Chorus Frog	3	250	NW
		Wood Frog	1	250	NW
May 24 2014	KIPRD12	None detected	0		
May 24 2014	KIPRD13	Boreal Chorus Frog	3	30	NW
		Wood Frog	1	30	NW
May 24 2014	KIPRD14	Boreal Chorus Frog	3	400	NORTH
		Boreal Chorus Frog	3	250	SE
May 24 2014	KIPRD15	Boreal Chorus Frog	3	160	NORTH
		Wood Frog	2	160	NORTH
May 24 2014	KIPRD16	Boreal Chorus Frog	3	250	NORTH
		Wood Frog	2	250	NORTH
		Wood Frog	1	60	SE
May 24 2014	KIPRD17	Boreal Chorus Frog	3	350	NORTH
		Boreal Chorus Frog	3	400	SOUTH
May 24 2014	KIPRD18	Boreal Chorus Frog	3	300	NORTH
		Boreal Chorus Frog	3	300	SOUTH
May 24 2014	KIPRD19	Boreal Chorus Frog	3	20	NE
		Wood Frog	1	20	NE
May 24 2014	KIPRD20	Boreal Chorus Frog	2	300	WEST
		Boreal Chorus Frog	3	500	NE
May 24 2014	KIPRD21	Boreal Chorus Frog	3	300	SW
		Wood Frog	1	300	SW

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
May 24 2014	KIPRD22	Boreal Chorus Frog	2	600	NW
May 24 2014	KIPRD23	Boreal Chorus Frog	3	200	SW
May 24 2014	KIPRD24	Boreal Chorus Frog	1	125	WEST
		Wood Frog	3	125	WEST
May 24 2014	KIPRD25	Boreal Chorus Frog	2	200	EAST
May 24 2014	KIPRD26	Boreal Chorus Frog	2	100	NE
		Wood Frog	1	100	NE
May 24 2014	KIPRD27	Boreal Chorus Frog	3	50	WEST
		Wood Frog	2	50	WEST
May 24 2014	KIPRD28	Boreal Chorus Frog	3	200	SE
May 24 2014	KIPRD29	Boreal Chorus Frog	3	150	NORTH
		Wood Frog	3	150	NORTH
May 24 2014	KIPRD30	Boreal Chorus Frog	2	200	SE
Keeyask Butnau Road					
May 28 2014	KSACCMP	Boreal Chorus Frog	2	40	SOUTH
May 28 2014	KSACRD10	Boreal Chorus Frog	1	200	EAST
May 28 2014	KSACRD2	Boreal Chorus Frog	1	100	ESE
May 28 2014	KSACRD3	Boreal Chorus Frog	1	100	EAST
May 28 2014	KSACRD4	Boreal Chorus Frog	1	300	WEST
May 28 2014	KSACRD5	Boreal Chorus Frog	1	100	EAST
May 28 2014	KSACRD6	None detected			
May 28 2014	KSACRD7	Boreal Chorus Frog	1	200	NW
May 28 2014	KSACRD8	Boreal Chorus Frog	2	10	WEST

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
May 28 2014	KSACRD9	Boreal Chorus Frog	2	100	NORTH
Provincial Road 280					
May 23 2014	PR280A	Boreal Chorus Frog	3	50	NORTH
May 23 2014	PR280A	Wood Frog	3	10	NORTH
May 23 2014	PR280A	Boreal Chorus Frog	3	200	SOUTH
May 23 2014	PR280A	Wood Frog	3	200	SOUTH
May 23 2014	PR280B	Boreal Chorus Frog	2	80	NORTH
May 23 2014	PR280B	Wood Frog	1	10	NORTH
May 23 2014	PR280B	Boreal Chorus Frog	3	50	SOUTH
May 23 2014	PR280C	Boreal Chorus Frog	3	150	SOUTH
May 23 2014	PR280C	Wood Frog	2	150	SOUTH
May 23 2014	PR280C	Boreal Chorus Frog	3	50	NORTH
May 23 2014	PR280C	Wood Frog	3	50	NORTH
May 23 2014	PR280D	Boreal Chorus Frog	3	100	NORTH
May 23 2014	PR280D	Wood Frog	3	100	NORTH
May 23 2014	PR280E	Boreal Chorus Frog	3	60	NE
May 23 2014	PR280E	Boreal Chorus Frog	3	30	SOUTH
May 23 2014	PR280E	Wood Frog	3	30	NE
May 23 2014	PR280E	Wood Frog	3	30	SOUTH
May 23 2014	PR280F	Boreal Chorus Frog	3	200	NORTH
May 23 2014	PR280F	Wood Frog	2	200	NORTH
May 23 2014	PR280G	Boreal Chorus Frog	3	200	NE
May 23 2014	PR280G	Wood Frog	3	200	NE
May 23 2014	PR280H	Boreal Chorus Frog	3	200	NW

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
May 23 2014	PR280H	Wood Frog	2	200	NW
May 23 2014	PR280I	Boreal Chorus Frog	3	30	NW
May 23 2014	PR280I	Wood Frog	2	30	NW
May 23 2014	PR280J	Boreal Chorus Frog	3	700	NORTH
May 23 2014	PR280J	Wood Frog	1	100	EAST
May 23 2014	PR280K	Boreal Chorus Frog	3	80	NORTH
May 23 2014	PR280K	Wood Frog	2	80	NORTH
May 23 2014	PR280L	Boreal Chorus Frog	3	30	EAST
May 23 2014	PR280L	Wood Frog	2	30	WEST
May 23 2014	PR280M	Boreal Chorus Frog	3	250	EAST
May 23 2014	PR280M	Wood Frog	2	100	NW
May 23 2014	PR280N	Boreal Chorus Frog	3	250	EAST
May 23 2014	PR280N	Wood Frog	2	30	WEST
May 23 2014	PR280N	Boreal Chorus Frog	2	30	WEST
May 23 2014	PR280O	Boreal Chorus Frog	3	500	EAST
May 23 2014	PR280O	Wood Frog	3	500	ES
May 23 2014	PR280O	Wood Frog	2	75	NE
May 23 2014	PR280P	Boreal Chorus Frog	3	500	NE
May 23 2014	PR280P	Wood Frog	3	500	NE
May 23 2014	PR280Q	Boreal Chorus Frog	3	200	EAST
May 23 2014	PR280Q	Boreal Chorus Frog	3	200	WEST
May 23 2014	PR280Q	Wood Frog	2	250	NE
May 23 2014	PR280R	Boreal Chorus Frog	3	100	NE
May 23 2014	PR280R	Boreal Chorus Frog	3	100	EAST

Table B-1: Results of Evening Road-call Counts					
Date	**Stop Location**	**Species**	**Calling Code**	**Distance (m)**	**Direction**
May 23 2014	PR280S	Boreal Chorus Frog	2	200	NORTH
May 23 2014	PR280S	Wood Frog	1	20	NORTH
May 23 2014	PR280S	Wood Frog	1	200	SOUTH
May 23 2014	PR280S	Boreal Chorus Frog	2	200	SOUTH
May 23 2014	PR280T	Wood Frog	2	300	NW
May 23 2014	PR280T	Boreal Chorus Frog	3	300	NW
May 23 2014	PR280T	Wood Frog	3	300	NORTH

APPENDIX C
WETLAND SURVEY DATA

Table C-1: Wetland Survey Data

Date	Location Description. (i.e., pond, ditch)	Wpt	Easting	Northing	Boreal Chorus Frog Code	Wood Frog Code	Habitat Description			
							Submergent Vegetation	Emergent Vegetation	Margin	Upland
25-May-14	wetland in burn	KIPS6	354300	6253127	3	1	NA	moss and equisetum	bog birch	old burn, BS10
25-May-14	wetland in burn	KIPS6	354300	6253127	3	1	NA	moss and equisetum	bog birch	old burn, BS10
25-May-14	wetland in burn	KIPS6	354300	6253127	3	1	NA	moss and equisetum	bog birch	old burn, BS10
25-May-14	wetland	KGSA7	354387	6250635	3	2	moss	grass	willow and tamarack	BS5TL5 Class 1,2
25-May-14	wetland	KGSA7	354387	6250635	3	2	moss	grass	willow and tamarack	BS5TL5 Class 1,2
25-May-14	wetland	KGSA7	354387	6250635	3	2	moss	grass	willow and tamarack	BS5TL5 Class 1,2
25-May-14	wetland	KGSS2	355274	6250589	2	2	moss	grass and sedge	bog rosemary	Old burn, BS10
25-May-14	wetland	KGSS2	355274	6250589	2	2	moss	grass and sedge	bog rosemary	Old burn, BS10
25-May-14	wetland	KGSS2	355274	6250589	2	2	moss	grass and sedge	bog rosemary	Old burn, BS10
24-May-14	ditch attached to larger wetland	KIPS1	343198	6255004	3	2	NA	grass and sedge	willow	BS10 Class 1,2, 50% burned
24-May-14	ditch attached to larger wetland	KIPS1	343198	6255004	3	2	NA	grass and sedge	willow	BS10 Class 1,2, 50% burned
24-May-14	ditch attached to larger wetland	KIPS1	343198	6255004	3	2	NA	grass and sedge	willow	BS10 Class 1,2, 50% burned
25-May-14	wetland	KIPS10	361373	6251252	3	1	sedge	sedge	bog birch	Old burn, BS10 Class 0,1
25-May-14	wetland	KIPS10	361373	6251252	3	1	sedge	sedge	bog birch	Old burn, BS10 Class 0,1
25-May-14	wetland	KIPS10	361373	6251252	3	1	sedge	sedge	bog birch	Old burn, BS10 Class 0,1
24-May-14	creek and wetland	KIPS17	360621	6250122	3	2	grass	grass and sedge	willow and alder	BS10 class 3,4, burned
24-May-14	creek and wetland	KIPS17	360621	6250122	3	2	grass	grass and sedge	willow and alder	BS10 class 3,4, burned
24-May-14	creek and wetland	KIPS17	360621	6250122	3	2	grass	grass and sedge	willow and alder	BS10 class 3,4, burned
25-May-14	wetland next to borrow pit	KIPS21	341787	6256181	3	1	grass	grass	thick willows	BS10 Class 1,2 gravel pit
25-May-14	wetland next to borrow pit	KIPS21	341787	6256181	3	1	grass	grass	thick willows	BS10 Class 1,2 gravel pit
25-May-14	wetland next to borrow pit	KIPS21	341787	6256181	3	1	grass	grass	thick willows	BS10 Class 1,2 gravel pit
25-May-14	wetland next to road	KIPS3	348546	6254656	2	1	grass	grass and sedge	willow	BS10 class 3,4, burned
25-May-14	wetland next to road	KIPS3	348546	6254656	2	1	grass	grass and sedge	willow	BS10 class 3,4, burned

Table C-1: Wetland Survey Data

Date	Location Description. (i.e., pond, ditch)	Wpt	Easting	Northing	Boreal Chorus Frog Code	Wood Frog Code	Habitat Description			
							Submergent Vegetation	Emergent Vegetation	Margin	Upland
25-May-14	wetland next to road	KIPS3	348546	6254656	2	1	grass	grass and sedge	willow	BS10 class 3,4, burned
25-May-14	wetland next to road	KIPS4	349894	6254302		2	moss	grass	tamarack	BS10 Class 1,2 burned
25-May-14	wetland next to road	KIPS4	349894	6254302		2	moss	grass	tamarack	BS10 Class 1,2 burned
25-May-14	wetland next to road	KIPS4	349894	6254302		2	moss	grass	tamarack	BS10 Class 1,2 burned
25-May-14	wetland next to road	KIPS5	351902	6254258		1	NA	none	sedge and leatherleaf	BS10 Class 1,2 burned
25-May-14	wetland next to road	KIPS5	351902	6254258		1	NA	none	sedge and leatherleaf	BS10 Class 1,2 burned
25-May-14	wetland next to road	KIPS5	351902	6254258		1	NA	none	sedge and leatherleaf	BS10 Class 1,2 burned
25-May-14	wetland	KGSA6	352890	6248917	1	1	moss	grass	willow and tamarack	BS10 Class 1,2
25-May-14	wetland	KGSA6	352890	6248917	1	1	moss	grass	willow and tamarack	BS10 Class 1,2
25-May-14	wetland	KGSA6	352890	6248917	1	1	moss	grass	willow and tamarack	BS10, Class 1,2
25-May-14	wetland	KIPS7	355712	6251816	2	1	grass	sedge	willow	BS10 class 3,4, burned
25-May-14	wetland	KIPS7	355712	6251816	2	1	grass	sedge	willow	BS10 class 3,4, burned
25-May-14	wetland	KIPS7	355712	6251816	2	1	grass	sedge	willow	BS10 class 3,4, burned
25-May-14	wetland	KIPS8	358241	6253349	3	2	grass	none (deep water)	none (steep banks)	BS10, high banks, class1,2
25-May-14	wetland	KIPS8	358241	6253349	3	2	grass	none (deep water)	none (steep banks)	BS10, high banks, class1,2
25-May-14	wetland	KIPS8	358241	6253349	3	2	grass	none (deep water)	none (steep banks)	BS10, high banks, class1,2
25-May-14	wetland	KIPS9	357946	6252516	3	1	grass	sedge	tamarack	BS7TL2PB1, high hills
25-May-14	wetland	KIPS9	357946	6252516	3	1	grass	sedge	tamarack	BS7TL2PB1, high hills
25-May-14	wetland	KIPS9	357946	6252516	3	1	grass	sedge	tamarack	BS7TL2PB1, high hills
25-May-14	wetland	KIPSA1	352906	6254621	2	2	moss	grass	grass and sedge	BS10 Class 2,3
25-May-14	wetland	KIPSA1	352906	6254621	2	2	moss	grass	grass and sedge	BS10 Class 2,3
25-May-14	wetland	KIPSA1	352906	6254621	2	2	moss	grass	grass and sedge	BS10 Class 2,3
24-May-14	standing water in gravel pit	KIPSANT3	351816	6253541	2		NA	none	sand	old burn, BS10

Table C-1: Wetland Survey Data

Date	Location Description. (i.e., pond, ditch)	Wpt	Easting	Northing	Boreal Chorus Frog Code	Wood Frog Code	Habitat Description			
							Submergent Vegetation	Emergent Vegetation	Margin	Upland
24-May-14	standing water in gravel pit	KIPSANT3	351816	6253541	2		NA	none	sand	old burn, BS10
24-May-14	standing water in gravel pit	KIPSANT3	351816	6253541	2		NA	none	sand	old burn, BS10

Appendix C, Table C-2: Water Quality Measurements Taken at Wetland Survey Sites 2014 (average of three independent measurements)

Wetland name	Water Temp (˚C)	TDS (ppm)	pH	Turbidity (NTU)	BCFR code	WOFR code
KGSA6	11.03	27.33	6.83	1.45	1	1
KIPS1	21.7	197.7	8.5	4.1	3	2
KIPSANT3	19.0	48.3	8.6	37.7	2	0
KIPS6	21.1	67.7	7.3	2.5	3	1
KIPS17	18.8	115.7	8.3	1.9	3	2
KIPS21	14.7	83.3	7.4	3.4	3	1
KIPS3	11.0	69.7	7.3	1.9	2	1
KIPS4	9.1	108.3	7.2	6.8	0	2
KIPS5	13.7	94.7	7.3	1.4	0	1
KIPSA1	12.9	33.0	7.2	1.5	2	2
KGSA7	8.6	26.3	6.5	1.1	3	2
KGSS2	11.6	36.7	7.1	1.0	2	2
KIPS7	15.2	82.7	7.1	2.4	2	1
KIPS9	15.0	109.7	7.7	2.7	3	1
KIPS8	13.9	79.7	7.7	2.3	3	2
KIPS10	13.9	6.7	6.6	1.4	3	1

APPENDIX D
PHOTOGRAPHS

Photo D-1: Typical Roadside Amphibian Habitat

Photo D-2: Remote Recorder Unit Set-up

Photo D-3: Typical Surveyed Wetland

Photo D-4: Wetland (KIPS21) with Elevated Sediment Concentration in 2013, Near Active Borrow Area

Photo D-5: Aerial view of KIP21 in 2014, Demonstrating Lower Sediment Concentration than 2013

Photo D-6: Removal of Vegetation for the Development of a Borrow Area

APPENDIX E
INCIDENTAL DATA

Table E-1: Incidental Frog Observations							
Date	**Time**	**Site**	**Project**	**Easting**	**Northing**	**Frog Species**	**Frog Code**
22-Jun-14	0:00	KGSRC6_13A	KGS	353819	6238146	Boreal Chorus Frog	1
22-Jun-14	1:00	KGSRC6_13A	KGS	353819	6238146	Boreal Chorus Frog	1
26-Jun-14	0:00	6	KGS	359311	6254064	Boreal Chorus Frog	2
26-Jun-14	1:00	6	KGS	359311	6254064	Boreal Chorus Frog	1
22-Jun-14	0:00	R9	KGS	359708	6244304	Boreal Chorus Frog	1
26-Jun-14	0:00	10	KGS	354623	6250867	Boreal Chorus Frog	1
21-Jun-14	22:00	KGSRC9_13	KGS	370949	6243372	Boreal Chorus Frog	1
22-Jun-14	0:00	KGSRC9_13	KGS	370949	6243372	Boreal Chorus Frog	1
22-Jun-14	1:00	KGSRC9_13	KGS	370949	6243372	Boreal Chorus Frog	1
22-Jun-14	20:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
22-Jun-14	22:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
23-Jun-14	0:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
23-Jun-14	1:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
23-Jun-14	20:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
23-Jun-14	22:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
24-Jun-14	0:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
24-Jun-14	1:00	KGSRC14I	KGS	367023	6246524	Boreal Chorus Frog	1
27-Jun-14	1:00	12	KIP	348519	6254840	Boreal Chorus Frog	1
21-Jun-14	20:00	36	KGS	372688	6243712	Boreal Chorus Frog	1
21-Jun-14	22:00	36	KGS	372688	6243712	Boreal Chorus Frog	1

APPENDIX F
WEATHER CONDITIONS

Table F-1: Weather Observations During 2014 Road-call Surveys

Date	Weather Range During Survey Period
May 23, 2014	15°C, wind 15 km/hr, 80% cloud cover
May 24, 2014	10-20°C; wind 10 - >20 km/hr from southeast; 70-80% cloud cover
May 28, 2014	10°C; 8km/hr from the east; 70% cloud cover