



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Priority Habitats Monitoring Report

TEMP-2017-02



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2017-02

PRIORITY HABITATS MONITORING REPORT

Prepared for

Manitoba Hydro

By

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. Before the government issued a licence to construct the Project, the Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station are affecting the environment, and whether or not more needs to be done to reduce harmful effects.

This report describes the results of terrestrial sensitive sites monitoring conducted during the third summer of Project construction.

Why is the study being done?

Some of the land habitat types are especially important for ecosystem health and/or to people. These include the habitat types in the Keeyask region that are rare or uncommon, support more plant or animal species than other habitat types, or are very sensitive to disturbance from Project construction (called “priority habitat types”). Other habitat types are included in the Project’s Environmental Protection Plans (EnvPPs) because they are very important to wildlife (e.g., caribou calving islands, vegetation along streams). Together, all of these are the sensitive sites included in this monitoring study. The purpose of this study is to confirm the predicted Project effects on the terrestrial sensitive sites.

What was done?

During construction, this study monitors Project effects on sensitive sites by documenting Project clearing or disturbance in these sites. A more detailed and cumulative evaluation is completed the year after construction completion.

The map of Project clearing or physical disturbance up to September 2016 (produced by another terrestrial monitoring study) was used to determine which and how much of the sensitive sites were impacted up to that time. Ground surveys were also carried out at 21 sensitive sites because they were of special interest or were already being visited for other reasons.

What was found?

The amounts of Project clearing and disturbance in sensitive sites were very low, occurring in less than 3% of the total sensitive site area. About 80% of the impacted sensitive site area was within the Environmental Protection Plan (EnvPP) green zones (in which clearing can occur throughout). Another 10% of the impacted area was within the EnvPP yellow and red zones (in these areas there are provisions to reduce clearing in sensitive sites, where possible). The

remaining 10% of impacted area was within or outside of areas approved for use by the Project after the license was issued. The impacts outside of the originally licensed Project areas accounted for only 0.3% of total sensitive site area.

Of the four types of sensitive sites being monitored by this study, Project impacts in September 2016 were highest on priority habitat (93% of total impacted area), followed by caribou calving and rearing habitat (almost 7% of total impacted area) and then by off-system marsh (less than 1%). Mammal riparian habitat sites were not impacted.

Although the mammal riparian habitat sites had no clearing or disturbance, a thick layer of road dust was found on the vegetation close to the Looking Back Creek site on the east side of the north access road. This dust was found on plants that were more than 100 m from the road (much further than assumed for the Environmental Impact Statement). A recommendation was made to study how far this dust extended from the road.

What does it mean?

So far, there are no major unanticipated Project effects on the terrestrial sensitive sites.

The higher impacts on priority habitat, compared with the other important habitat types, were expected because there was much more of this type to start with. Also, many of these habitat types occur on areas with gravelly or sandy soils (which is a preferred location for borrow areas and roads). Off-system marsh and mammal riparian habitat sites are in wet and/or peaty areas.

Project clearing and disturbance to September 2016 were very low, impacting less than 3% of the total sensitive site area being monitored. The clearing within and outside of the additional areas the Province approved for use after the license was issued are not a major concern, mostly for two reasons. There are no major concerns with the specific sites that were impacted. Additionally, 90% of the sensitive site area within the licensed Project footprint had not been cleared or disturbed in September 2016, and it is expected that much of this area will remain undisturbed given that most of the permanent Project features are already in place.

What will be done next?

Continued surveys to document the amount of priority habitat and sensitive sites affected by the Project will be done in summer 2017 (Year 4 of construction).

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STUDY TEAM

Dr. James Ehnes was the project manager and study designer.

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1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695 megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume* (TE SV). The *Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, priority habitats, during the construction and operation phases.

Ecosystem diversity refers to the number of different ecosystem types, and their size distribution, within a defined geographic area. Habitat composition and priority habitat types were the indicators for Project effects on ecosystem diversity. Habitat composition provides an overall representation of ecosystem diversity. Priority habitat types are those native habitat types that are particularly important for ecological and/or social reasons. In this monitoring study, priority habitat types are the native habitat types in the Keeyask region that were rare or uncommon, highly diverse (i.e., species rich and/or structurally complex), highly sensitive to disturbance, had a high potential to support rare plants and/or were highly valued by people.

The ecosystem diversity monitoring program includes a single study, the Priority Habitats study, which periodically evaluates changes to ecosystem diversity based on effects to the priority habitat types. This study also monitors the sensitive terrestrial sites that are not being monitored by other TEMP studies.

The goal of the Priority Habitats study is to determine the nature of Project effects on ecosystem diversity. The objectives of this study are to:

- Confirm that the N-6 priority habitat site identified for avoidance in the EIS is not disturbed;
- Determine the degree to which the other priority habitat patches and other environmentally sensitive terrestrial sites identified in the EnvPP (excluding sites whose condition is being monitored by another program) are disturbed;
- Quantify and situate the amounts and locations of priority habitat types affected by the Project; and,
- Quantify and situate Project effects on ecosystem diversity.

A previous monitoring study and report (ECOSTEM 2015) documented effects on ecosystem diversity from the Keeyask Infrastructure Project (KIP), which ended in June 2014. Monitoring

for this study was conducted in 2015 and 2016. ECOSTEM (2016) provides results for the priority habitat monitoring conducted in 2015. The following presents the monitoring conducted during 2016.

2.0 METHODS

Section 2.3.2 of the TEMP details the methods for this study. The following summarizes the activities conducted during 2016. The methods were the same as in 2015 except that the more precise mapping of clearing and disturbance boundaries within the planned footprint and possibly disturbed areas (see ECOSTEM 2017a) was used.

Prior to describing the 2016 monitoring activities, some terminology is defined to assist the reader. In the terrestrial habitat, ecosystems and plant studies, clearing refers to complete vegetation removal in a patch that was at least 400 m² in size. Disturbance refers to either physical disturbance in intact vegetation (e.g., machinery trail, test pits), use of a pre-existing trail or a clearing smaller than 400 m². Also, an “impact” refers to what the Project does in terms of the question of interest (e.g., vegetation clearing), while an “effect” refers to the consequences relative to the question of interest (e.g., marsh habitat loss, reduced wetland function).

2.1 SENSITIVE SITES MONITORED

The general types of sensitive terrestrial sites included in this monitoring are priority habitats, off-system marsh habitat, mammal riparian habitat and caribou calving and rearing habitat. Caribou calving and rearing habitat has been included in the reporting in 2016. The first Project impacts on these sensitive sites occurred after the 2015 monitoring surveys, once clearing for the future reservoir began.

Map 2-2 shows the 5,844 ha of sensitive terrestrial sites present at the start of construction, and that are being monitored for this study. Contiguous sites prior to construction were combined with each other, resulting in 2,751 spatially distinct sensitive sites. A given sensitive site may include more than one of the possible terrestrial sensitivities listed above. All of the resulting sites were referred to as sensitive sites regardless of their reasons for inclusion. Some of the individual sites that were very small in size were removed. The primary reason for very small sites was that the remainder of the site had been removed because it overlapped a permanent Project feature.

The reporting of effects on the sensitive sites includes providing results based on the three environmental sensitivity zones included in the Project’s Environmental Protection Plans (EnvPPs; Map 2-1) in the licensed Project footprint; and, within the remaining areas within Study Zone 3 (Map 2-2). The EnvPPs include provisions to avoid all of the environmentally sensitive terrestrial sites (which includes sites being monitored by other studies in addition to this one within the possibly disturbed areas of the licensed Project Footprint, to the extent practicable. The EnvPP maps show the environmentally sensitive sites as “red zones” (reproduced in Map 2-1).

For the portions of the possibly disturbed areas that are not environmentally sensitive sites, the EnvPPs include provisions to minimize clearing or disturbance to the extent practicable. This is because there is some flexibility in the locations of clearing, disturbance or material placement within this portion of the Project footprint. The EnvPP maps show these portions of the possibly disturbed areas are shown as “yellow zones” (reproduced in Map 2-1).

All of the sensitive sites in the EnvPPs are outside of the planned Project footprint. The planned footprint is largely comprised of permanent features, which means there is limited flexibility to reduce or relocate Project impacts in these areas. As such, there are no requirements for the contractor to avoid any areas within the planned portion of the Project footprint. These areas are shown in the EnvPP maps as “green zones” (reproduced in Map 2-1).

The sensitive sites included in this study (Map 2-1) are monitored to meet the first and second objectives of this study. The remaining sensitive sites within Study Zone 3 (Map 2-2) are also monitored to meet the third and fourth objectives of this study. Reporting for the first and second objectives occurs annually during construction, and in the year following construction completion. Reporting for the third and fourth objectives occurs the year after construction ends, and then at years 3, 5, 10, 15 and 25 of operation.

2.2 IMPACT MAPPING

Site selection for 2016 field surveys began by reviewing the available Worldview 2 imagery available for the Project area. At this time, the only imagery was acquired in early June 2016. Aerial surveys were conducted on August 20-21, 2016 to ensure that Project clearing boundaries had not increased since the Worldview imagery was taken. This was important because the imagery would later be used to map the extent of sensitive site impacts in a GIS in the office. The aerial surveys showed that the footprint clearing boundaries had grown since the Worldview imagery was acquired, particularly around Borrow Area KM17. This was noted so that the extended boundaries could be accounted for in the subsequent mapping.

Twenty-one of the 2,751 sensitive sites were also surveyed on the ground because they were within the “N-6 priority habitat site to avoid” or along Looking Back Creek. Ground sampling recorded conditions in the designated patches using reconnaissance surveys, geo-referenced photographs, marked-up maps and notes. Field data were mapped in a GIS using digital orthorectified imagery as the base maps.

Additional Worldview 2 imagery of the Project area was acquired on September 21, 2016. This became available approximately three months after the field surveys were completed. This new imagery, along with other supplemental imagery and data, were then used in a GIS to digitize Project footprint clearing and disturbance boundaries.

This study used the Project clearing or disturbance mapping produced by the Habitat Loss and Disturbance study (ECOSTEM 2017a) to identify sensitive sites that were impacted as of September 2016. TEMP (Section 2.1.2) indicates that precise mapping of clearing and

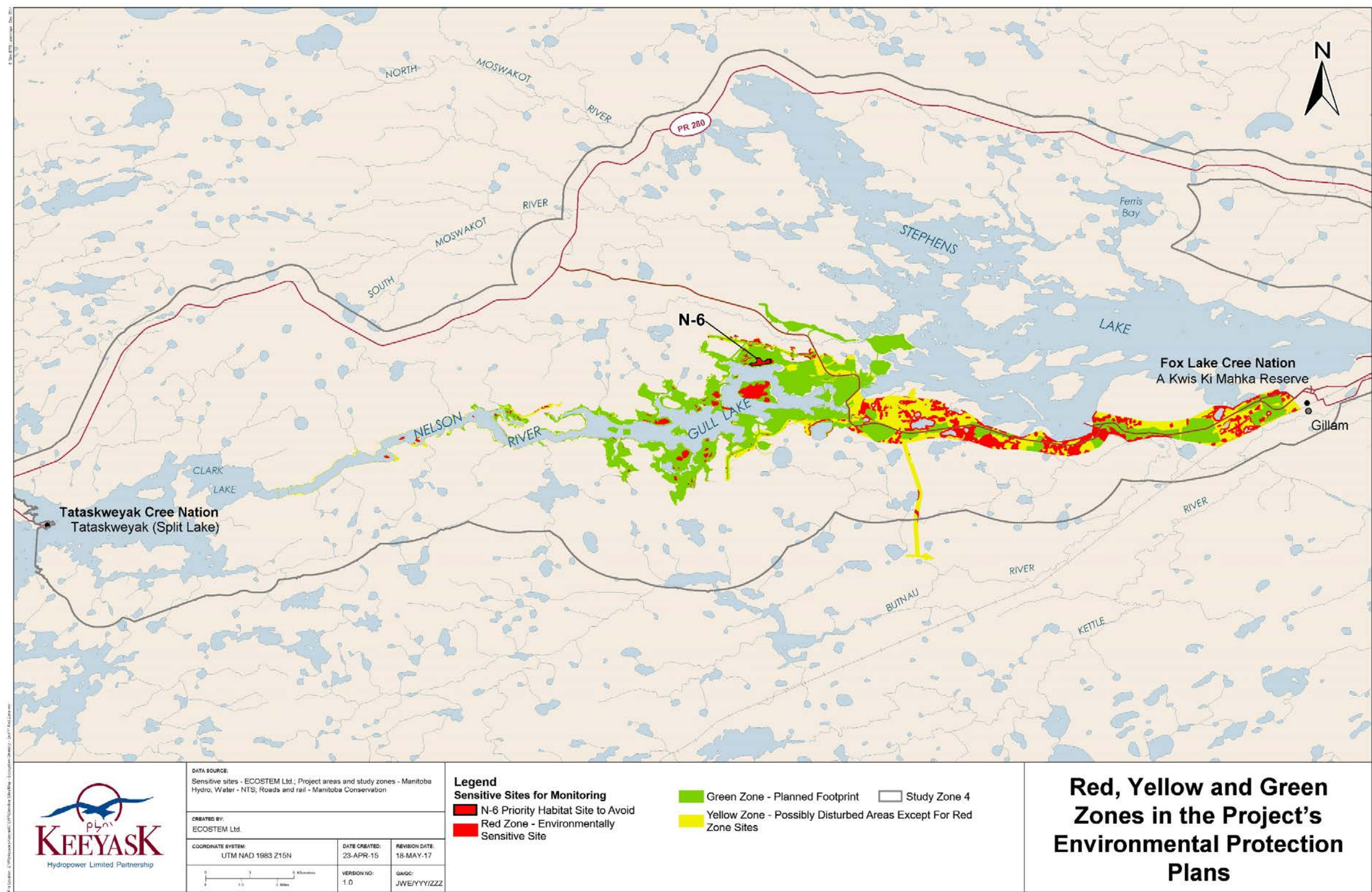
disturbance inside the licensed footprint will occur at the end of the construction phase. On this basis, the 2015 annual report generally mapped the approximate maximum extent of clearing and disturbance. The one exception was that boundaries for cleared or disturbed areas that were potentially outside of the licensed Project footprint were precisely digitized (see ECOSTEM 2016).

It was found that the 2015 mapping approach was more time consuming than anticipated. In 2016, the mapping approach was modified to the one contemplated for the end of construction based on the 2015 experience, and because the majority of Project clearing had been completed. Project clearing or disturbance as of September 2016 was precisely mapped (see ECOSTEM 2017a). To provide comparisons of changes from 2015 to 2016 based on consistent mapping methods, clearing or disturbance as of September 2015 was also digitized using the 2016 approach.

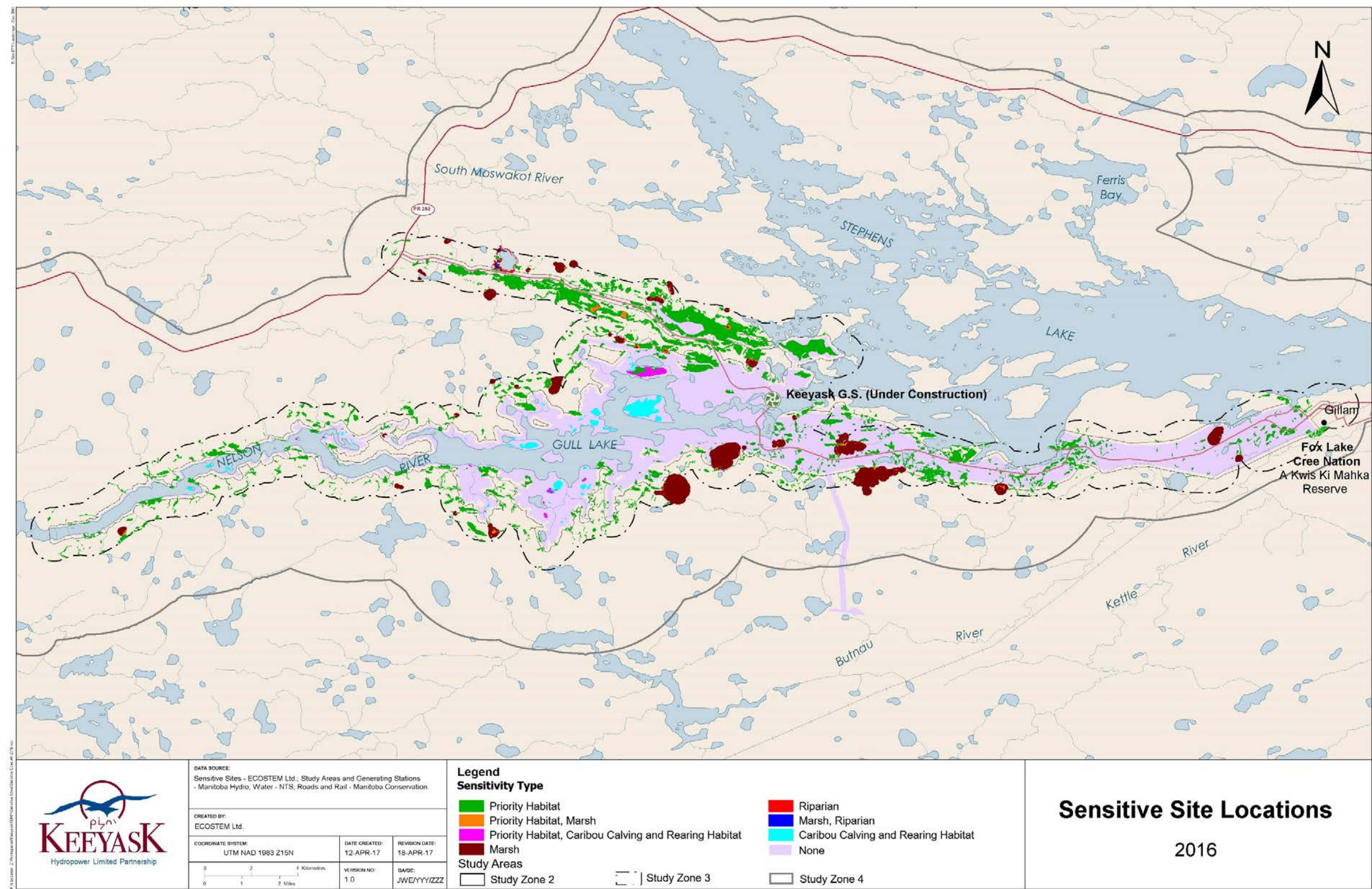
Impacts on sensitive sites were identified and then classified as being cleared or disturbed using the precise Project impact mapping produced by the Habitat Loss and Disturbance study. These impact boundaries were overlaid on the precisely mapped 2015 and 2016 impact boundaries on the sensitive sites in a GIS, and then the cleared or disturbed boundaries were used to subdivide each sensitive site into cleared, disturbed or undisturbed.

The more precisely mapped 2015 clearing or disturbance boundaries resulted in some updates to the previously reported impacts on sensitive sites up to September 2015 (ECOSTEM 2016). These changes are noted when reporting results below.

After the Project was licensed, Manitoba Conservation and Water Stewardship (MCWS; now Manitoba Sustainable Development) approved several additional areas for Project use (see ECOSTEM 2017a). These additional areas are considered when reporting results that describe sensitive site clearing or disturbance by Project planning zone. These areas were not a concern when they were added to the approved Project footprint because they were evaluated prior to their addition, and their locations were modified to alleviate ecological concerns that were identified during the evaluation. Important considerations for these evaluations were changes to cumulative effects as well as the amount of the licensed Project Footprint that was expected to remain undisturbed at the end of construction (the EIS intentionally erred on the side of overestimating impacts). As of September 2015, the vast majority (98%) of sensitive site area had not been impacted by the Project (ECOSTEM 2016).



Map 2-1: Environmental sensitivity zones in the Project's Environmental Protection Plans



Map 2-2: Sensitive sites included in the Priority Habitat study

3.0 RESULTS

3.1 OVERALL IMPACTS ON SENSITIVE SITES

The 2,751 sensitive sites being monitored for this study covered 5,844 ha in Study Zone 3.

Map 3-1 shows the sensitive sites that were cleared (see Photo 3-1 for an example) or disturbed (see Photo 3-2 for an example) by the Project as of September 2016 (see Section 2.0 definitions of clearing and disturbance).

As of September 2016, Project clearing or disturbance had impacted 168.2 ha of area in 339 of sensitive sites. The total impacted area was 2.9%, of total sensitive site area (Table 3-1), leaving approximately 97% of sensitive site area as unimpacted.

Using the detailed clearing or disturbance mapping completed in 2016 (Section 2.2), the total amount of impacted sensitive site area increased by 36.6 ha between September 2015 and 2016, or less than 0.01% of total pre-Project sensitive site area.

Table 3-1: Number and area of impacted sensitive sites in September 2015 or 2016

Parameter	Pre-Project	Impacts (cleared or disturbed)		
		2015	2016	Change
Number of Sites				
Total number	2,751	189	339	150
Number impacted as a percentage of pre-Project total	-	6.9	12.3	5.5
Area (ha)				
Total area	5,844.2	131.6	168.2	36.6
Area impacted as a percentage of pre-Project total	-	2.3	2.9	0.6



Photo 3-1: Example of Project clearing and excavation in a black spruce mixture vegetation on mineral site



Photo 3-2: Example of a Project disturbed area with machinery compaction in recently burned area that was a jack pine mixture vegetation on thin peatland site

In September 2016, 98% of the sensitive site area within the EnvPP yellow and red zones had not been cleared or disturbed. Additionally, 90% of the sensitive site area within the licensed Project footprint has not been cleared or disturbed.

Of the total sensitive site area cleared or disturbed as of 2016, 135.2 ha (or 80%) was situated within EnvPP green zones (Table 3-2). About half of the area impacted between September 2015 and 2016 was also in EnvPP green zones. Only 10% of the impacted sensitive site area was in EnvPP yellow and red zones, or 0.3 ha and 16.4 ha of area, respectively, which was an increase of 14.9 ha over 2015 (Table 3-3).

Clearing or disturbance of sensitive sites within areas subsequently approved for Project use was 13.2 ha in 2016 (Table 3-2), which was 2.5 ha higher than in 2015 (Table 3-3). As of September 2016, clearing or disturbance outside of the approved Project areas was 3.2 ha, or 1.9% of total impacted area. Most of this was associated with clearing and disturbance outside of Borrow Area KM17.

Table 3-2: Project clearing or disturbance in sensitive sites as of September 2016, by EnvPP zone

EnvPP Zone	Total Pre-Project Area (ha)	Clearing or Disturbance		
		Impacte d Area (ha)	Percent of Pre- Project Area	Percent of Impacte d Area
Within EnvPP green zones	716.0	135.2	2.3	80.4
Within EnvPP yellow zones	10.5	0.3	0.0	0.2
Within EnvPP red zones	750.6	16.4	0.3	9.8
Within subsequently approved Project areas	13.2	13.2	0.2	7.8
Outside of subsequently approved Project areas	-	3.2	0.1	1.9
All other areas being monitored	4,353.8	-	-	-
Total	5,844.2	168.2	2.9	100.0

Table 3-3: Changes to Project clearing or disturbance in sensitive sites as of September 2015 and September 2016, by EnvPP zone

EnvPP Zone	Clearing or Disturbance (ha)		
	2015	2016	Increase
Within EnvPP green zones	117.8	135.2	17.3
Within EnvPP yellow zones	0.0	0.3	0.3
Within EnvPP red zones	1.8	16.4	14.6
Within subsequently approved Project areas	10.6	13.2	2.5
Outside subsequently approved Project areas	1.3	3.2	1.9
Total	131.6	168.2	36.6

Priority habitat, off-system marsh, mammal riparian habitat, or caribou calving and rearing habitat were the four types of sensitive sites included in this monitoring study (Section 2.1). Since a particular monitored site may include more than one sensitivity, the rest of the tables in this subsection report two sets of impacts by sensitivity. In each table, the top half of a table provides total areas for each general type of sensitivity while the bottom half of a table provides totals for the various combinations of sensitivities found in sites. Adding the rows in the top half of a table yields a higher total than shown in the last row (e.g., 270 ha for total sensitive site area) because some sites included more than one sensitivity.

Priority habitat was the sensitivity with the highest total number of sites and total area before Project construction started (Table 3-4). As of September 2016, priority habitat also had the highest impacts (*i.e.*, clearing or disturbance) using either number of sites or area, comprising 92.7% of total impacted area (Table 3-5). This was expected since the priority habitat tended to be the areas with granular mineral material, which was a preferred substrate for borrow areas and roads.

Caribou calving and rearing habitat sites had the second highest Project impacts (6.6% of total impacted area), followed by marsh (0.7%). The biggest increase in impacted area from 2015 to 2016 was caribou calving and rearing habitat (9.53 ha) as there was no clearing of the reservoir at the time of the 2015 surveys.

Mammal riparian habitat sites were not impacted by the Project as of September 2016.

Of the sensitive sites impacted to date, priority habitat was the only sensitivity with Project disturbance (Table 3-6; see Section 2.0 for definitions of disturbance versus clearing). The 6.8 ha of priority habitat disturbance was low compared to the 149.7 ha of clearing.

For priority habitat, most (86%) of impacts were in EnvPP green zones (Table 3-7), and similarly for off-system marsh (73%). However, most (88%) of the impacted caribou calving and rearing habitat was in EnvPP yellow and red zones.

The sensitive site ground surveys found high accumulations of road dust on the vegetation on the east side of the NAR along Looking Back Creek (Photo 3-3). These dust accumulations extended more than 100 m from the road, which was much further than assumed for the EIS. It is recommended to study dust accumulation on vegetation further as several studies in northern regions have found that road dust accumulations can have major long-term adverse effects on vegetation and soils (Walker and Everett 1987; Auerbach et al. 1997; Myers-Smith et al. 2006). While these studies were from a different ecological zone than the Project, a preliminary literature review found them to be from the most comparable ecozone and that they documented effects on vegetation types similar to those in the Project area.

Table 3-4: Number and area of sensitive sites with documented Project clearing or disturbance as of September 2015 and 2016, by sensitivity

Sensitivity ¹	Number				Area (ha)			
	Pre-Project	Impacted			Pre-Project	Impacted		
		2015	2016	Change		2015	2016	Change
Total Area, Including Sites with More Than One Sensitivity								
P	2,502	188	306	118	4,258.5	131.4	156.5	25.1
M	430	1	9	8	1,331.6	0.2	1.1	0.9
R	17	-	-		28.7	-	-	-
C	72	-	33	33	393	-	11.2	11.2
All	3,021	189	348	159	6,011.8	131.6	168.8	37.2
Total Area by Combination of Sensitivities								
P	2,245	188	297	109	4,098.0	131.4	155.9	24.5
P, M	231	-	1	1	82.2	-	0.0	0.0
P, C	26	-	8	8	78.3	-	0.6	0.6
M	186	1	8	7	1,242.5	0.2	1.1	0.9
R	4	-	-	-	21.8	-	-	-
M, R	13	-	-	-	6.9	-	-	-
C	46	-	25	25	314.7	-	10.6	10.6
All	2,751	189	339	150	5,844.2	131.6	168.2	36.6

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Table 3-5: Impacts on terrestrial sensitive sites, as a percentage of totals, as of September 2015 or 2016, by sensitivity

Sensitivity ¹	Number			Area (ha)		
	Pre-Project	Impacted		Pre-Project	Impacted	
		2015	2016		2015	2016
Total Including Sites with More Than One Sensitivity						
P	82.8	99.5	87.9	70.8	99.8	92.7
M	14.2	0.5	3.0	22.1	0.2	0.7
R	0.6	-	-	0.5	-	-
C	2.4	-	9.5	6.5	-	6.6
	100.0	100.0	100.0	100.0	100.0	100.0
Total by Combination of Sensitivities						
P	81.6	99.5	87.6	70.1	99.8	92.7
P,M	8.4	-	0.3	1.4	-	0.0
P,C	0.9	-	2.4	1.3	-	0.4
M	6.8	0.5	2.4	21.3	0.2	0.7
R	0.1	-	-	0.4	-	-
M,R	0.5	-	-	0.1	-	-
C	1.7	-	7.4	5.4	-	6.3
	100.0	100.0	100.0	100.0	100.0	100.0
1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat						

Table 3-6: Area of terrestrial sensitive sites with documented Project impacts as of September 2015 or 2016, by clearing or disturbance and by sensitivity

Sensitivity ¹	Pre-Project Area (ha)	Cleared or Disturbed Area (ha)					
		Disturbed 2015	Disturbed 2016	Change	Cleared 2015	Cleared 2016	Change
Total Area, Including Sites with More Than One Sensitivity							
P	4,258.5	5	6.8	1.8	126.4	149.7	23.3
M	1,331.6	-	-	-	0.2	1.1	0.9
R	28.7	-	-	-	-	-	-
C	393	-	-	-	-	10.6	10.6
Total Area by Combination of Sensitivities							
P	4,098.0	5.0	6.8	1.8	126.4	149.1	22.7
P, M	82.2	-	-	-	-	0.0	0.0
P, C	78.3	-	-	-	-	0.6	0.6
M	1,242.5	-	-	-	0.2	1.1	0.9
R	21.8	-	-	-	-	-	-
M, R	6.9	-	-	-	-	-	-
C	314.7	-	-	-	-	10.6	10.6
All	5,844.2	5.0	6.8	1.8	126.6	161.4	34.8
1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat							

Table 3-7: Area of terrestrial sensitive sites impacted by the Project as of September 2015 or 2016, by EnvPP zone and sensitivity

Sensitivity ¹	Pre-Project Area (ha)	Cleared or Disturbed Area (ha)				
		EnvPP Green Zones	EnvPP Yellow and Red Zones	Subsequently Approved Areas	Outside of Subsequently Approved Areas	Total Area Impacted
Total Area, Including Sites with More Than One Sensitivity						
P	4,258.4	34.1	6.8	12.8	2.8	156.5
M	1,324.6	0.8	0.3	-	-	1.1
C	392.9	0.4	9.8	0.6	0.5	11.2
Total Area by Combination of Sensitivities						
P	4,098.0	134.0	6.6	12.6	2.8	155.9
P, M	82.2	-	0.0	-	0.0	0.0
P, C	78.3	0.1	0.2	0.3	-	0.6
M	1,242.5	0.8	0.3	-	0.0	1.1
C	314.7	0.2	9.5	0.3	0.5	10.6
All	5,815.5	135.2	16.7	13.2	3.2	168.2

¹ Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Table 3-8: Area of sensitive sites impacted by the Project as of September 2015 and 2016, by EnvPP zone and sensitivity

Sensiti- vity ¹	Pre-Project Area (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zones (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
		2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Total Area, Including Sites with More Than One Sensitivity													
P	4,258.4	117.6	134.1	16.5	1.84	6.8	5.0	10.6	12.8	2.2	1.3	2.8	1.5
M	1,324.6	0.2	0.8	0.6		0.3	0.3						
C	392.9		0.4	0.4		9.8	9.8		0.6	0.6		0.5	0.5
Total Area by Combination of Sensitivities													
P	4,098.0	117.6	134.0	16.3	1.84	6.6	4.8	10.6	12.6	1.9	1.3	2.8	1.5
P, M	82.2					0.0	0.0					0.0	0.0
P, C	78.3		0.1	0.1		0.2	0.2		0.3	0.3			
M	1,242.5	0.2	0.8	0.6		0.3	0.3					0.0	0.0
C	314.7		0.2	0.2		9.5	9.5		0.3	0.3		0.5	0.5
All	5,815.5	117.8	135.2	17.3	1.84	16.7	14.8	10.6	13.2	2.5	1.3	3.2	1.9
1: P = Priority Habitat; M = Marsh; R = Mammal Riparian Habitat; C = Caribou Calving and Rearing Habitat													



Photo 3-3: Road dust covering vegetation on east side of North Access Road along Looking Back Creek

3.2 IMPACTS ON MAMMAL RIPARIAN HABITAT SITES

Mammal riparian habitat sites made up a very small portion (< 0.01%) of pre-Project sensitive site area (Table 3-4). No Project clearing or disturbance was observed in any of the mammal riparian sites.

Ground surveys on Looking Back Creek in 2016 found that erosion from the north access road (NAR) shoulder was depositing sediment into natural waterbodies adjacent to the creek near the northeast corner of the NAR bridge (Photo 3-4). No recommendation was made for this site as currently the sediment is confined to the pool next to the road bank.



Photo 3-4: Erosion and sedimentation from North Access Road into a natural waterbody adjacent to Looking Back Creek

3.3 IMPACTS ON OFF-SYSTEM MARSH SITES

Monitoring by this study focuses on the off-system marsh area included in the EnvPPs. Impacts on off-system marsh are being studied in more detail by the Wetland Loss and Disturbance monitoring program (TEMP Section 2.5.2).

Of the three types of sensitive sites with Project impacts as of September 2016, off-system marsh was the least impacted, both in terms of total area (Table 3-4) and as a percentage (Table 3-5) of its pre-Project area.

As of September 2016, Project clearing or disturbance had affected nine of the marsh sensitive sites included in the EnvPP, for a total of 1.1 ha (Table 3-4), and 84% of this was in the 100 m buffer zone surrounding the marsh habitat (ECOSTEM 2017b).

Compared to clearing, no marsh site had Project disturbance in 2015 or 2016 (Table 3-6).

The greatest proportion of cleared marsh was found within EnvPP green zones (where clearing was expected) and the remainder was found within EnvPP yellow and red zones (Table 3-8). No marsh was cleared outside of these areas.

3.4 IMPACTS ON CARIBOU CALVING AND REARING HABITAT SITES

Of the four types of sensitive sites, caribou calving and rearing habitat was the second most impacted type in September 2016 (Table 3-4). No caribou calving and rearing habitat had been impacted by the Project in September 2015 (Table 3-6) since reservoir clearing did not begin until later in 2015. Compared to clearing, no caribou calving and rearing habitat area was disturbed by the Project in 2015 or 2016.

About 10.6 ha of reservoir clearing impacted almost half of the total number of pre-Project caribou sensitive sites at this time. These impacts were generally situated in places where clearing extended slightly into the sensitive site boundaries over a long length.

The bulk of the impacted caribou calving and rearing habitat was within the EnvPP yellow and red zones, where 9.75 ha was cleared (Table 3-8). Small cleared areas amounting to 0.6 ha or less were found in the EnvPP green zones and within and outside the subsequently approved Project areas.

Caribou calving and rearing habitat had the largest area impacted (9.53 ha) within the EnvPP yellow and red zones in 2016 (Table 5-3).

3.5 IMPACTS ON PRIORITY HABITAT SITES

As of September 2016, 12.2% (306) of the priority habitat sites being monitored were impacted (Table 3-4). Impacts on total priority habitat area were much lower at 3.7% (156.5 ha) of total area (Table 3-4). The vast majority of impacted priority habitat (134.1 ha) was in the EnvPP green zones (Table 3-7). Subsequently approved areas included the next highest amount of priority habitat (12.8 ha), followed by the EnvPP yellow and red zones (6.8 ha), followed by areas outside of subsequently approved Project areas (2.8 ha).

Compared with September 2015, the amount of priority habitat area cleared by the Project increased by 23.3 ha, while disturbance increased by 1.8 ha (Table 3-6). The disturbance resulted from machinery activity near Borrow Area KM17 (Photo 3-2).

Most of the increased impacts on priority habitat from 2015 to 2016 (16.5 ha) were in the EnvPP green zones (Table 3-8). The amount of impacted priority habitat in the EnvPP yellow and red zones increased by 5 ha. Changes within and outside of the subsequently approved areas increased by 2.18 and 1.45 ha, respectively in 2016.

Aerial and ground surveys in 2016 found that the “N-6 priority habitat site to avoid” had not been impacted by the Project. However, some priority habitat adjacent to this site was impacted by reservoir clearing to the southwest, and by geotechnical explorations for a fish egress channel to the northwest (Photo 3-3). To prevent any impacts on the “N-6 priority habitat site to avoid”, this adjacent clearing was noted to Manitoba Hydro shortly after the field survey, along with a recommendation to avoid further clearing or disturbance outside of the existing cleared area.



Photo 3-5: Geotechnical exploration trails and reservoir clearing adjacent to the western and southern boundary of the N-6 priority habitat site to avoid

At the time of the 2016 survey, the Project had slightly impacted some priority habitat within the off-system marsh buffer zones (see Wetland Function study report (ECOSTEM 2017b) for more information).

Of the 54 priority habitat types, 18 had not been impacted by the Project in September 2016 (Table 3-9). For those types impacted, increases in area between September of 2015 and 2016 were small, with maximum being 6.8% of pre-Project area.

Project impacts on priority habitat types as of September, 2016 were highest in black spruce mixture vegetation on mineral ecosites (60.9 ha) and jack pine dominant vegetation on mineral ecosites (30.5 ha; Table 3-9), respectively. An increase of 7.4 ha was found in black spruce mixture on mineral and a 3.1 ha increase was found in jack pine dominant on mineral over 2015 (Table 5-1).

In relative terms, black spruce dominant vegetation on shallow peatland had the highest impacts at 78% (0.6 ha) of the total pre-Project area being monitored. None of the other habitat types had impacts on more than 13% of their total monitored area.

Project disturbance was highest in the jack pine dominant on mineral priority habitat type, with 2.41 ha in 2016 (Table 5-2), which amounted to only 0.6% of the total pre-Project area. This was a marginal increase from 2015. Black spruce dominant vegetation on mineral ecosites had the highest disturbance in percentage terms in 2016, affecting 1.1% of pre-Project area.

Table 5-3 provides the areas impacted by the Project as of September 2016 by habitat type and EnvPP zone. Black spruce mixture vegetation on mineral ecosites had the largest area impacted within the EnvPP green zones (55.5 ha), followed by jack pine dominant vegetation on mineral ecosites (25.8 ha) and black spruce mixture on thin peatland (10.3 ha). Black spruce mixture vegetation on mineral ecosites had the highest increase in impacted area from 2015 to 2016 (6.1 ha).

The priority habitat type with the largest cleared or disturbed area within the subsequently approved Project areas was jack pine dominant vegetation on mineral ecosites with 3.9 ha in 2016 (Table 5-3). Black spruce mixture vegetation on mineral ecosites and jack pine mixture vegetation on thin peatland ecosites were similarly impacted with 3.7 and 3.5 ha, respectively in 2016. The biggest increase in impacted area from 2015 to 2016 was in trembling aspen mixedwood vegetation on all ecosites with 0.7 ha.

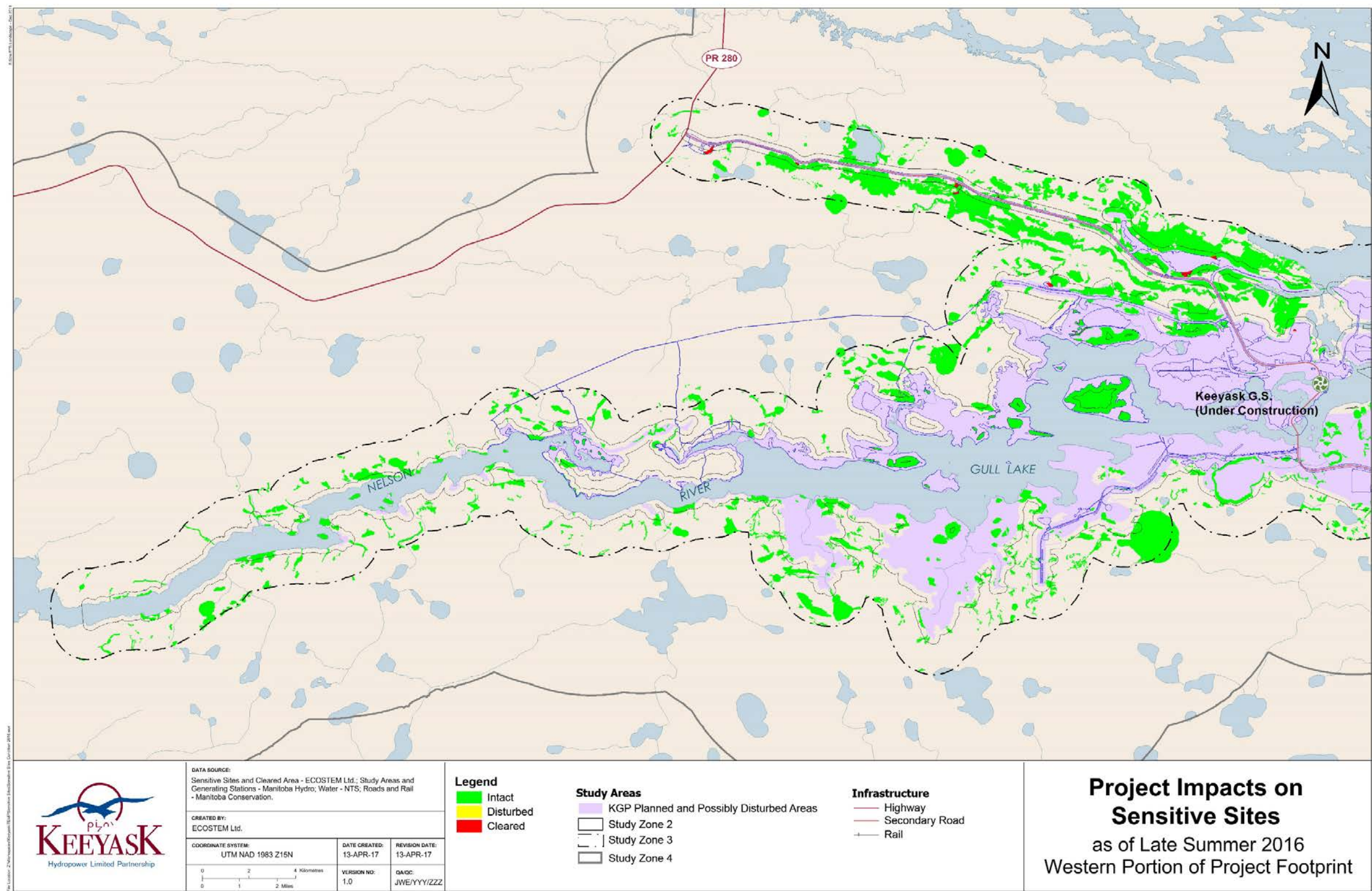
Jack pine mixture vegetation on thin peatland ecosites had the largest area impacted outside of the subsequently approved areas with 1.1 ha (Table 5-3) and had the largest increase in impacted area from 2015 to 2016 (0.8 ha). Jack pine dominant vegetation on mineral ecosites, and trembling aspen mixedwood vegetation on all ecosites made up the majority of the remaining impacted areas with 0.8 ha and 0.7 ha, respectively.

Table 3-9: Composition of impacts on priority habitats

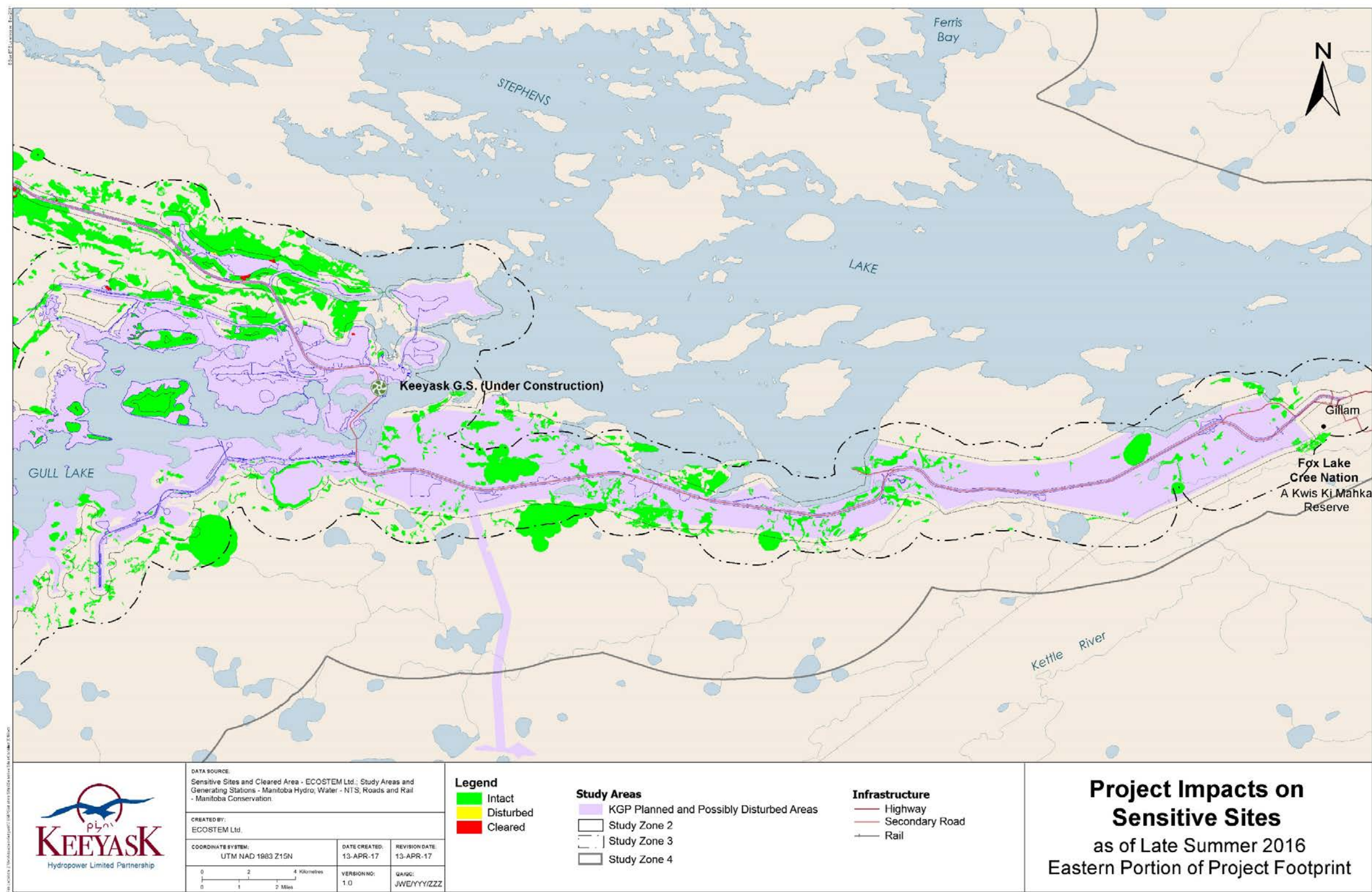
Priority Habitat Type	Number of Sites		Area (ha)	
	Pre-Project	Impacted	Pre-Project	Impacted
Balsam poplar dominant on all ecosites	2		1.0	
Black spruce dominant on ground ice peatland	5	1	0.3	0.0
Black spruce dominant on mineral	8	2	0.9	0.0
Black spruce dominant on riparian peatland	2	1	0.3	0.0
Black spruce dominant on shallow peatland	18	7	0.7	0.6
Black spruce dominant on thin peatland	20	0	0.6	0.0
Black spruce dominant on wet peatland	476	24	432.6	6.4
Black spruce mixedwood on mineral	37	7	166.9	1.6
Black spruce mixedwood on shallow peatland	5	1	4.2	0.0
Black spruce mixedwood on thin peatland	18	2	9.3	0.0

Priority Habitat Type	Number of Sites		Area (ha)	
	Pre-Project	Impacted	Pre-Project	Impacted
Black spruce mixture on ground ice peatland	1		0.0	
Black spruce mixture on mineral	146	50	528.8	60.9
Black spruce mixture on shallow peatland	232	5	218.3	2.3
Black spruce mixture on thin peatland	300	50	333.9	11.0
Black spruce mixture on wet peatland	25	1	17.9	0.1
Emergent island in littoral	5		6.6	
Emergent on lower beach	15		4.2	
Emergent on upper beach	32		8.0	
Jack pine dominant on mineral	88	34	376.7	30.5
Jack pine dominant on shallow peatland	2		4.7	
Jack pine dominant on thin peatland	17	2	74.0	0.6
Jack pine mixedwood on mineral	34	2	122.7	0.6
Jack pine mixedwood on shallow peatland	4		7.6	
Jack pine mixedwood on thin peatland	23	4	83.4	1.9
Jack pine mixture on shallow peatland	12	2	44.2	0.3
Jack pine mixture on thin peatland	86	23	294.9	13.0
Low vegetation on mineral	4	1	0.4	0.0
Low vegetation on riparian peatland	5		0.2	
Low vegetation on shallow peatland	1		0.0	
Low Vegetation on thin peatland	3		1.1	
Low vegetation on wet peatland	1		0.0	
Tall shrub on mineral	18	7	35.3	0.6
Tall shrub on riparian peatland	1		0.0	
Tall shrub on shallow peatland	64	2	150.0	0.1
Tall shrub on thin peatland	55	15	77.2	9.9
Tall shrub on wet peatland	63	1	51.3	0.1
Tamarack- black spruce mixture on riparian peatland	3		0.4	
Tamarack dominant on mineral	7	3	6.1	0.4
Tamarack dominant on shallow peatland	9	0	5.3	0.0
Tamarack dominant on thin peatland	5	2	5.9	0.4
Tamarack dominant on wet peatland	17	0	25.9	0.0
Tamarack mixture on mineral	40	12	69.9	7.9
Tamarack mixture on shallow peatland	164	6	132.9	0.1
Tamarack mixture on thin peatland	129	13	134.5	1.2
Tamarack mixture on wet peatland	100	7	103.3	0.8
Trembling aspen dominant on all ecosites	91	12	242.6	3.1
Trembling aspen mixedwood on all ecosites	54	4	217.5	2.0
White birch dominant on all ecosites	25	1	40.1	0.1

Priority Habitat Type	Number of Sites		Area (ha)	
	Pre-Project	Impacted	Pre-Project	Impacted
White birch mixedwood on all ecosites	16	2	38.3	0.0
Marsh	186	8	1,242.5	1.1
Riparian	4	0	21.8	0.0
Riparian- Looking Back Creek	14	0	177.6	0.0
Marsh, Riparian	13		6.9	
Caribou Calving and Rearing Habitat	46	25	314.7	10.6
All	2,751	339	5,844.2	168.2



Map 3-1: Project impacts on sensitive sites outside of EnvPP green zones (i.e., the planned footprint) as of September 2016 – western portion of Project footprint



Map 3-2: Project impacts on sensitive sites outside of EnvPP green zones (i.e., the planned footprint) as of September 2016 – eastern portion of Project footprint

4.0 SUMMARY AND CONCLUSIONS

The Priority Habitats study monitors Project effects on priority habitats as well as the marsh, riparian and caribou sensitive sites included in the Project EnvPPs. These sites are collectively called the sensitive sites in this report. A given sensitive site may include more than one type of sensitivity.

The Priority Habitats monitoring includes 2,751 individual sensitive sites with a pre-Project area totaling 5,884 ha. Even prior to Project construction, some of the individual sites were very small in size, primarily because overlaps with permanent Project features were removed.

For each year of Project construction, mapping produced by the Habitat Loss and Disturbance study (TEMP, Section 2.1.2) is used to determine the locations and amounts of Project clearing or disturbance in the sensitive sites (see Section 2.0 for the definitions of clearing and disturbance). Ground surveys are also conducted in selected sensitive sites each year, either because they are of special interest or they are already being visited for other reasons. In September 2016, 21 of the 2,751 sensitive sites were also ground-surveyed because they were within the “N-6 priority habitat site to avoid” or along Looking Back Creek.

When predicting Project effects on ecosystem diversity, the EIS anticipated that a substantial proportion of the area within the licensed Project footprint area would not be used (e.g., it was likely that not all of the planned borrow areas would be required for Project construction). The EIS did not attempt to go beyond this qualitative statement to predict how much of the total sensitive site area would remain unimpacted due to uncertainties such as the ultimate actual amount of borrow material available.

At the time of the September 2016 survey, the Project had disturbed or completely cleared only 168.2 ha, or 2.9%, of the total pre-Project sensitive site area. This was a 36.6 ha increase over the total area impacted to September 2015.

To date, 90% of the sensitive site area within the licensed Project footprint has not been cleared or disturbed. As of September 2016, 80% (135.2 ha) of the total sensitive site area impacted by the Project was within EnvPP green zones, which is where there are no contractor limitations on the areas that can be cleared or disturbed. Only 10% (16.7 ha) was within the EnvPP yellow and red zones (predominantly in the red zone), which is where provisions to minimize impacts on sensitive sites are applicable.

Approximately 7.8% (13.2) ha of the impacted sensitive site area was within areas subsequently approved as Project areas by Manitoba Conservation and Water Stewardship (now Manitoba Sustainable Development). These additional areas were needed to address things that arose and could not be foreseen when the Project was licensed (see ECOSTEM (2017a) for details). These additions were not a concern for the sensitive sites being monitored by this study. They were evaluated for potential effects on the sensitive sites by terrestrial specialists prior to their submission to MCWS for approval, and their locations were modified to alleviate ecological concerns that were identified at that time. Important considerations for these evaluations were

changes to cumulative effects and the amount of the licensed Project footprint that was expected to remain undisturbed at the end of construction. In the latter regard, the Project assessment intentionally erred on the side of overestimating total impacted area. At the time the additional proposed areas were evaluated, monitoring had shown that the vast majority (98%) of the total sensitive site area had not been impacted. Additionally, 99% of the EnvPP yellow and red zones had not been impacted as of September, 2015 (ECOSTEM 2016), and it was expected that much of this area would remain undisturbed given the status of infrastructure construction in summer 2015.

In September 2016, 90% of the sensitive site area within the licensed Project footprint has not been cleared or disturbed. Additionally, 98% of the sensitive site area within the EnvPP yellow and red zones had not been impacted, and it was expected that much of this area would remain undisturbed given the status of infrastructure construction.

Less than 2% (3.2 ha) of sensitive site clearing, or 0.1% of pre-impact sensitive site area, was outside of subsequently approved Project areas. The very small amount of clearing was not a concern for the sensitive sites for the same reasons identified in the previous paragraph.

There was no clearing or disturbance in the “N-6 priority habitat site to avoid”. Adjacent to this site, some priority habitat was impacted by reservoir clearing to the southwest, and by geotechnical explorations for a fish egress channel to the northwest. To prevent any impacts on the “N-6 site to avoid”, this adjacent clearing was noted to Manitoba Hydro shortly after the field survey, along with a recommendation to avoid extending existing clearing or disturbance toward the “N-6 priority habitat site to avoid”.

Of the terrestrial sensitivities being monitored by this study, Project impacts were highest on priority habitat by far (93% of total impacted area). This was expected since a much higher proportion of priority habitat included areas with granular mineral material, which was a preferred substrate for borrow areas and roads. Off-system marsh and mammal riparian habitat sites were wet and/or peat dominated areas.

Caribou calving and rearing habitat sites had the second highest degree of Project impacts in September 2016, followed by off-system marsh sites. No Project clearing or disturbance was observed in any of the mammal riparian habitat sites.

Compared with conditions in September 2015, priority habitat had the largest increase in Project impacts, followed by caribou calving and rearing habitat sites and then off-system marsh sites. Caribou calving and rearing habitat sites had the largest increase within the EnvPP yellow and red zones due to the fact that the reservoir clearing began after the 2015 survey, and much of the Project clearing between September 2015 and 2016 was in the future reservoir area (ECOSTEM 2017a).

The monitoring area includes 54 priority habitat types. Of these, 18 remained entirely unaffected by the Project in September 2016. The priority habitat types with the highest Project impacts included black spruce mixture vegetation on mineral ecosites and jack pine dominant vegetation on mineral ecosites, with 60.9 ha and 30.5 ha of disturbed or cleared area, respectively. Jack

pine dominant vegetation on mineral ecosites had the largest cleared or disturbed area within the subsequently approved areas. Jack pine dominant vegetation on thin peatland ecosites had the largest cleared or disturbed area outside of the Project approved areas.

Although the mammal riparian habitat sites were not affected, there were two impacts sufficiently close to the Looking Back Creek site to warrant further investigation. Ground surveys in 2016 found that erosion from the north access road (NAR) shoulder was depositing sediment into small waterbodies adjacent to the creek near the northeast corner of the NAR bridge. No recommendation was made for this site as the sediment appeared to be confined to the pool next to the road bank.

The ground surveys at Looking Back Creek also found high accumulations of road dust on the vegetation on the east side of the NAR. These dust accumulations extended more than 100 m from the road, which was much further than assumed for the EIS. A recommendation is made to study dust accumulation further under the terrestrial habitat monitoring.

Monitoring to September 2016 did not identify any major unanticipated Project effects on the important habitats. As assumed in the EIS, much of the area in the EnvPP yellow zones remains undisturbed, which means construction impacts on the sensitive sites being monitored by this study have been low to date. There was a very small amount (0.3% of total sensitive site area) of clearing or disturbance outside of the originally licensed Project areas due to things that could not be foreseen when the Project was licensed. These additional areas were not a concern for the sensitive sites. Proposed impacts in these areas were reviewed for their effects on the sensitive sites before being submitted for government approval, and the proposed locations of impacts were adjusted to address concerns. Additionally, the supplemental area is only 1% of the remaining undisturbed sensitive site area situated within the approved Project areas, and it is expected that the final amounts of clearing in these types will be considerably lower than assumed for the EIS given that impacts to date are only 10% of the sensitive site area situated within the approved Project areas.

4.1 NEXT STEPS

Monitoring Project effects on priority habitats and other sensitive terrestrial sites will continue in 2017. No major changes to field methods are anticipated.

5.0 LITERATURE CITED

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APPENDIX 1: DETAILED RESULTS

Table 5-1: Number and area of sensitive sites impacted by the Project as of September 2015 or 2016, by broad/priority habitat type

Broad/Priority Habitat Type	Sensiti- vity ¹	Number of Sensitive Sites				Total Area (ha) Impacted			
		Pre- Project	Impacted			Pre- Project	Impacted		
			2015	2016	Change		2015	2016	Change
Balsam poplar dominant on all ecosites	P	2				1.0			
Black spruce dominant on ground ice peatland	P	5		1	1	0.3		0.0	0.0
Black spruce dominant on mineral	P	8	2	2	0	0.9	0.0	0.0	0.0
Black spruce dominant on riparian peatland	P	2		1	1	0.3		0.0	0.0
Black spruce dominant on shallow peatland	P	18	6	7	1	0.7	0.5	0.6	0.0
Black spruce dominant on thin peatland	P	19				0.6			
	P,M	1				0.0			
Black spruce dominant on wet peatland	P	440	18	24	6	424.7	6.2	6.4	0.1
	P,M	36				7.8			
Black spruce mixedwood on mineral	P	36	1	6	5	165.8	1.1	1.6	0.5
	P,C	1		1	1	1.0		0.0	0.0
Black spruce mixedwood on shallow peatland	P	5		1	1	4.2		0.0	0.0
Black spruce mixedwood on thin peatland	P	18	1	2	1	9.3	0.0	0.0	0.0
Black spruce mixture on ground ice peatland	P	1				0.0			
Black spruce mixture on mineral	P	133	28	47	19	511.8	53.3	60.7	7.4
	P,C	7		3	3	15.9		0.2	0.2
	P,M	6				1.1			

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensiti- vity ¹	Number of Sensitive Sites			Total Area (ha)				
		Pre- Project	Impacted			Pre- Project	Impacted		
			2015	2016	Change		2015	2016	Change
Black spruce mixture on shallow peatland	P	225	1	5	4	215.3	1.4	2.3	0.9
	P,C	1				0.2			
	P,M	6				2.8			
Black spruce mixture on thin peatland	P	285	36	48	12	327.4	8.0	11.0	3.0
	P,C	8		2	2	3.1		0.0	0.0
	P,M	7				3.4			
Black spruce mixture on wet peatland	P	25	1	1	0	17.9	0.1	0.1	0.0
Emergent island in littoral	P,M	5				6.6			
Emergent on lower beach	P,M	15				4.2			
Emergent on upper beach	P,M	32				8.0			
Jack pine dominant on mineral	P	86	27	34	7	376.1	27.4	30.5	3.1
	P,M	2				0.6			
Jack pine dominant on shallow peatland	P	2				4.7			
Jack pine dominant on thin peatland	P	16	1	2	1	74.0	0.6	0.6	0.0
	P,M	1				0.0			
Jack pine mixedwood on mineral	P	23	2	2	0	119.7	0.6	0.6	0.0
	P,M	11				3.0			
Jack pine mixedwood on shallow peatland	P	4				7.6			
Jack pine mixedwood on thin peatland	P	18	4	4	0	80.4	1.9	1.9	0.0
	P,M	5				3.0			
Jack pine mixture on shallow peatland	P	10	1	2	1	43.8	0.0	0.3	0.2
	P,M	2				0.4			
Jack pine mixture on thin peatland	P	79	16	23	7	292.6	10.7	13.0	2.2
	P,M	7				2.3			

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensiti- vity ¹	Number of Sensitive Sites				Total Area (ha)			
		Pre- Project	Impacted			Pre- Project	Impacted		
			2015	2016	Change		2015	2016	Change
Low vegetation on mineral	P	4	1	1	0	0.4	0.0	0.0	0.0
Low vegetation on riparian peatland	P	5				0.2			
Low vegetation on shallow peatland	P	1				0.0			
Low Vegetation on thin peatland	P	3				1.1			
Low vegetation on wet peatland	P	1				0.0			
Tall shrub on mineral	P	18	2	7	5	35.3	0.1	0.6	0.4
Tall shrub on riparian peatland	P	1				0.0			
Tall shrub on shallow peatland	P	61		2	2	149.7		0.1	0.1
	P,M	3				0.3			
Tall shrub on thin peatland	P	54	6	14	8	77.1	8.2	9.9	1.7
	P,M	1		1	1	0.1		0.0	0.0
Tall shrub on wet peatland	P	53		1	1	49.6		0.1	0.1
	P,M	10				1.7			
Tamarack- black spruce mixture on riparian peatland	P	3				0.4			
Tamarack dominant on mineral	P	7	3	3	0	6.1	0.4	0.4	0.0
Tamarack dominant on shallow peatland	P	7				5.2			
	P,M	2				0.1			
Tamarack dominant on thin peatland	P	5	1	2	1	5.9	0.4	0.4	0.0
Tamarack dominant on wet peatland	P	16				25.9			
	P,M	1				0.0			
Tamarack mixture on mineral	P	38	8	12	4	69.5	7.7	7.9	0.2
	P,M	2				0.4			

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensiti- vity ¹	Number of Sensitive Sites				Total Area (ha)			
		Pre- Project	Impacted			Pre- Project	Impacted		
			2015	2016	Change		2015	2016	Change
Tamarack mixture on shallow peatland	P	154	4	6	2	131.6	0.1	0.1	0.0
	P,C	1				0.3			
	P,M	9				1.0			
Tamarack mixture on thin peatland	P	126	8	13	5	130.2	1.1	1.2	0.2
	P,C	1				3.8			
	P,M	2				0.6			
Tamarack mixture on wet peatland	P	80	5	7	2	101.3	0.7	0.8	0.1
	P,M	20				2.0			
Trembling aspen dominant on all ecosites	P	73	2	10	8	217.8	0.0	2.7	2.7
	P,C	4		2	2	16.6		0.4	0.4
	P,M	14				8.3			
Trembling aspen mixedwood on all ecosites	P	46	2	4	2	214.7	0.7	2.0	1.3
	P,M	8				2.8			
White birch dominant on all ecosites	P	12		1	1	25.3		0.1	0.1
	P,C	2				11.1			
	P,M	11				3.7			
White birch mixedwood on all ecosites	P	13	1	2	1	11.2	0.0	0.0	0.0
	P,C	1				26.3			
	P,M	2				0.8			
Marsh	M	186	1	8	7	1,242.5	0.2	1.1	0.9
Riparian	R	4				21.8			
Riparian- Looking Back Creek	P	4				160.4			
	P,M	10				17.1			
Marsh, Riparian	M,R	13				6.9			
Caribou Calving and Rearing Habitat	C	46		25	25	314.7		10.6	10.6
All	All	2,751	189	339	150	5,844.2	131.6	168.2	36.6

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Table 5-2: Area of sensitive sites disturbed or cleared by the Project as of September 2016 by broad/priority habitat type

Broad/Priority Habitat Type	Sensitivity ¹	Total Area Pre-Project	Area (ha) Cleared or Disturbed					
			Disturbed 2015	Disturbed 2016	Change	Cleared 2015	Cleared 2016	Change
Balsam poplar dominant on all ecosites	P	1.0						
Black spruce dominant on ground ice peatland	P	0.3					0.02	0.02
Black spruce dominant on mineral	P	0.9	0.01	0.01	0	0.01	0.01	0
Black spruce dominant on riparian peatland	P	0.3					0.01	0.01
Black spruce dominant on shallow peatland	P	0.7				0.53	0.57	0.05
Black spruce dominant on thin peatland	P	0.6						
	P,M	0.0						
Black spruce dominant on wet peatland	P	424.7				6.25	6.38	0.13
	P,M	7.8						
Black spruce mixedwood on mineral	P	165.8		0.19	0.19	1.13	1.40	0.28
	P,C	1.0					0.02	0.02
Black spruce mixedwood on shallow peatland	P	4.2					0.03	0.03
Black spruce mixedwood on thin peatland	P	9.3				0.01	0.02	0.01
Black spruce mixture on ground ice peatland	P	0.0						
	P	511.8	0.82	1.11	0.29	52.50	59.61	7.11
Black spruce mixture on mineral	P,C	15.9					0.19	0.19
	P,M	1.1						
	P	215.3				1.37	2.30	0.93
Black spruce mixture on shallow peatland	P,C	0.2						
	P,M	2.8						

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensitivity ¹	Total Area Pre-Project	Area (ha) Cleared or Disturbed					
			Disturbed 2015	Disturbed 2016	Change	Cleared 2015	Cleared 2016	Change
Black spruce mixture on thin peatland	P	327.4	0.07	0.07	0.00	7.92	10.93	3.01
	P,C	3.1					0.05	0.05
	P,M	3.4						
Black spruce mixture on wet peatland	P	17.9				0.05	0.05	0.00
Emergent island in littoral	P,M	6.6						
Emergent on lower beach	P,M	4.2						
Emergent on upper beach	P,M	8.0						
Jack pine dominant on mineral	P	376.1	2.39	2.41	0.02	25.06	28.12	3.07
	P,M	0.6						
Jack pine dominant on shallow peatland	P	4.7						
Jack pine dominant on thin peatland	P	74.0				0.61	0.61	0.00
	P,M	0.0						
Jack pine mixedwood on mineral	P	119.7	0.62	0.62	0	0.00	0.00	0
	P,M	3.0						
Jack pine mixedwood on shallow peatland	P	7.6						
Jack pine mixedwood on thin peatland	P	80.4	0.02	0.02	0	1.93	1.93	0
	P,M	3.0						
Jack pine mixture on shallow peatland	P	43.8				0.04	0.26	0.22
	P,M	0.4						
Jack pine mixture on thin peatland	P	292.6	0.45	0.64	0.19	10.26	12.31	2.05
	P,M	2.3						
Low vegetation on mineral	P	0.4				0.00	0.00	0.00
Low vegetation on riparian peatland	P	0.2						
Low vegetation on shallow peatland	P	0.0						

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensiti- vity ¹	Total Area Pre- Project	Area (ha) Cleared or Disturbed					
			Disturbed 2015	Disturbed 2016	Change	Cleared 2015	Cleared 2016	Change
Low Vegetation on thin peatland	P	1.1						
Low vegetation on wet peatland	P	0.0						
Tall shrub on mineral	P	35.3				0.11	0.55	0.44
Tall shrub on riparian peatland	P	0.0						
Tall shrub on shallow peatland	P	149.7		0.09	0.09		0.03	0.03
	P,M	0.3						
Tall shrub on thin peatland	P	77.1		0.23	0.23	8.22	9.68	1.46
	P,M	0.1					0.01	0.01
Tall shrub on wet peatland	P	49.6		0.01	0.01		0.04	0.04
	P,M	1.7						
Tamarack- black spruce mixture on riparian peatland	P	0.4						
Tamarack dominant on mineral	P	6.1				0.41	0.41	0.00
Tamarack dominant on shallow peatland	P	5.2						
	P,M	0.1						
Tamarack dominant on thin peatland	P	5.9				0.37	0.38	0.01
Tamarack dominant on wet peatland	P	25.9						
	P,M	0.0						
Tamarack mixture on mineral	P	69.5				7.73	7.94	0.20
	P,M	0.4						
Tamarack mixture on shallow peatland	P	131.6		0.00	0.00	0.07	0.07	0.00
	P,C	0.3						
	P,M	1.0						

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/Priority Habitat Type	Sensitivity ¹	Total Area Pre-Project	Area (ha) Cleared or Disturbed					
			Disturbed 2015	Disturbed 2016	Change	Cleared 2015	Cleared 2016	Change
Tamarack mixture on thin peatland	P	130.2				1.07	1.23	0.16
	P,C	3.8						
	P,M	0.6						
Tamarack mixture on wet peatland	P	101.3				0.69	0.76	0.07
	P,M	2.0						
Trembling aspen dominant on all ecosites	P	217.8		0.01	0.01	0.02	2.72	2.69
	P,C	16.6					0.37	0.37
	P,M	8.3						
Trembling aspen mixedwood on all ecosites	P	214.7	0.66	1.40	0.74	0.03	0.62	0.59
	P,M	2.8						
White birch dominant on all ecosites	P	25.3					0.10	0.10
	P,C	11.1						
	P,M	3.7						
White birch mixedwood on all ecosites	P	11.2				0.00	0.01	0.00
	P,C	26.3						
	P,M	0.8						
Marsh	M	1,242.5				0.21	1.10	0.89
Riparian	R	21.8				0.00	0.00	0.00
Riparian- Looking Back Creek	P	160.4						
	P,M	17.1						
Marsh, Riparian	M,R	6.9						
Caribou Calving and Rearing Habitat	C	314.7					10.57	10.57
Grand Total		5,844.2	5.04	6.81	1.77	126.59	161.40	34.81

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Table 5-3: Area of sensitive sites impacted by the Project as of September, 2016 by EnvPP environmental sensitivity zone

Broad/ Priority Habitat Type	Sensiti- vity ¹	Total Area Impacte d by the Project (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zone (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
			2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Black spruce dominant on ground ice peatland	P	0.02				0.02	0.02							
Black spruce dominant on mineral	P	0.02	0.02	0.02	0.00									
Black spruce dominant on riparian peatland	P	0.01		0.00	0.00	0.01	0.01							
Black spruce dominant on shallow peatland	P	0.57	0.53	0.53	0.00	0.05	0.05							
Black spruce dominant on wet peatland	P	6.38	6.15	6.19	0.04	0.09	0.18	0.09						
Black spruce mixedwood on mineral	P	1.59	1.13	1.16	0.03	0.00	0.25	0.25		0.19	0.19			
	P,C	0.02				0.02	0.02							

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/ Priority Habitat Type	Sensiti- vity ¹	Total Area Impacted by the Project (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zone (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
			2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Black spruce mixedwood on shallow peatland	P	0.03					0.02	0.02					0.01	0.01
Black spruce mixedwood on thin peatland	P	0.02	0.01	0.01	0.00		0.01	0.01						
Black spruce mixture on mineral	P,C	60.72	49.42	55.50	6.08	0.48	1.51	1.03	3.42	3.71	0.29		0.00	0.00
		0.19					0.04	0.04		0.15	0.15			
Black spruce mixture on shallow peatland	P	2.30	1.37	2.27	0.90		0.03	0.03						
Black spruce mixture on thin peatland	P,C	11.00	7.80	10.33	2.53	0.09	0.57	0.48	0.09	0.09	0.00			
		0.05								0.05	0.05			
Black spruce mixture on wet peatland	P	0.05	0.04	0.04	0.00	0.01	0.01	0.00						
Jack pine dominant on mineral	P	30.53	23.34	25.77	2.43	0.05	0.08	0.03	3.73	3.94	0.21	0.33	0.75	0.41

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/ Priority Habitat Type	Sensiti- vity ¹	Total Area Impacted by the Project (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zone (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
			2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Jack pine dominant on thin peatland	P	0.61	0.61	0.61	0.00									
Jack pine mixedwood on mineral	P	0.62	0.62	0.62	0.00									
Jack pine mixedwood on thin peatland	P	1.94	1.89	1.89	0.00				0.05	0.05	0.00			
Jack pine mixture on shallow peatland	P	0.26	0.04	0.04	0.00								0.22	0.22
Jack pine mixture on thin peatland	P	12.95	7.06	8.33	1.27	0.02	0.02	0.00	3.31	3.48	0.18	0.32	1.12	0.80
Low vegetation on mineral	P	0.00							0.00	0.00	0.00			
Tall shrub on mineral	P	0.55	0.11	0.19	0.08	0.00	0.36	0.36						
Tall shrub on shallow peatland	P	0.12		0.02	0.02		0.03	0.03		0.07	0.07			

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/ Priority Habitat Type	Sensiti- vity ¹	Total Area Impacted by the Project (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zone (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
			2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Tall shrub on thin peatland	P	9.91	7.30	7.50	0.20	0.92	2.18	1.26		0.22	0.22		0.00	0.00
	P,M	0.01					0.01	0.01					0.00	0.00
Tall shrub on wet peatland	P	0.05					0.04	0.04		0.01	0.01			
Tamarack dominant on mineral	P	0.41	0.41	0.41	0.00									
Tamarack dominant on thin peatland	P	0.38	0.37	0.38	0.01		0.00	0.00						
Tamarack mixture on mineral	P	7.94	7.73	7.89	0.15		0.05	0.05						
Tamarack mixture on shallow peatland	P	0.07	0.06	0.06	0.00	0.01	0.01	0.00		0.00	0.00			
Tamarack mixture on thin peatland	P	1.23	1.00	1.16	0.15	0.07	0.07	0.00						
Tamarack mixture on wet peatland	P	0.76	0.63	0.63	0.00	0.06	0.14	0.07						

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat

Broad/ Priority Habitat Type	Sensiti- vity ¹	Total Area Impacte d by the Project (ha)	EnvPP Green Zone (ha)			EnvPP Yellow and Red Zone (ha)			Within Subsequently Approved Areas (ha)			Outside of Subsequently Approved Areas (ha)		
			2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Trembling aspen dominant on all ecosites	P	2.73	0.00	2.45	2.45	0.02	0.26	0.24		0.01	0.01			
	P,C	0.37		0.13	0.13		0.16	0.16		0.08	0.08			
Trembling aspen mixedwood on all ecosites	P	2.02		0.00	0.00		0.59	0.59	0.03	0.77	0.73	0.66	0.66	0.00
White birch dominant on all ecosites	P	0.10		0.00	0.00		0.10	0.10						
White birch mixedwood on all ecosites	P	0.01	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00			
Marsh	M	1.10	0.21	0.82	0.61		0.28	0.28					0.00	0.00
Caribou Calving and Rearing Habitat	C	10.57		0.23	0.23		9.53	9.53		0.33	0.33		0.47	0.47
		168.2	117.8											
Grand Total		1	4	135.15	17.31	1.84	16.66	14.82	10.64	13.16	2.52	1.31	3.24	1.92

1: P = Priority Habitat, M = Off-system Marsh Habitat, R = Mammal Riparian Habitat, C = Caribou Calving and Rearing Habitat