



# Keeyask Generation Project

## Socio-Economic Monitoring Plan

# Socio-Economic Monitoring Report

SEMP-2020-01



# **KEEYASK GENERATION PROJECT**

## **SOCIO-ECONOMIC MONITORING PLAN**

REPORT #SEMP-2020-01

## **SOCIO-ECONOMIC MONITORING REPORT**

**APRIL 2019 TO MARCH 2020:**

**YEAR SIX CONSTRUCTION**

Prepared by  
Manitoba Hydro

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# SUMMARY

The Keeyask Generation Project (“the Project” or “KGP” or “Keeyask”) Environmental Impact Statement (EIS), completed in June 2012, provides a description of the existing environment, summary of predicted effects and planned mitigation for the Project. Technical supporting information for the socio-economic environment, including a description of the existing environment, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the Socio-Economic Environment, Resource Use and Heritage Resources Supporting Volume (SE SV).

The environmental assessment for the KGP used both technical science and Aboriginal Traditional Knowledge (ATK). Mitigation measures were carefully planned and designed to prevent or reduce (to the extent practical), adverse effects from the Project. However, there were uncertainties associated with predicted effects and the effectiveness of planned mitigation measures. To address these uncertainties, many of the predictions and mitigation measures identified in the KGP EIS are supported by monitoring to enable testing of the predictions and timely response when actual results differ from the predictions.

The KGP Socio-economic Monitoring Plan (SEMP) is a commitment made by the Keeyask Hydropower Limited Partnership (KHLP) in Chapter 8 of the KGP EIS. The SEMP is intended to monitor changes over time for certain socio-economic Valued Environmental Components (VECs). The SEMP focuses on key pathways of effect to, and components of, the socio-economic environment, including:

- Economy,
- Population, Infrastructure and Services, and
- Personal, Family and Community Life

This report focuses on SEMP monitoring activities for the Project to March 31, 2020. Key learnings of the SEMP Program over the 2019/20 period and next steps are presented below by monitoring topic area. Efforts will continue in the next year and beyond to implement monitoring activities identified under the SEMP.

## EMPLOYMENT AND TRAINING:

- From the start of construction to the end of March 2020:
  - There were 23,345 hires and 14, 258 person years<sup>1</sup> of employment on the Project. Total Manitoba hires represented 15,259 hires. Of this, 6,367 (42%) hires represented northern Manitoba (Indigenous and non-Indigenous) hires.

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<sup>1</sup> A person year of employment is generated based on a 2000-hour person year.



- The cumulative turnover rate for the Project was 33% of total hires, 45% of Indigenous hires and 25% of non-Indigenous hires.
- As of March 31, 2020, 1,824 Indigenous employees had training opportunities on the Project: 596 (33%) of these were filled by partner First Nation members.
- The Keeyask Advisory Group on Employment (AGE) was created to act as a forum for addressing employment-related issues associated with construction of the KGP. Over the past year, efforts focused on community outreach, improving the pathways for skilled Northern Indigenous workers entering the workforce at Keeyask, filling open on-the-job training opportunities for designated and non-designated trades, and maintaining the partner First Nations' peak employment numbers achieved in 2018.

### **BUSINESS OPPORTUNITIES:**

- From the start of construction to the end of March 2020:
  - \$4,980.0 million has been spent on goods and services for the Project. Of this, \$1,207.5 million were Manitoba purchases. Total northern Manitoba (Indigenous and non-Indigenous) purchases represent \$772.3 million (64%) of total Manitoba purchases.
  - Direct Negotiated Contracts (DNCs), ranging from camp services to heavy construction, have been awarded to partner First Nations' businesses with a total value exceeding \$725 million. Partner First Nations' businesses have also received contract work on the Project through five subcontract agreements for a total value exceeding \$24.5 million.

### **INCOME:**

- Since the start of construction to the end of March 2020, total labour income earned as a result of the Project was approximately \$1,502.4 million. Of this, Manitoba labour income represented \$824.8 million.

### **KEEYASK WORKPLACE ENVIRONMENT**

- Efforts to foster a positive workplace environment at the Project site are continuous and ongoing. Manitoba Hydro and the partner First Nations are continuing to work together at many levels to develop strategies to drive a positive work environment at the Project site.

### **CULTURE AND SPIRITUALITY:**

- During this reporting period, there were nine ceremonies held. Ninety-seven Indigenous awareness training workshops were held over this same period. Counseling services were available to employees on site on a voluntary basis. These efforts will continue throughout construction.

**WORKER INTERACTION:**

- A Worker Interaction Subcommittee was established by Manitoba Hydro prior to the beginning of Keeyask construction as part of a corporate-wide initiative to address anticipated increases in the Gillam area workforce associated with a number of projects and activities.
- During this reporting period, the Worker Interaction Subcommittee met four times. Key topics of interest included proactively identifying ways to prepare Gillam and FLCN residents for transition out of the Keeyask construction phase.

**POPULATION:**

- The changes in total population observed in 2019 for the partner First Nations and 2018 for Gillam are consistent with trends observed over time in each of the communities. The slight increases and decreases in population across the communities do not suggest a significant pattern of construction related in- or out-migration.

**MERCURY AND HUMAN HEALTH:**

- The KHLP has prepared a Mercury and Human Health Risk Management Plan in consultation with provincial and federal regulators. This reporting period's key activities included: 'Mercury Community Coordinator' role fulfilled in each partner First Nation community; community events to promote the goals of the Risk Management Plan; communication materials and a "Know Your Number" campaign and information sessions; voluntary hair sampling events and food surveys in all four communities (to understand mercury levels in one's body); and monitoring for mercury of fish and plants in the Project area.

**TRANSPORTATION INFRASTRUCTURE:**

- Over the past year, traffic monitoring data indicate that Keeyask related construction traffic varied month to month accounting for between 37% to 69% of all traffic on PR 280 near the PR 280/Keeyask North Access Road intersection.
- A number of mitigation measures have been adopted to reduce the impact of Project traffic on PR 280 including road reconstruction and increased maintenance efforts, operation of the Provincial Trunk Highway (PTH) 6 weigh station near Thompson, the operation of a temporary weigh station located near the junction of PR 391 and PR 280, and communicating driver expectations to contractors in an effort to promote appropriate driving behavior on PR 280.
- Collision rates along PR 280 and PR 290 have remained below the industry standard threshold of 1.50 million vehicle-kilometres of travel (MVKT). Spot grade improvements, localized design considerations, and other road safety improvements are being implemented to address ongoing concerns and to improve the driving experience for all road users.
- The Keeyask North Access Road connects PR 280 to the construction site. On average, 90 vehicles per day used the road between April 2019 and March 2020.

- The Keeyask South Access Road connects Gillam to the Project site. On average, 39 vehicles per day used the road between April 2019 and March 2020. Data is reflective of all traffic types including daily construction activities such as hauling.



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# 1.0 INTRODUCTION

Manitoba Hydro, on behalf of the KHLP, received regulatory approval to commence construction of the KGP in July 2014.

The KGP follows the Keeyask Infrastructure Project (KIP), which included a start-up camp and associated infrastructure, a 25 km all weather North Access Road, and the first phase of the KGP main camp.

The KGP SEMP is intended to monitor changes over time for certain VECs. The SEMP focuses on key pathways of effect to, and components of, the socio-economic environment including:

- Economy,
- Population, Infrastructure and Services, and
- Personal, Family and Community Life

The SEMP is part of an integrated and coordinated Environmental Protection Program that has been developed to facilitate an effective transition from planning and assessment to construction and operation of the KGP.

This report focuses on monitoring for the Project from the start of construction to March 31, 2020.

## 2.0 OVERVIEW OF PROJECT

The Keeyask Generation Project is a 695 megawatt (MW) hydroelectric generating station located approximately 180 km northeast of Thompson and 40 km southwest of Gillam at Gull Rapids on the lower Nelson River. The Project consists of four principal structures: a powerhouse complex, a spillway, dams, and dykes. A reservoir will be created upstream of the principal structures. Supporting infrastructure consists of temporary facilities required to construct the principal structures and permanent facilities required to construct and operate the Project. Temporary infrastructure consists of work areas, cofferdams, rock groins, and an ice boom. Permanent supporting infrastructure consists of North and South Access Roads, a transmission tower spur, communications tower, some borrow areas, excavated-material placement areas, boat launches, and a portage to enable river traffic to bypass the dam.



## 3.0 OVERALL OBJECTIVES AND APPROACH

The KGP EIS identified primary effects to the socio-economic VECs and defined the process, scope, methods, documentation and application of the socio-economic monitoring for the Project. Overall, the intent of Manitoba Hydro and the partner First Nations has been to reduce adverse effects of the Project and to enhance project benefits to the extent feasible and practical. Monitoring information is intended to assist in this management task. The SEMP for the Project is intended to monitor changes over time for certain VECs in order to, where applicable:

- Test predicted effects in the EIS;
- Identify unanticipated effects related to the Project;
- Monitor the effectiveness of mitigation measures;
- Determine if adaptive management is required; and
- Confirm compliance with regulatory requirements, including terms and conditions in Project approvals.

The SEMP focuses on key pathways of effect to, and components of, the socio-economic environment. The SEMP builds on the assessment studies conducted for the EIS using established methods for data collection and analysis.

## 4.0 OVERALL SCHEDULE

Monitoring activities associated with the SEMP are more intensive during construction of the Project, but will also occur during the operation phase:

- **Construction Phase** – SEMP monitoring during construction is related to employment and training opportunities; business opportunities; income; population changes; housing; infrastructure and services; transportation infrastructure; public safety and worker interaction; travel, access and safety; and culture and spirituality.
- **Operation Phase** – SEMP monitoring during operation is more limited and related to population change in Gillam during the first five years of operation; transportation infrastructure/travel safety at Split Lake; and mercury and human health.

## 5.0 STUDY AREA

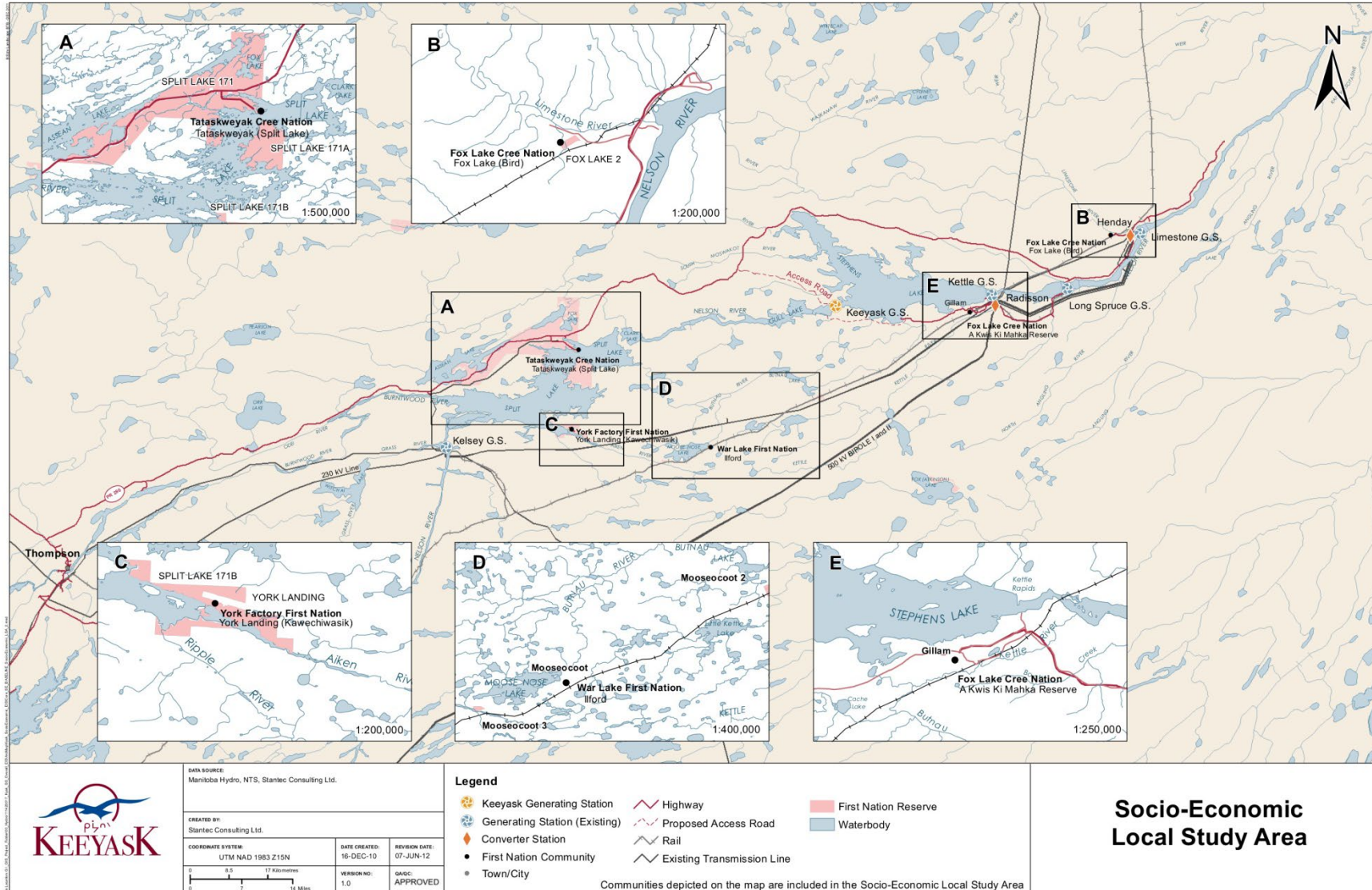
The Socio-Economic Local Study Area for the SEMP (see Map 1) incorporates the Project site and includes the partner First Nations' communities of Tataskweyak Cree Nation (TCN) at Split Lake, War Lake First Nation (WLFN) at Ilford, York Factory First Nation (YFFN) at York Landing and Fox Lake Cree Nation (FLCN) at Fox Lake/Gillam. The partner First Nations may be affected by the Project through the following pathways of effect:

- Physical/biophysical changes to the way the landscape looks;
- Physical/biophysical effects on resource use/traditional use areas and heritage resources;
- Employment and business opportunities;
- Construction traffic;
- Interaction with non-local construction workers within the partner First Nations' home communities; and
- Investment income.

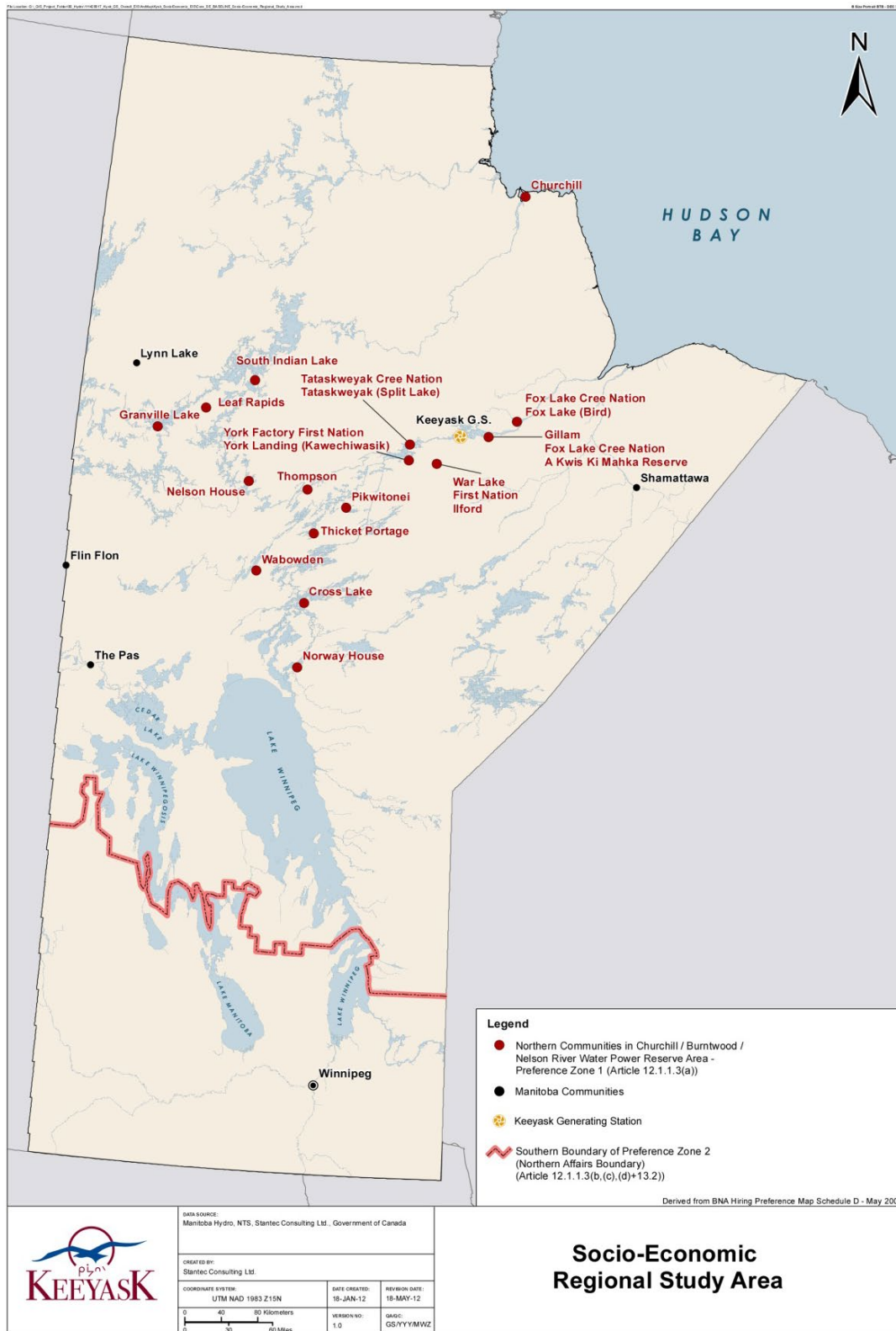
In addition to the partner First Nations' communities, the Town of Gillam and the City of Thompson are included in the Socio-Economic Local Study Area because of their proximity to the Project.

Certain project effects, in particular preferential hiring of northern Indigenous and other northern workers for construction employment, will extend beyond the Socio-Economic Local Study Area to all of northern Manitoba. For this reason, the Socio-Economic Regional Study Area has been defined as the area pertaining to northern hiring preference and using the boundary identified under Schedule D of the Burntwood Nelson Agreement (BNA) (see Map 2). This includes the Churchill-Burntwood-Nelson (CBN) communities identified in the BNA as part of hiring preference Zone 1.





**Map 1: Socio-Economic Local Study Area**



**Map 2: Socio-Economic Regional Study Area**

## 6.0 ECONOMIC MONITORING

Economic monitoring includes monitoring of all employment, training, business and income outcomes associated with the Project. Monitoring is conducted using a consistent methodology that Manitoba Hydro has used for other major capital projects.

All information regarding economic monitoring is provided from the start of generating station project activities (2014) to the end of March 2020.

Economic impacts can be direct, indirect or induced. Direct impacts result from project expenditures and include employment, purchases, and income generated by the Project. Indirect impacts refer to the employment, purchases and income created in other industries as the effects of project expenditures work their way through the economy. For example, there are indirect impacts on businesses supplying materials and equipment to companies in the direct impact segment. Induced impacts are created by the spending of additional income and profits earned by workers and company owners associated with the Project directly or indirectly. This includes additional spending on food, housing, entertainment, transportation, and all of the other expenses that make up a typical household budget. Adding up the direct, indirect and induced impacts, results in the total economic impact of the Project.

### 6.1 EMPLOYMENT AND TRAINING

The Project EIS analyzed and provided employment estimates for partner First Nations, the Indigenous workforce in the CBN area and the Indigenous workforce in the Socio-Economic Study Area as a whole (see SE SV Section 3.4.1) for the construction phase of the Project. The EIS also predicted that there would be northern participation in the operating jobs required to operate the facility.

Monitoring of employment and training is being undertaken, to determine the overall employment outcomes of the Project construction, with particular emphasis on Indigenous and northern resident participation. Monitoring is also intended to determine the extent to which recipients of Hydro Northern Training and Employment Initiative (HNTEI) pre-project training (PPT) participated in Keeyask construction jobs and received on-the-job training. It was estimated that the levels of participation would be influenced by several factors, including timing of the opportunities and the level of interest by potential workers in pursuing those opportunities.

Monitoring of employment outcomes provides data on overall success in attracting and retaining partner First Nations' members, Indigenous persons and Manitobans during Project construction.

As noted within the SEMP, the Project has an established AGE that is a forum to address employment-related issues related to the construction of the Project, and in particular Indigenous employment. The AGE is established to receive, review and find solutions to concerns and issues

and to monitor, report and make recommendations to the Project manager on employment-related matters, as required.

During construction, employment data is collected on site by contractors through an employee self-declaration form designed specifically for the Project. All completed forms are provided by on-site contractors to Manitoba Hydro and stored in a central database for the Project. Contractors also provide information to Manitoba Hydro on hours worked and labour income to enable calculations for person years and income during construction. Employment data is provided in the formats outlined below:

- Person years – When part-time and/or seasonal workers are used, it is useful to standardize the hires in terms of person years of employment. Person years of employment are defined as the amount of work that one worker could complete during twelve months of full-time employment. This usually means about 2,000 hours of work per year using a standard 40-hour work week in most industries; whereas for Keeyask construction work, a person year of employment represents 3,000 hours of work per year. The person years of employment presented below are shown both at 2,000 hours of work per year, for economic comparisons to other industries, as well as at 3,000 hours (identified in parentheses) of work per year.
- Hires – Refers to the number of times people were hired on the Project site for any duration.
- Employees – Refers to the number of individuals hired. The variance between Hires and Employees can be attributed to an individual being hired to the Project more than once.
- Type (job classifications) of work available.

Training data is collected by Manitoba Hydro through established methods utilizing contractor on-the-job reporting, and the completion of an employee self-declaration form. HNTEI PPTs are tracked by comparing self-declared Employee Report information to the Manitoba Hydro HNTEI database.

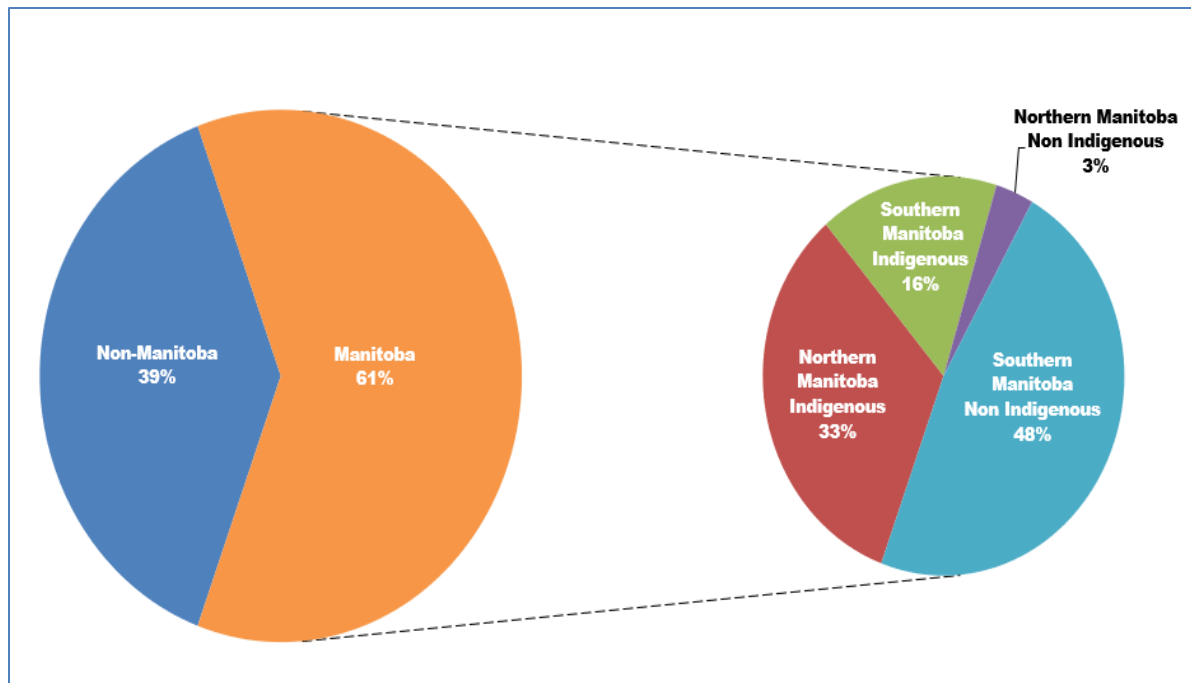
### **6.1.1 PERSON YEARS OF EMPLOYMENT**

From the start of construction to March 31, 2020, direct employment on the Project totaled 14,258 (9,505) person years. As shown below, 61%, or 8,727 (5,818) of these person years, represent Manitobans.

Of the 61% of employees who are Manitobans:

- Northern Manitobans represent 36%, or 3,188 (2,126) person years;
- Other Manitobans represent 64%, or 5,539 (3,692) person years;
- Indigenous employment represents 49%, or 4,287 (2,858) person years; and
- Non-Indigenous employment represents 51%, or 4,440 (2,960) person years.



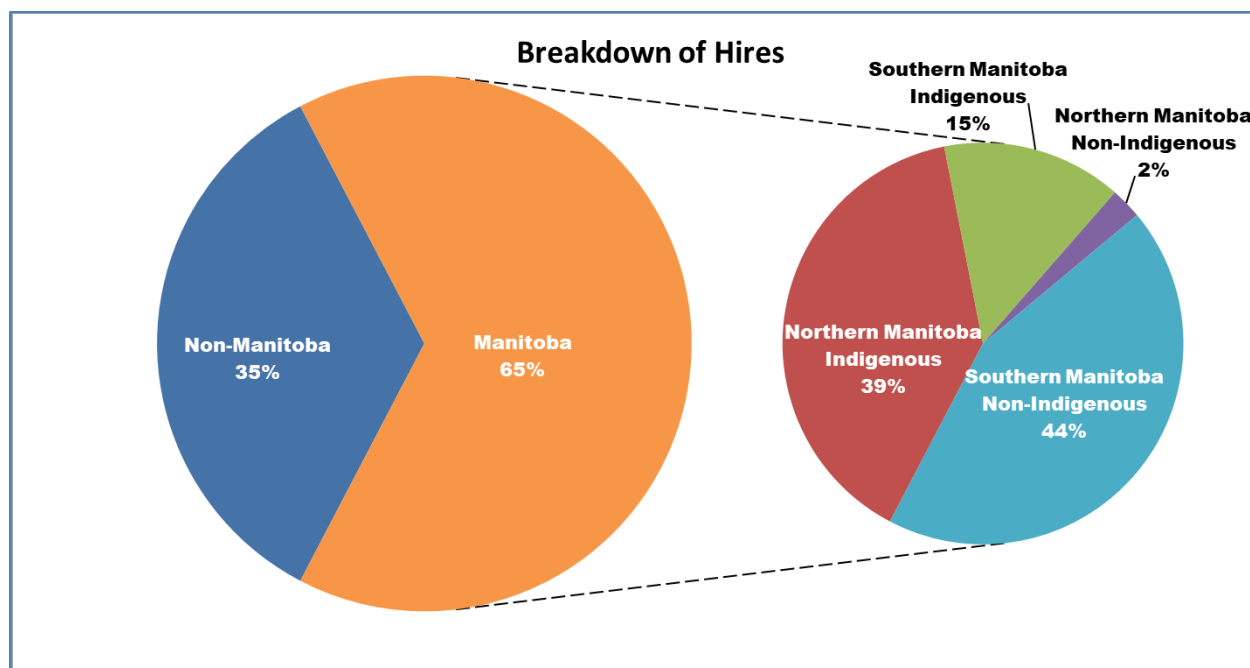


**Figure 1: Person Years of Employment (Start of Construction to end of March 2020)**

## 6.1.2 HIRES

From the start of construction to March 31, 2020, there were 23,345 hires on the work site. Of the total hires, 15,259 or approximately 65% were Manitobans:

- Total northern Manitoban hires represent 42% (6,367) of Manitoba hires;
- Indigenous hires represent 54% (8,204) of Manitoba hires; and
- Non-Indigenous hires represent approximately 46% (7,055) of Manitoba hires.



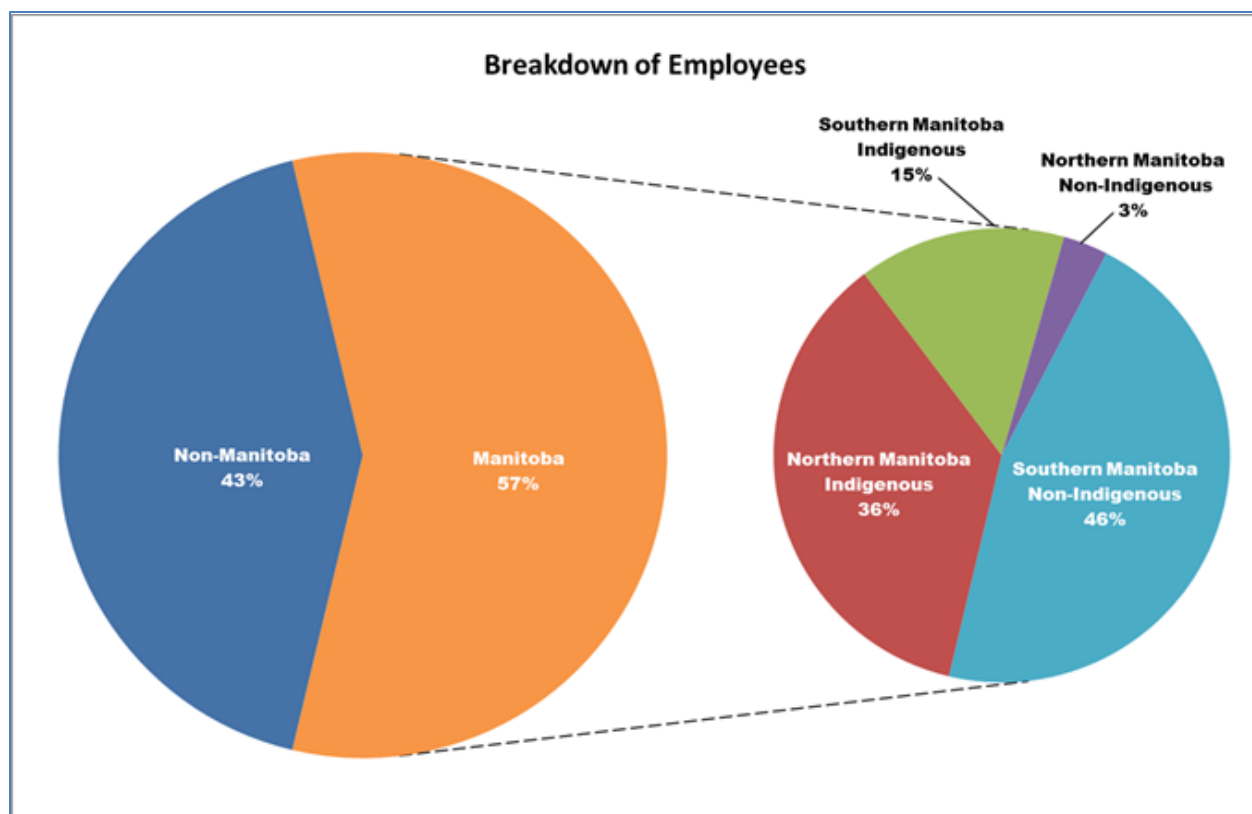
**Figure 2: Number of Hires (Start of Construction to end of March 2020)**

### 6.1.3 INDIVIDUAL EMPLOYEES

From the start of construction to March 31, 2020, a total of 10,645 individual employees were hired on the KGP. Of this, 57% (6,114 individual employee hires) were Manitobans:

- Total northern Manitoban employees represent 39% (2,394) of Manitoba hires;
- Indigenous employees represent 51% (3,099) of Manitoba employees; and
- Non-Indigenous employees represent approximately 49% (3,015) of Manitoba employees.

The total number of employees is less than the total number of hires (23,345) because the same individual may have been hired more than once. For example, an individual may have moved to work on a different contract or moved to a different job classification to improve their position. The difference of 12,700 identifies the number of re-hires at the Project site.



**Figure 3: Total Individual Employees (Start of Construction to end of March 2020)**

The number of individual employees to date does not reflect the number of employees on site at a given time. The number of employees on site at any given time varies depending on the work in progress and the time of year. The number of employees on site is usually highest during the period from late spring through early fall, which is typically the period with the highest level of construction activity and the largest workforce on site. The actual number of employees on site over the course of the year ultimately depends upon the work plans and schedules of the contractors for the various Project components, in conjunction with the provisions of the BNA, which is the collective bargaining agreement for the Project.

### 6.1.4 EMPLOYMENT IN THE PARTNER FIRST NATIONS

Construction of the KGP has resulted in the establishment of full and part time positions in each of the partner First Nations. While these positions have experienced vacancies, overall the number of positions filled over the last reporting period as a result of construction of the KGP has included:

- Thirteen positions at FLCN;
- Seventeen positions at TCN;
- Three positions at WLFN; and



- Eight positions at YFFN.

These positions have been created on the basis of community specific work plans for the implementation of governance and other commitments in the Joint Keeyask Development Agreement (JKDA).

The partner First Nations also have a total of five positions available for members associated with the Job Referral Service (i.e., Job Seeker Manager staff) who work within their respective communities to assist community members in accessing Keeyask employment opportunities. Additionally, each partner First Nation has one Keeyask Site Representative whose employment is reported within the construction employment statistics because they work a portion of their time in the community and at the Project site.

### **6.1.5 TYPE OF WORK (JOB CLASSIFICATION) AVAILABLE**

The total cumulative hires by job classification (to the end of March 2020) are provided in the table below. For employee privacy and confidentiality reasons, the numbers of hires by community cannot be disclosed, as the numbers are low for some of the classifications listed.

**Table 1: Total Hires by Job Classification (Start of Construction to end of March 2020)**

Job Classification	Total Hires	% of Total Hires	CBN	Indigenous	Non-Indigenous	Northern MB	Other MB	Non-MB
Labourers	3567	15%	978	1860	1707	1405	1441	721
Security Guards	225	<1%	19	82	143	53	172	<5
Crane Operators	412	2%	9	57	355	19	255	138
Equipment Operators	2048	9%	255	607	1441	413	751	884
Teamsters	1857	8%	395	854	1003	599	796	462
Carpenters	3800	16%	129	796	3004	335	831	2634
Millwrights	176	<1%	<5	25	151	12	124	40
Painters	58	<1%	<5	15	43	<5	34	23
Glass Workers	<5	<1%	<5	<5	<5	<5	<5	<5
Floor Covering Installers	9	<1%	<5	<5	9	<5	8	<5
Insulator Workers	108	<1%	<5	23	85	<5	94	12
Lathing and Drywall Workers	46	<1%	<5	8	38	<5	18	27
Plasterers	<5	<1%	<5	<5	<5	<5	<5	<5
Cement Masons	520	2%	<5	56	464	6	185	329
Bricklayers	27	<1%	<5	<5	25	<5	27	<5
Sheet Metal Workers	37	<1%	<5	7	30	<5	33	<5
Roofers	46	<1%	<5	6	40	<5	41	<5
Sheeters, Deckers and Cladders	100	<1%	<5	19	81	<5	64	34
Boilermakers	51	<1%	<5	5	46	<5	43	8
Iron Workers	1179	5%	20	309	870	61	515	603
Rodmen	314	1%	<5	51	263	<5	45	266
Electrical Workers	806	3%	57	163	643	115	652	39
Plumbers and Pipefitters	448	2%	23	97	351	42	333	73
Refrigeration Workers	37	<1%	<5	18	19	6	21	10
Sprinkler System Installers	10	<1%	<5	<5	7	<5	8	<5
Office and Professional Employees	1848	8%	226	647	1201	409	1043	396
Caterers	2637	11%	1736	2550	87	2470	113	54
Elevator Constructors	9	<1%	<5	<5	9	<5	9	<5
Other*	2967	13%	330	557	2410	409	1234	1324
<b>Total Hires</b>	<b>23345</b>	<b>100%</b>	<b>4190</b>	<b>8817</b>	<b>14528</b>	<b>6367</b>	<b>8892</b>	<b>8086</b>

\*The "Other" category refers to hires in job classifications not covered by the BNA, i.e. "out of scope" positions. This would include managerial and supervisory staff (both Contractor and Manitoba Hydro), other Manitoba Hydro on-site staff and certain technical staff (engineers and technicians).

## 6.1.6 RATES OF TURNOVER

The cumulative rate of turnover is calculated as total incidents of separation, for discharges and resignations, divided by hires<sup>2</sup> from the start of construction to a given point in time. The cumulative rate of turnover does not include layoffs or transfers to other positions or contracts.

From the start of construction to March 31, 2020, the cumulative turnover rate for the Project is 33% for total hires, 45% for Indigenous hires and 25% for non-Indigenous hires.

<sup>2</sup> Hires for calculating turnover has been modified to exclude Contract 016125 (Emergency Medical Services), Contract 16180 (Nurse Practitioners) and all environmental monitoring contracts as hiring and work scheduling practices for these contracts can misrepresent the true turnover rate.

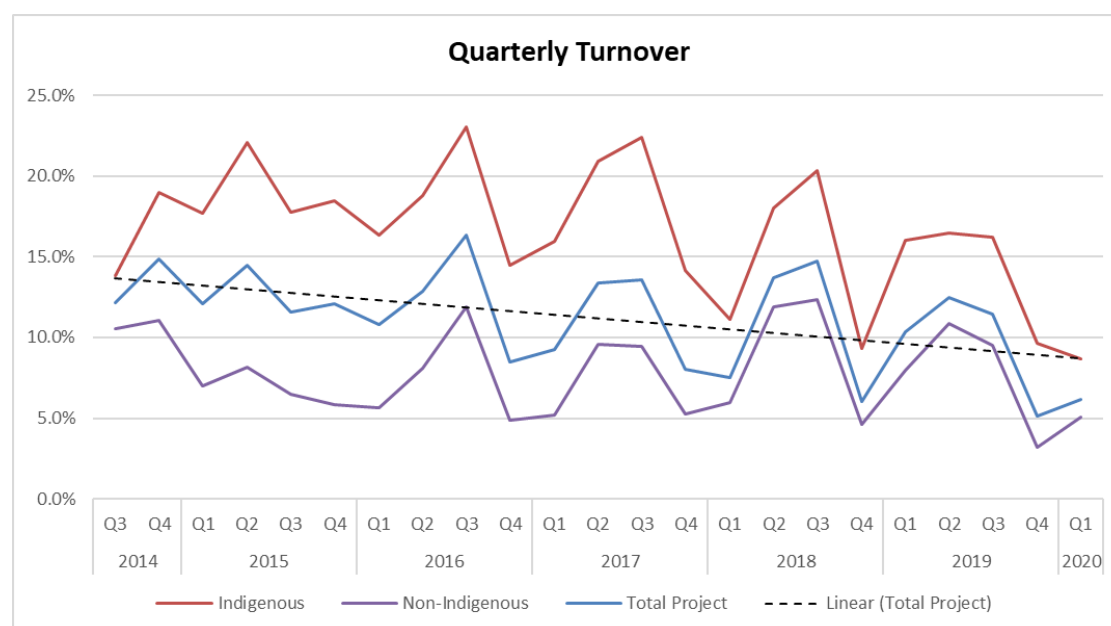
**Table 2: Turnover**

	<b>Total Discharges</b>	<b>Total Resignations</b>	<b>Total Separations</b>	<b>Rate of Turnover</b>
CBN	226	1823	2049	53%
Indigenous	412	3252	3664	45%
Non-Indigenous	384	2976	3360	25%
Northern Manitoba Indigenous	284	2522	2806	50%
Northern Manitoba Non-Indigenous	19	103	122	32%
Manitoba	603	4354	4957	37%
Non-Manitoba	193	1874	2067	26%

Note: Figures above are not additive

There have been instances where individuals have been discharged or resigned, but later returned to work on the Project. This occurred 2,864 times, approximately 41% of the total discharges and resignations.

It is also useful to look at the amount of turnover within certain time periods throughout the life of the Project. When looking at a specific period within the life of the Project, turnover is expressed as total incidents of separation (for discharges and resignations), divided by hires working on site within that specific time period. Since the start of construction, and as shown in Figure 4 below, the amount of turnover within a given quarter has ranged from 5.1% to 16.4%. Of this, turnover among Indigenous employees has ranged from 8.7% to 23.1% and among non-Indigenous employees from 3.2% to 12.4%. While there has been variation in the amount of turnover across each quarter, overall the amount of turnover for the workforce in Q1, 2020 is lower than in Q3, 2014. Among Indigenous workers the amount of turnover is lower than the Q1 turnover in previous years.

**Figure 4: Quarterly Turnover (Start of Construction to end of March 2020)**

## **6.1.7 EMPLOYMENT MITIGATION**

### **6.1.7.1 THE ADVISORY GROUP ON EMPLOYMENT**

The AGE is a forum for addressing employment-related issues, in particular Indigenous employment, related to the construction of the Project. The committee includes representatives from the Province of Manitoba, contractors, Manitoba Hydro, Hydro Projects Management Association, Allied Hydro Council and the partner First Nations.

Since the start of KGS construction, an emphasis has been placed on reaching skilled Indigenous workers in the partner First Nations, reducing the obstacles for northern Indigenous workers to enter apprenticeships and to fill open on-the-job training opportunities. The goal is to maintain the partner First Nations' peak employment numbers during the construction season and to have more Indigenous workers trained for future job opportunities beyond Keeyask. The AGE committee has created a collaborative environment for interaction, fact finding, and developing solutions to issues that are raised.

Job Seeker Managers (JSMs) are based in each of the four partner First Nations and are supported by the Province of Manitoba, Thompson Job Referral Service (JRS) team and Manitoba Hydro. Each JSM is responsible for developing an annual community employment plan. Each plan is unique to the community, but all plans have common goals including improving the ability for employers to make contact with members and ensuring that members' Job Seeker profiles are up to date. In addition, partner First Nations' Keeyask Site Representatives support the JSMs, and help contact community members referred for jobs or for an open training opportunity.

The JSM's and Province, with support from Manitoba Hydro, continue to work on what the AGE committee has identified as a key factor to increasing the partner First Nations' workforce on the Project: reducing the number of job seekers who cannot be contacted. Several strategies are being used to ensure registration contact information is up to date such as: career counseling, community-based employment sessions, and assistance with updating candidate profiles. Additional methods of contacting candidates have been used including: emails; phone calls during weekends, holidays and the time preferred by job seekers; Facebook postings; and cellular text messages.

The Province of Manitoba, with community JSMs, continue to deliver career counseling through the Keeyask Employment Project (KEP) Referral List. The KEP Referral List identifies an individual's current trade and level as well as preferred trade(s) or area of interest and is used by contractors following the direct hire provisions under LOA 44 for on-the-job training opportunities. The KEP Referral List is distributed regularly to contractors who direct hire individuals into training and apprenticeship opportunities prior to posting a job order through the JRS. Use of the KEP Referral List continues to receive positive reviews from both contractors and job seekers and has proven to be successful in identifying and filling training and apprenticeship positions in an expeditious manner.

The Keeyask Workplace Essential Skills Training (KWEST) Centre, continues to operate throughout the year and has been onsite since August 2016. The goal of KWEST is to provide new and existing workers access to skills development support, to enhance their capacity to participate in on-the-job training, to carry out workplace tasks effectively and efficiently, and to prepare for advanced training and employment opportunities. Essential skills assessment, administered by Workplace Education Manitoba, establishes the candidate's development plan for the trade they are in or are interested in pursuing. The tool allows the trainer and student to address skill gaps through tutorials and small group sessions which are provided at the KWEST Centre. Contactors are also using the service to deliver targeted training in support of skills development program for their workforce. Since its inception, the total support services provided has been 882 (client service count). These individuals have benefited from the support and ongoing instruction offered through the KWEST Centre.

KWEST also offered four Career Development Sessions in 2019: August 12-16, September 9-13, November 25-28, and December 9-12. Services were available to all Keeyask workers and delivered using a one-to-one coaching context in the areas of:

- Intake and Orientation
- Job Search Skills
- Resume Development
- Interviewing Skills
- Drop in Support

### **6.1.8 TRAINING**

On-the-job training programs were developed at site to hire individuals as trainees and apprentices and to enhance their qualifications for further career development. The programs offered during the last year were in the following areas:

- Catering, janitorial services and housekeeping
- Maintenance services
- General civil contract
- Intake Gates, Guides and Hoists
- Turbines, Generators and Governors

As of March 31, 2020, 1,824 Indigenous employees participated in training opportunities on the Project (322 in on-the-job programs): 596 of these employees were partner First Nations' members (178 in on-the-job programs). Apprenticeship opportunities were available in trade classifications such as Mobile Crane Operators, Mechanics, Carpenters, Millwrights, Iron Workers, Plumbers & Pipefitters, Cement Masons, Electricians, Refrigeration Workers, Dozer Operator, Loader and Rock Truck Drivers, Clerks, Fitness Leaders, Hospitality Management and Red Seal Cooks.

**Table 3: On-the-Job Training Programs**

Labour Type	Training Programs - by Labour Type								
	Indigenous Hires			KCN Hires			Indigenous & KCN GS Training Totals		
	Individuals Trained*	Training Hours	Average Training Duration (Hours)	Individuals Trained*	Training Hours	Average Training Duration (Hours)	Individuals Trained*	Training Hours	Average Training Duration (Hours)
Non-Designated Trades	932	19429	21	212	11603	55	1144	31031	27
Designated Trades	559	435514	779	106	171119	1614	665	606633	912
Support & Service Trades	411	83577	203	338	57959	171	749	141536	189
Staff & Supervisory	12	3527	294	<5	2662	666	16	6190	387
<b>Total GS Training</b>	<b>1824</b>	<b>542047</b>	<b>324</b>	<b>596</b>	<b>243342</b>	<b>627</b>	<b>2420</b>	<b>785389</b>	<b>379</b>

\*Total Individuals Trained is not additive; some individuals may have had training in multiple labour or contract types.

In addition to Keeyask's on-the-job programs, Manitoba Hydro also hosted partner First Nations' summer students at the Keeyask site in 2019/20. This has been done annually for the last three summer seasons. In the summer of 2019, Manitoba Hydro hosted eight summer students from the partner First Nations. The students were hosted in two groupings at site for two rotations of two weeks each. The students worked with the following Manitoba Hydro groups:

- Environment,
- Earthworks and Excavations,
- Mechanical/Electrical, and
- Surveys.

Three hundred and sixty-five (365) members of the partner First Nations employed on the Project site were participants of the past HNTEI PPT Program. HNTEI PPT Program trainees have gained employment in craft trade positions as labourers, security guards, crane and equipment operators, teamsters, carpenters, iron workers, rodmen, electrical workers, plumbers and pipefitters, office and professional employees, caterers, cement masons, millwrights and painters. They have also gained employment in out-of-scope positions such as safety and environmental staff, employee retention and support staff and as trade supervisors. Of the 365 past HNTEI trainees, 32 remain active on the Project as of March 31, 2020.

## 6.1.9 KEYYASK WORKERS' OPPORTUNITY FUND

Through the generosity of Keeyask Project employees, this fund was created to provide opportunities to support education, training, and employment for members of the four partner First Nations.

Within the first four years of Project construction, employees contributed approximately \$198,000 to this fund by purchasing clothing at the on-site commissary. It is anticipated that additional donations will be added to the fund by Keeyask employees and site guests over the final two

years of construction. The funds are maintained by Manitoba Hydro in an interest-bearing account, and are dispersed during Project construction, to a maximum of \$10,000 per year. Remaining funds will be transitioned into a legacy fund managed by the Fund Committee, once construction is complete.

The Committee awarded 9 bursaries to partner First Nations' members during the 2019/2020 fiscal year.

## **6.2 BUSINESS OPPORTUNITIES**

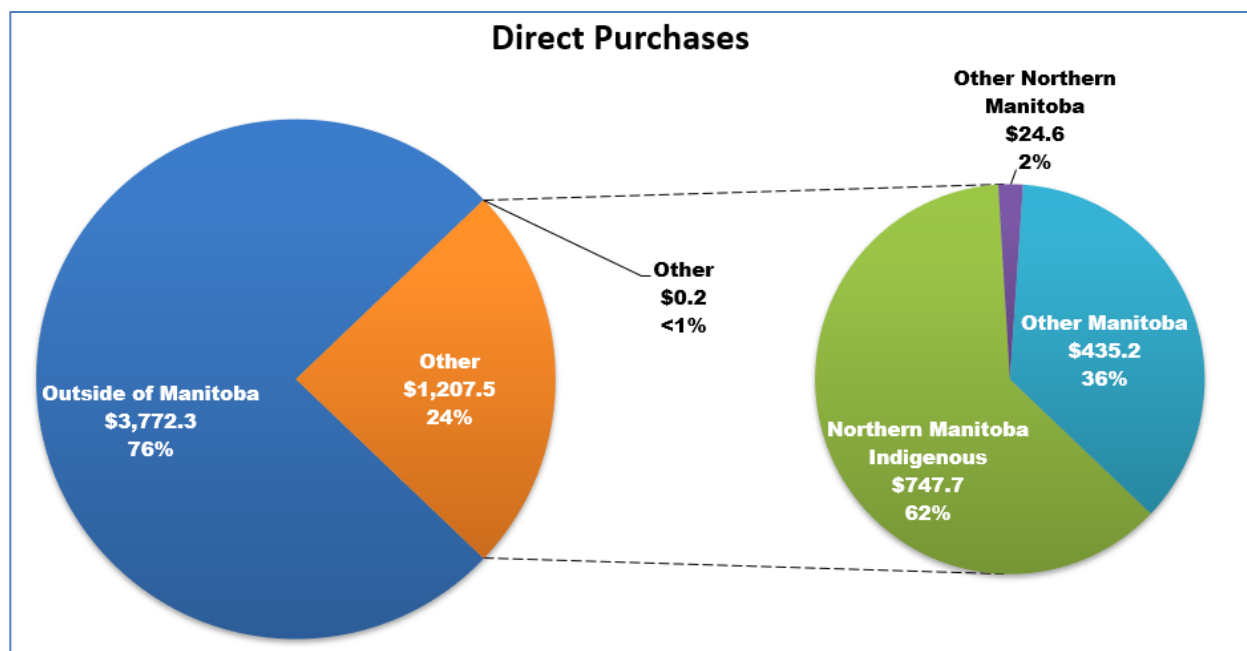
Project construction presents direct and indirect business opportunities locally, regionally and across the province as a whole. Business outcomes of Project construction are being tracked, with a particular focus on Indigenous and northern Manitoba business participation.

Direct impacts result from Project expenditures and include employment, purchases, and income generated by the Project. Indirect impacts refer to the employment, purchases and income created in other industries as the effects of Project expenditures work their way through the economy. For example, there are indirect impacts on businesses supplying materials and equipment to companies in the direct impact segment.

### **6.2.1 DIRECT PROJECT EXPENDITURES**

To date \$4,980.0 million has been spent on direct purchases of goods and services for the Project. Of this, \$1,207.5 (24%) million were Manitoba purchases. Total northern Manitoba (Indigenous and non-Indigenous) purchases represent \$772.3 million or 64% of the total Manitoba purchases. Figure 5 summarizes the breakdown of total direct purchases to date.





**Figure 5: Direct Purchases**

## 6.2.2 INDIRECT AND INDUCED BUSINESS SURVEY

One-time Key Person Interviews (KPIs) have been conducted to ascertain any indirect business opportunities that may have been generated because of Keeyask. The results of the Gillam and Thompson interviews were reported in the 2018-2019 Annual Report. Due to the small sample size, results from the partner First Nations' interviews have been combined.

Generally, partner First Nations' businesses reported that Keeyask was having a positive impact on their businesses. This was attributed to the increase in activity in the region and, more specifically, the availability of DNCs as a result of Keeyask. The majority of businesses reported an increase in employment levels as well as revenues since 2014. However, one business interviewed felt that there should have been more DNCs available and that the business opportunities experienced were short-term rather than long-term economic growth.

Filling open positions in the community and retaining skilled workers for community-based jobs was documented as a challenge due to the availability of higher wages elsewhere. However, it was also noted that Keeyask had provided partner First Nations' members with the opportunity to upgrade their skills and this resulted in a more experienced workforce at the community level.

## 6.2.3 DIRECT NEGOTIATED CONTRACTS

As part of the JKDA, Manitoba Hydro and the partner First Nations committed to negotiate a series of business opportunities for the Project as DNCs with partner First Nations' businesses.

As of the end of March 2020, 20 DNCs for the Project had been awarded to the partner First Nations, with a total value of exceeding \$725 million. DNCs awarded to partner First Nations included work undertaken on the following components of the Project:

**Services (throughout Infrastructure and Generation projects)**

- Catering & janitorial services
- Security services
- Camp maintenance services
- Employee retention & support services
- Emergency medical services

**Supporting Infrastructure**

- PR 280
- North Access Road (Part A & B)
- Start-up camp and work areas site preparation
- Looking Back Creek bridge
- Work areas site development

**Generation Station**

- Southside containment dykes
- South Access Road
- Reservoir clearing
- Upstream and downstream boat launches
- Reservoir spawning shoals
- Ellis Esker Winter Trail
- Placement of North Access Road organics

In addition, there have been four DNCs awarded to TCN for the Keeyask Transmission Project with a total value exceeding \$85 million. The DNCs have been highly successful in providing significant employment opportunities for members of the partner First Nations.

Partner First Nations' businesses have also received work on the Keeyask Project through subcontract agreements: a total of 5 subcontracts for a total value exceeding \$24.5M.

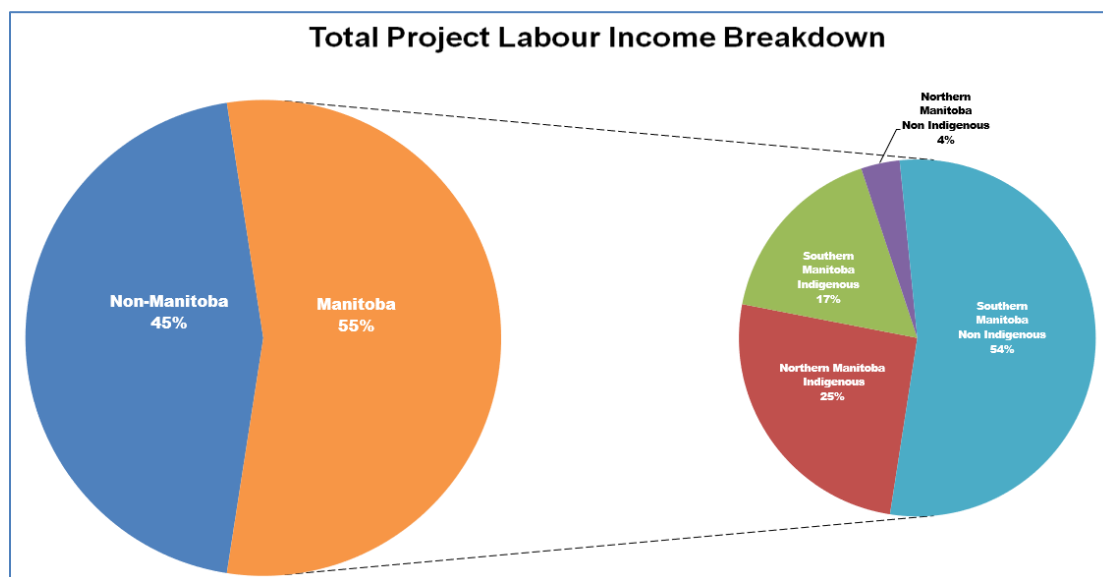
## 6.3 INCOME

Project construction has generated income from a number of sources including employment, business opportunities and payment of taxes. Partner First Nations' income has originated mainly from employment and to a lesser extent from business opportunities resulting from construction. During the operation phase, the partner First Nations will receive equity income as a result of being partners in the Project.

Labour income is an important indicator of the economic impact of a project. It is the sum of wages and salaries earned by workers.

### 6.3.1 LABOUR INCOME<sup>3</sup>

From July 2014 to March 2020, the KGP has generated \$1,502.4 million in total labour income. Of this, Manitoba labour income represented \$824.8 million or approximately 55% of total labour income. Of total Manitoba labour income, Indigenous labour income represented approximately \$350.1 million (42%), northern Manitoba Indigenous labour income represented approximately \$211.0 million (25%), northern Manitoba non-Indigenous labour income represented approximately \$29.0 million (4%), and Manitoba non-Indigenous labour income represented \$474.7 million (58%). Partner First Nations' labour income represented approximately \$119.9 million (15% of total Manitoba labour income).



**Figure 6: Labour Income**

<sup>3</sup> Labour income is calculated based on information provided by contractors and Manitoba Hydro.

## 7.0 SOCIAL MONITORING

### 7.1 KEYYASK WORKPLACE CULTURE

As predicted in the KGP EIS, construction of the Project has required a large temporary workforce comprised of both local and non-local workers. The Keeyask workforce includes individuals from other parts of Manitoba, Canada and other countries, with diverse cultures, perspectives and experiences. The KHLP is committed to creating a respectful workplace culture for all employees at the Project site. A Harassment and Discrimination Free Standard has been implemented at the Project site. The Standard describes a strong vision for a workplace free from discrimination and harassment and emphasizes the importance of being respectful of different cultures. Achieving this goal is the responsibility of everyone involved in the Project.

Efforts to foster a positive workplace environment at the Project site are continuous and ongoing. Manitoba Hydro and the partner First Nations are continuing to work together at many levels to develop strategies to drive a positive work environment at the Project site. Forums where this work is occurring include:

- The KHLP Board;
- An Issues Sub-Committee of the Board: a committee with representation from the partner First Nations and Manitoba Hydro. The mandate of this committee is to discuss and take action on concerns raised by the partner First Nations regarding drugs and alcohol and harassment and discrimination;
- The Keeyask Project Diversity and Inclusion Committee: a site-based committee with representation from the partner First Nations' Site Representatives, Project contractors, Employee Retention Services (ERS) and Manitoba Hydro labour relations. The mandate of this committee is to develop a Diversity and Inclusion Strategy for the Project. The committee also reviews past investigations involving complaints of harassment and discrimination, violence in the workplace, personal conduct cases, and any other significant events, to identify trends that could be addressed through diversity and inclusion initiatives and actions; and
- A Harassment and Discrimination Free Workplace Implementation Task Force (HDFWIT): an advisory group to the Site Support Manager with representation from the partner First Nations, Manitoba Hydro, the Allied Hydro Council and Employee Retention Services. The HDFWIT's mandate is to understand and make recommendations on the investigation process and course of action for workplace complaints under the Harassment and Discrimination Free Standard. This includes the process for receiving, investigating and taking action on workplace complaints under the Standard.

The HDFWIT successfully implemented 12 recommendations (11 implemented & closed one) and continue to monitor compliance and harassment and discrimination data. Review of 2019 harassment and discrimination data is showing less complaints being filed in comparison to 2018.

Work has begun to expand the harassment and discrimination process to include Restorative Practices (healing circles) as an option to addressing workplace conflict including non-compliance of the Harassment and Discrimination and Violence in the Workplace Standards. The task force will continue to monitor compliance and look for other opportunities for enhancement of the process.

Going forward, the HDFWIT's work will primarily focus on expanding the recommendation of placing "More Focus on Restoring Relationships" by incorporating a restorative approach through healing circles into the informal harassment and discrimination process and for other workplace complaints. It's important to highlight that restorative approach will be offered as an option similar to informal harassment and discrimination resolution. Ultimately, it's up to the individuals involved to agree to any options presented to them.

On-site training for conflict resolution and workplace investigations being provided to front line supervisors and others was completed for front line supervisors and management. Going forward conflict resolution training workshops will be offered on a regular schedule and will serve as refreshers and capture any new supervisors. A Respect Campaign is ongoing at site. The Diversity and Inclusion Committee developed monthly initiatives on site to honour and promote an inclusive workplace, including activities around Orange Shirt (residential schools) Day, Stop Hunger Day, cultural diversity, and Pink Shirt (anti-bullying) Day. Efforts and initiatives that promote a respectful workplace culture at the Project site will continue throughout construction.



**Figure 7: Pink Shirt Day T-Shirt Available at Keeyask**



**Figure 8: Aboriginal Veterans Day Pin Available at Keeyask**

## **7.2 EMPLOYEE RETENTION AND SUPPORT PROGRAMS**

Since the start of construction, various measures were put in place to support the retention of northern and Indigenous employees at the job site, and to ensure that sensitivity and respect for local culture are demonstrated throughout construction of the Project. These measures include establishing the ERS Services contract where scope was developed jointly with the FLCN and YFFN Keeyask Joint Venture who endeavored to include all partner First Nations' interests. The ERS contractor began delivery of services during the KIP and continued into the KGP.

### **7.2.1 INDIGENOUS AWARENESS TRAINING**

On-site Indigenous awareness training workshops are provided for staff working at the Keeyask site. Because of the dedicated team effort between Site Liaisons, ERS & Project contractors, and with an active workforce of over 3,571 in the peak months, the overall site surpassed 96% compliance (target is 100%) between April 2019 and March 2020. During this period a total of 1,213 employees completed training, and 97 training workshops were held. The purposes of training workshops are to:

- Increase understanding and appreciation of the cultural differences, beliefs and values of individuals within the various parties/communities working at the site;
- Enhance comfort in living, working and/or doing business in a culturally diverse environment;
- Identify barriers and issues between the various parties working at the site;

- Identify common goals;
- Develop strategies and action plans for addressing issues/barriers, reaching common goals and developing and maintaining long-term harmonious relationships;
- Increase participants' understanding of contemporary issues facing Indigenous peoples;
- Challenge participants to re-think their assumptions and personal biases about Indigenous peoples;
- Provide participants with information that will promote understanding and respect of Indigenous cultures, enabling participants to work effectively with Indigenous peoples; and
- Increase participants understanding of what a harassment and discrimination free work environment means and what each individuals' responsibilities are to maintain a work environment that is safe for all.

## 7.2.2 ON-SITE COUNSELING

On-site counseling is available to help all employees, on a voluntary basis, deal with any issues experienced while working on the Project. This could include: work adjustment problems, vocational/career issues, cultural adjustments, family stresses, money management, and alcohol and narcotics anonymous. The intent is to reduce attrition for all workers by assisting them in dealing with challenges directly affecting their work performance.

## 7.2.3 SITE LIAISON

The Site Liaison Team's main focus has been engaging the partner First Nations on all KGP activities and functions. The team consists of the Site Liaison Lead, a Liaison Officer and a Site Representative from each of the partner First Nations. The Liaison Team continues to support local community stakeholder management including collaboration with the four partner First Nations and the site contractors with a high emphasis on employment and training opportunities, as well as cultural activities. The team works closely with the ERS team where the focus has been on providing support to all Keeyask workers.

The four partner First Nations' Keeyask Site Representatives were fully engaged throughout this past reporting period. Over the past year, Project liaison staff worked closely with the Site Representatives on the following activities:

- Engaging partner First Nations' members in employment and training opportunities;
- Assisting with communication between Project contractors and community JSMs; and
- Facilitating improved communication with partner First Nations' workers at site.



Project liaisons and partner First Nations' Keeyask Site Representatives are also members of the following committees and taskforces:

- Construction Advisory Committee,
- Advisory Group on Employment,
- Monitoring Advisory Committee,
- Diversity and Inclusion Committee, and
- Harassment and Discrimination Free Workplace Implementation Taskforce.

Engagement with these committees not only provides for direct input and feedback from the partner First Nations' communities but also allows the team to bridge networks and expand communications within the entire Project.

Keeyask site tours have been a consistent activity throughout the year. A variety of individuals and stakeholder groups have expressed interest in coming to site to learn about Keeyask and to gain more insight on employment and training opportunities. Requests for site tours came in a variety of forms: schools and training centres in northern Manitoba, members of the partner First Nations, off site Keeyask Committees, and various Manitoba Hydro departments. Over the past year, forty-nine tours were conducted with 426 visitors at site.

## **7.2.4 WORKER FAMILY SURVEY**

The KGP EIS noted some uncertainty about how the employment experience during Project construction would affect workers and their families. To address this uncertainty, a worker family survey was undertaken to assess the experiences of a sample of partner First Nations' members employed on the Project and their families. The worker family survey covered a wide range of socio-economic topics, including work and camp life, employee experience with measures taken to create a positive workplace culture at site, employee experience with unions, family experience, effects of employment on traditional activities, and community changes as a result of the Project.

The worker family survey began in the fall of 2017 and was undertaken as a collaborative process. The details of this process were reported on in the 2018-2019 Annual Report. The worker family survey was completed in the summer of 2019 with the finalization of the combined survey results for all four partner First Nations. These were shared amongst the partners and have been used to continue to improve the experiences of workers and their families.

## **7.2.5 EMPLOYEE SUCCESS GUIDE**

The KGP Employee Success Guide was developed in 2019 and continues to be utilized to help prospective and new employees as well as their families learn more about living and working at Keeyask prior to applying or starting employment. The Guide is an online tool, available at

Keeyask.com, and has been distributed in hard copy form at key locations including in the partner First Nations. The tool consists of the following seven modules:

- Is Keeyask right for you?;
- Preparing yourself and packing;
- Preparing with your family;
- Coming to Keeyask;
- Your room;
- Camp life; and
- Safety first.

## **7.3 CULTURE AND SPIRITUALITY**

Since the start of construction, various measures were put in place to ensure that sensitivity and respect for local culture is maintained throughout construction of the Project.

### **7.3.1 CULTURAL SITE CEREMONIES**

Site ceremonies have been held at key construction milestones to help mitigate the effect of the Project on partner First Nations' culture, and to demonstrate respect for the land and all that is supported by the land. Attendance at ceremonies is welcome and voluntary and consists of various partner First Nations' members, contractor staff and Manitoba Hydro staff. Between April 2019 and March 2020, there were nine ceremonies held including a spring ceremony, National Indigenous Peoples Day celebration, and fall pipe ceremony.

Several Grandmother Moon ceremonies were held for women at site. During the ceremony women can ask Grandmother Moon not only for new energy, guidance and direction in life, but also for wisdom to help her children and others.

This past year prayers and blessing were held before the lowering of the spillgate for the first time, as well as for watering up and impoundment. These prayers asked for forgiveness, for healing and acknowledging the changes to the land and water.



**Figure 9: Keeyask Water-up Prayer and Blessing (February 3, 2020)**

### 7.3.2 SWEAT LODGE

A sweat lodge and teepee area were set up at the Keeyask site in September 2017. Since that time numerous sweat lodge ceremonies have been held which accommodate both night and day shift workers. The sweat lodge is a circular, dome-shaped structure used for many purposes in Indigenous culture. Through ceremonies, it offers a way of clearing, cleaning and freeing obstacles, obstructions and blockages to healing and well-being. During a purification ceremony, participants talk with and listen to the Creator and Grandfathers and Grandmothers for guidance. There are similarities between the physical body and the sweat lodge. Your skin is like the sweat lodge cover; ribs are like the willows; heart beat is like the drumming; songs are your life lived. Between April 2019 and March 2020, thirteen sweat ceremonies were held.

## 7.4 RESPONDING TO COMMUNITY CONCERNS

An important component of socio-economic monitoring is ongoing discussions with communities to identify and address concerns or issues as they arise. Concerns have been raised by the partner First Nations that the Project has contributed to an increase in the presence and use of drugs and alcohol in the region (including at the Project site and in the communities), and regarding incidences of harassment, discrimination and gender-based violence at Keeyask.

The Drug and Alcohol Standard continues at the Project site. The standard applies to all Manitoba Hydro employees, contractors, workers, subcontractors, and their respective employees working, living or attending the Project site. The Drug and Alcohol Standard is a component of Manitoba

Hydro's commitment to providing a safe workplace for everyone on site. As part of the standard, drug and alcohol testing is conducted after:

- Safety incidents or high potential near miss;
- It is determined that there are reasonable grounds due to canine indication; or
- Information established by the direct observation of one's conduct.

Manitoba Hydro and each of the partner First Nations have had discussions on what supports can be provided at the community level to mitigate any potential increase of drugs and alcohol associated with the Project. Follow-up support by the substance abuse professional hired to support the Project site has occurred in all four partner First Nations. In 2019 the Keeyask substance abuse professional visited TCN to assist in undertaking an inventory of available local services and to assist in community planning. Similar visits were made to other partner First Nations in previous years.

The Project Drug and Alcohol Standard provides the opportunity for treatment where addiction is present. The treatment for addiction not only supports a safe working environment, but also improves the lives of individuals and their families.

The KHLP takes seriously any reports of discrimination, harassment or violence. Strong policies and processes are in place at the Project site aimed at preventing and addressing concerns of this nature. In planning for Keeyask, efforts occurred early on to reduce interactions between partner First Nations' members and the non-local Project workforce. In response to concerns during the Project, several committees have been established at the KHLP level and at site to continue efforts. Efforts will continue through the remainder of Project construction towards ensuring a safe and welcoming work environment for everyone at the Project site (see section 7.1 Keeyask Workplace Culture).

### **7.4.1 WORKER INTERACTION**

A Worker Interaction Subcommittee (WIS) was established prior to Keeyask construction to deal with anticipated increases in the Gillam area workforce resulting from Keeyask, other Manitoba Hydro projects or related work occurring concurrently in the area.

WIS is a forum for information sharing and communication, originally established to identify potential worker interaction concerns, prevent issues to the extent possible, and identify ways to work cooperatively to address issues as they arise. It is composed of members from Manitoba Hydro, FLCN, the Town of Gillam, the RCMP (Gillam Detachment), the Gillam Hospital and Northern Health Region, and the Gillam School. Other stakeholder representatives attend as needed.

During peak construction periods of the KGP and Keewatinohk Converter Station, WIS focused on addressing project effects as they related to public safety, community services and infrastructure. WIS established an 'incident tracker' to monitor and respond to specific community concerns and incidents during this time. Several mechanisms and adaptive measures were

established to respond in part, to issues raised at WIS such as a “PR 280/PR290 Taskforce”, provision of on-site health care services at Keeyask, including nurse practitioner and emergency medical services, and ongoing cultural awareness programming for contractors working in the Gillam area.

Over the past two years, WIS shifted its focus to proactively identify ways to prepare Gillam and FLCN residents for transition out of the Keeyask construction phase. Anticipated local socio-economic effects of this transition include reduced economic opportunities, income and services associated with the Project.

WIS met four times in 2019-20. The priority focus in these meetings was to build synergies between various community resources; specific efforts included supporting the effective coordination of resources and services relating to counseling supports, traditional healing opportunities, FLCN history and cultural awareness workshops and shared recreational space and cultural activities for both Gillam and FLCN community residents.

## **7.4.2 EMPLOYMENT TRANSITION TASK FORCE**

The Employment Transition Task Force (ETTF) was created this past year to explore potential opportunities related to employment of partner First Nations’ members following the completion of Keeyask construction-related employment. The committee includes individuals from each of the partner First Nations and Manitoba Hydro. The focus of the ETTF discussions include identifying existing resources, venues, and opportunities that the committee can access collectively. Over the past year, the ETTF continued to develop an inventory of available resources related to training and employment (provincial and federal government programs), engaged in a brainstorming workshop to identify opportunities to work together collectively (e.g. training especially apprenticeship levels) and considered of a coordinator for workforce transition services to support community-based services.

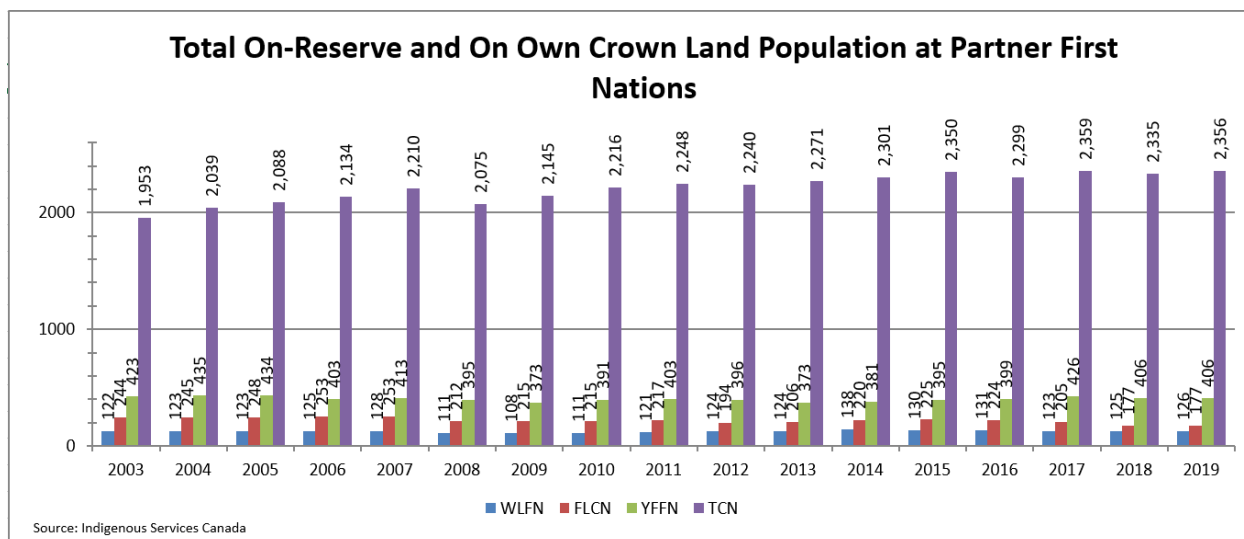
## **7.5 POPULATION**

The KGP EIS predicted the Project would not result in notable change in the number of people in the partner First Nations’ communities or in Gillam. However, measuring levels of in- and out-migration is difficult, with limitations existing for all related data sources, and the partner First Nations have noted that any in-migration to their communities could stress services that are already at capacity. Population is being monitored to confirm the extent of Project-induced migration in the partner First Nations’ communities and Gillam.

The changes in total population observed in 2019 for the partner First Nations and 2018 for Gillam are consistent with trends observed over time in each of the communities. The slight increases and decreases in population across the communities do not suggest a significant pattern of construction related in- or out-migration.

## 7.5.1 PARTNER FIRST NATIONS' COMMUNITIES

Population data for the partner First Nations is based on data from Indigenous Services Canada for on-reserve and on-own-Crown<sup>4</sup> land populations. As shown in the graph that follows, data for the partner First Nations from 2003 to 2019 shows periods of moderate population growth as well as moderate decline across years. In 2019, modest increases were observed in the TCN and WLFN populations while the FLCN and YFFN populations remained the same as those reported in 2018.

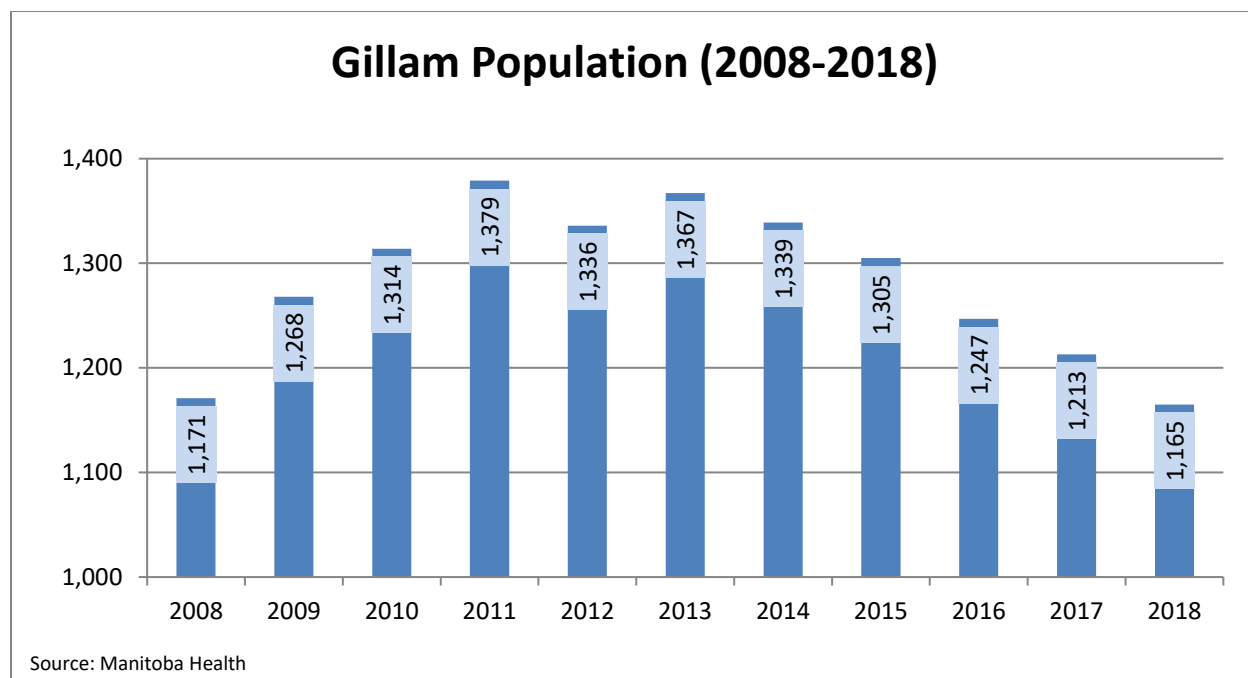


**Figure 10: Total On-Reserve and On-Own-Crown Land Population at Partner First Nations (2003-2019)**

## 7.5.2 TOWN OF GILLAM

Population data for the Town of Gillam is based on data from Manitoba Health's annual health statistics, which were available up to 2018. As shown in the graph below, the population of Gillam experienced slight annual increases between 2008 and 2011, and, with the exception of a slight increase between 2012 and 2013, slight annual decreases between 2012 and 2018.

<sup>4</sup> On-own-Crown lands are those lands not classified as reserve lands but Crown lands that have been assigned to a particular First Nation.



**Figure 11: Gillam Population (2008-2017)**

## 7.6 MERCURY AND HUMAN HEALTH

As a result of past experience with hydroelectric development, the partner First Nations raised the issue of mercury and human health as a primary concern in relation to the KGP. Manitoba Hydro and the partner First Nations have been working together since 2007 to study the issue and communicate information related to mercury and the Project. The KHLP, through the Mercury and Human Health Implementation Group (MHHIG), with advice from technical and health experts, developed a Mercury and Human Health Risk Management Plan. Key components include: a communication strategy about fish consumption for resource users in affected waterbodies; monitoring of mercury in fish, wildlife and plants; voluntary hair sampling; and periodic human health risk assessments.

Mercury is a metal found naturally in small amounts in rock, air, soil, water, and living organisms. It can be released into the environment through natural processes, but mainly as a result of human activity related to industrial development. When organic material such as peat is broken down by bacteria, mercury is converted to a more toxic form called methylmercury. Methylmercury becomes more concentrated as it moves up the food web from bugs to smaller fish to larger predatory fish. This process occurs in the natural environment and can be accelerated by processes such as flooding. It is most affected by unnatural causes, like the larger scale flooding caused by the creation of a hydroelectric reservoir.

The creation of the Keeyask reservoir is predicted to raise mercury (methylmercury) levels in fish in Gull Lake and to a lesser extent, Stephens Lake. Mercury levels will increase temporarily,



mostly due to the breakdown of peat in the reservoir. Fish mercury levels are estimated to peak 3-7 years after flooding and gradually decrease over the next 20-30 years to levels similar to non-impacted waterbodies in the region.

People can be exposed to mercury (methylmercury) through eating fish. Large, predatory fish, like pickerel and jackfish, generally have higher mercury levels than smaller fish. Too much mercury can cause human health problems, particularly for the developing brain (e.g., babies and children).

Soil and surface water are not affected by the same processes that result in fish having elevated mercury levels. Studies show that at current levels, recreational use of water and land is not a threat to human health as a result of mercury.

Because fish is an important part of a healthy traditional diet and offers many important health benefits, the MHHIG is working to build awareness and understanding in the partner First Nation communities about mercury and the risks and benefits of eating fish.

This section focuses on the key KHL P activities related to mercury and human health in 2019-2020.

### **7.6.1 MERCURY AND HUMAN HEALTH IMPLEMENTATION GROUP MEETINGS**

The MHHIG met twice over the course of the year to develop and plan for mercury and human health activities, with a focus on delivering in-community hair sampling and food survey events. Much of the planning was achieved through bilateral discussions with community representatives. Ongoing communication with provincial and federal health representatives assisted in the planning for these activities and development of materials.

### **7.6.2 COMMUNITY BASED ACTIVITIES**

Individuals fulfilling the role of Mercury Community Coordinators assisted in the implementation of mercury and human health related activities and organized mercury and human health events in each partner First Nation community including:

- Community events such as fishing derbies and education events for youth to generate interest and understanding about fish, mercury and human health.
- Communication materials (e.g., posters, fish tape, and a short introductory video) were available at events to provide information about mercury in fish and consumption advice for those consuming fish from the reservoir and downstream areas.
- Voluntary hair sampling events and food surveys (to understand mercury levels in one's body) were held in all four communities. A "Know Your Number" campaign, information sessions



about hair sampling, and a “mercury 101” session with YFFN health staff, were held prior to events.

### 7.6.3 HAIR SAMPLING AND FOOD SURVEYS

Between February 2019 and March 2020, Mercury Community Coordinators worked with the Project’s Hair Sampling Consultant to host at least one hair sampling and food survey event in each of the four partner First Nation communities (see Appendix 1 for more details on methodology and hair sampling materials):

- A combined total of 128 participants volunteered for the hair sampling and food surveys in the partner First Nations’ communities: 123 people provided hair samples, in which three people provided a second sample in a later event for a total of 126 hair samples; and 68 people participated in the food survey, five of whom did not provide hair samples due to insufficient hair length.
- Hair typically grows at a rate of approximately 1 cm per month. Hair samples are taken close to the scalp. For non or low fish consumers, 3 cm hair segments were collected to measure mercury exposure from the past three months. For moderate or high fish consumers, up to three 1 cm segments were analyzed to understand monthly exposures to mercury. For individuals with long hair, 1 cm hair segments representing the past 12 months were analyzed to understand seasonal variation of mercury exposure.
- The mercury hair results were compared to mercury levels that are considered acceptable by World Health Organization (WHO) and Health Canada in terms of risk to human health (“thresholds”):
  - 2 parts per million (ppm) for sensitive people (i.e., children aged 12 or under, women who may become pregnant)
  - 5 ppm for non-sensitive people (i.e., male teenagers over the age of 12, male adults, and female adults who may not become pregnant).
- Individual results were communicated to each participant in a personal letter, which compared their personal result with the mercury threshold that was applicable to them. The letter also included information about how to maintain a healthy fish diet and stay within an acceptable threshold as well as contact information should the participant have questions or wish to receive nutritional counselling.
- One hair sampling event and community feedback sessions on results were deferred as a result of the global pandemic situation. Because aggregate and community level hair sampling and food survey results have not been shared with partner First Nations’ communities, results from pre-impoundment events will be reported in the 2020-21 annual report.
- Additional hair sampling and food survey events are anticipated to occur in Fall 2020. Following impoundment, hair sampling and food surveys will continue to be offered in all

partner First Nations' communities, as will nutritional counselling. Hair sampling will continue to be available upon request via the participant's local Mercury Community Coordinator.

## **7.6.4 MONITORING FOR MERCURY IN FISH, WILDLIFE AND PLANTS**

Monitoring results for mercury in fish, wildlife and plants in the Project area (including a voluntary sampling component, where partner First Nations' members can submit plant, Lake Sturgeon, and wildlife samples for mercury analysis):

- Average length standardized whitefish mercury concentrations remain consistently low in Gull and Stephens lakes.
- Concentrations in the piscivorous species are more variable from year to year.
  - Mercury in jackfish measured in Stephens Lake in 2018 is similar to what was measured in previous years, both before and during construction. Measurements in pickerel in 2018 were lower than those measured in 2015.
  - In Gull Lake, mercury measured in jackfish and pickerel in 2019 was higher than in previous years, both before and during construction (see the Keeyask Aquatic Environment Monitoring Plan).
  - These fluctuations reflect the intermittent increases observed in Gull and Stephens lakes since the KGP EIS data were collected. Mercury in pickerel and jackfish has increased intermittently throughout northern Manitoba, in both on- and off-system lakes and rivers, since 2001. This shows that mercury concentrations in fish can change due to factors in the environment that are not necessarily related to hydroelectric development.
- The Project Toxicologist reviewed fish data (up to 2017) and developed lake-specific consumption recommendations for maximum safe monthly consumption rates for various fish species based on Health Canada and World Health Organization guidance. The results of final data before impoundment on mercury concentrations in fish from Stephens Lake (2018) and Gull Lake (2019) will be reviewed with the MHHIG to assess revisions to consumption guidance developed in 2017. New, updated products will be developed for the post-impoundment conditions.
- Mercury in fish will be monitored annually in Gull and Stephens lakes once the reservoir is impounded in order to determine the actual effect on fish mercury levels. It will also continue to be monitored throughout northern Manitoba as part of the Coordinated Aquatic Monitoring Program (CAMP) to continue to track broader area changes.
- The plant sampling program was designed to provide a representative sample of mercury concentration in plants in the Project area. Samples of blueberries and labrador tea collected between 2017-2019 (see the Keeyask Terrestrial Environment Monitoring Plan) showed that

levels of mercury are low and would be safe to consume based on relatively frequent consumption rates (see Appendix 2).

- No wildlife samples were collected or submitted for analysis through the voluntary sampling program in 2019. Beaver trapped in 2017 and 2018 (see the Keeyask Terrestrial Environment Monitoring Plan) indicate that levels of mercury are low and would be safe to consume based on previously reported consumption rates (see Appendix 2). The KGP EIS concluded that wild game and waterfowl (e.g., moose, snowshoe hare, muskrat, ducks) are safe to consume at reported consumption rates while no conclusion was provided for gull eggs (see Appendix 2). The wildlife discipline experts have confirmed that the baseline concentrations of mercury provided in the KGP EIS for wildlife remain current under present day conditions.
- Sampling for wildlife and plants will continue during the operation period. Data collected will be supplemented by any samples provided by partner First Nations through the voluntary sampling program.

## **7.7 TRANSPORTATION INFRASTRUCTURE, TRAVEL, ACCESS AND SAFETY**

While the KGP EIS predicted that existing transportation networks and plans for PR 280 upgrades would be able to accommodate the changes in road use associated with KGP construction, community concerns remain regarding traffic safety and road conditions.

In response to community concerns, the Province, which is responsible for maintenance and upgrades to PR 280, established the PR 280 Joint Advisory Committee in the fall of 2014. The committee is comprised of representatives from the Province of Manitoba, Manitoba Hydro, the Town of Gillam and the partner First Nations' communities to involve the latter directly in the planning of upgrades to PR 280. In the period between April 2019 and March 2020, the PR 280 Joint Advisory Committee met once, in June of 2019.

A number of mitigation measures have been adopted to reduce the impact of project traffic on PR 280 including road reconstruction and increased maintenance efforts, operation of the PTH 6 weigh station near Thompson, the operation of a temporary weigh station located near the junction of PR 391 and PR 280 and communicating driver expectations to Project contractors in an effort to promote appropriate driving behavior on PR 280.

In the fall of 2016, Manitoba Hydro developed a comprehensive transportation management plan to reduce the impacts of project traffic on PR 280. The plan includes pre-hauling construction materials to site during the winter months, night hauling, reductions in Manitoba Hydro truck traffic and reductions in truck weights during periods when the road has deteriorated substantially.

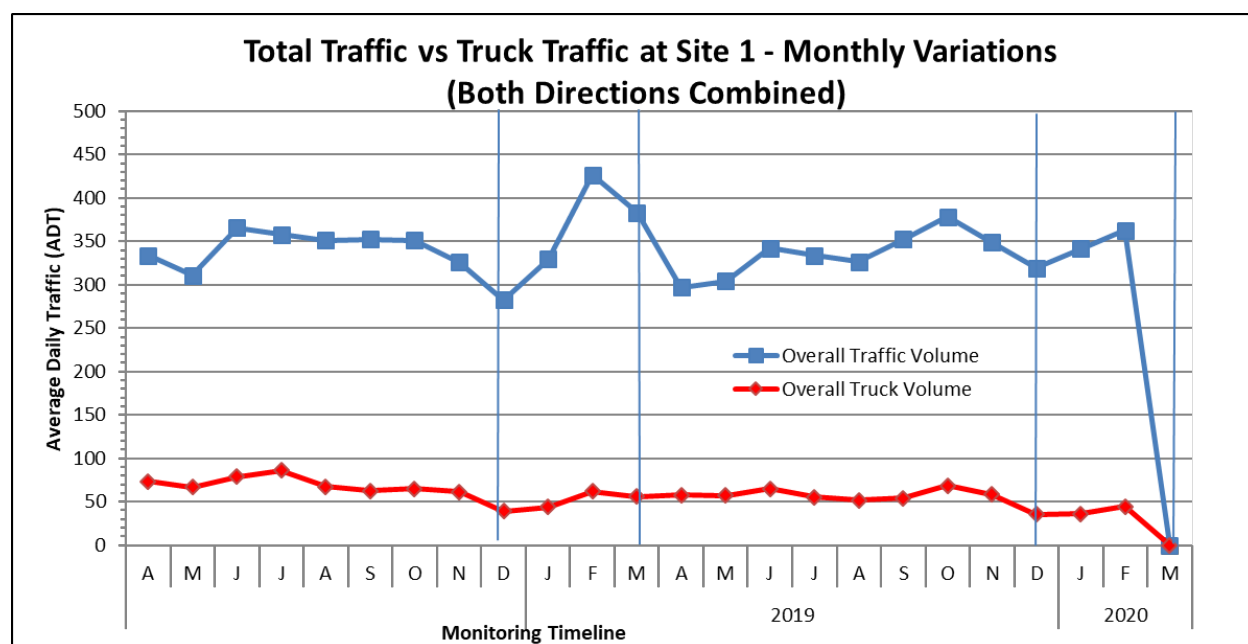
Manitoba Hydro, in collaboration with Manitoba Public Insurance (MPI) and the RCMP will continue to monitor traffic volumes, speeds, and vehicle types on PR 280 and PR 290 in 2019/20.

## 7.7.1 TRAFFIC VOLUMES

Traffic volume data is typically collected by Manitoba Infrastructure (MI) every two years. Traffic data for PR 280 is divided into three segments: PR 391 to Split Lake, Split Lake to the PR 280/PR 290 intersection, and PR 280/ PR 290 intersection to Gillam. Use of PR 280 and PR 290 steadily increased leading up to the completion of the Keewatinohk Converter Station, Bipole III Project and the peak construction years of Keeyask. Decreases in traffic volumes have been realized during the time period of April 2019 to March 2020 due to the completion of Keewatinohk Converter Station, Bipole III Project and Keeyask peak construction.

To better understand traffic patterns during construction, Manitoba Hydro worked with MI to have five, permanent traffic counters installed on PR 280 and PR 290. The segment of PR 280 with the highest traffic volumes is between PR 391 and Split Lake where from April 2019 to March 2020, the average traffic counts (northbound and southbound combined) were 309 vehicles per day. Of the 309 vehicles per day, 49 were large trucks.

Further details on traffic volumes are provided in Manitoba Hydro's Northern Road Traffic Monitoring Quarterly Data Collection Summary (see Appendix 3).



**Figure 12: Monthly Variations: Overall Traffic Versus Truck Traffic<sup>5</sup>**

<sup>5</sup> Monitoring station failure in March 2020.

## 7.7.2 COLLISION DATA

Collision rates along PR 280 and PR 290 have remained below the industry standard threshold of 1.50 million vehicle-kilometers of travel (MVKT). Collision rates are a factor of annual average daily traffic (AADT) volume, road length and reported collisions. Spot grade improvements, localized design considerations, and other road safety improvements are being implemented to address ongoing concerns and to improve the driving experience for all road users.

Further details on collisions are provided in Manitoba Hydro's Northern Road Traffic Monitoring Quarterly Data Collection Summary (see Appendix 3).

## 7.7.3 KEEYASK SITE ACCESS

The Keeyask North Access Road connects PR 280 to the Project site. It is a private road with restricted access, which is controlled by a security gate near the PR 280/North Access Road intersection. The gate office is staffed 24 hours per day, 7 days per week and security staff document all authorized vehicles entering and exiting the road. On average, 90 vehicles per day used the road between April 2019 and March 2020.

Traffic counts from the monitoring station located at PR 280 Site 2, which is the closest station to the Keeyask North Access Road, allows construction related traffic to be compared to the overall traffic on PR 280. Over the past year, these two sets of traffic counts indicate that the percentage of Keeyask related construction traffic varies monthly and accounts for 37% to 69% of all traffic on PR 280 near the PR 280/Keeyask North Access Road intersection.

The Keeyask South Access Road makes it possible to cross the Nelson River to access the south side construction area and Keeyask camp from Gillam resulting in a reduction of construction traffic on PR 280. Traffic is restricted to authorized construction and project vehicles only and all access is documented by gate security staff. On average, 39 vehicles per day used the road between April 2019 and March 2020. Data is reflective of all traffic types including daily construction activities such as hauling.

## **APPENDIX 1: HAIR SAMPLING MATERIALS**

## Consent to Take Part in Hair Sampling/Food Survey

### (General – Age 18 years and older)

**TITLE:** Keeyask Generation Project Hair Sampling and Food Survey

**PRINCIPAL RESEARCHER:** Andrea Amendola (Phone Number: (905) 567-4444)

**SPONSOR:** Keeyask Hydropower Limited Partnership (The Partnership)

You have been invited to participate in mercury hair sampling and a food survey being offered in your community. **Participation in this activity is voluntary. If you choose to participate in this activity you can withdraw from the activity at any time.** Before you decide, you need to understand what this activity is for, what risks you might take and what benefits you might receive. This consent form explains the activity being proposed.

**Please read this carefully.** Take as much time as you like. If you prefer, you may take this form home to think about for a while. Mark anything you do not understand, or want explained better. After you have read it, please ask questions about anything that is not clear.

The researchers will:

- Discuss the activity with you
- Answer your questions
- Keep confidential any information which could identify you personally
- Be available during the sampling and survey to deal with problems and answer questions

This consent form only applies to the current food survey and hair sampling program. If future sampling is undertaken, you will be asked again to provide your consent at that time.

### 1. Introduction/Background

Mercury is a metal that is “naturally” present in the environment and in fish. Since industrial times (1800s), mercury levels have risen in the environment due to industries like coal-fired power generation, incinerators, metal refining, and chemical manufacturing. All of these processes release mercury into the atmosphere from where it is deposited, onto land and water. Flooding of soil or wetlands commonly results in a temporary increase in mercury and its organic form, methylmercury. Methylmercury is taken up by the organisms that live in and use those environments. Bacteria living, for example, in soils and water change inorganic mercury to ‘methylmercury’. This type of mercury builds up and becomes more concentrated at higher levels in the food web, such as in predatory fish.

The Keeyask Project will flood some forest and wetland areas through the creation of a reservoir which will increase mercury levels in fish from Gull Lake, and to a lesser extent in Stephens Lake. Mercury concentrations in fish are expected to peak three to seven years after the creation of the Keeyask reservoir, and then slowly decline over time. We want to know whether eating fish from the reservoir will increase people’s exposure to mercury and if people’s health might be affected.

### 2. Purpose of this Activity

To collect information on baseline mercury levels from people who live or fish in the Keeyask Generation Project area.



### **3. Description of Activity Procedures**

The food survey will include questions about the number of people in your home and their ages, if anyone is pregnant or breastfeeding, the type of work and hobbies you have, and the food you and your family eat, with a focus on wild foods. After the survey, a small section of hair less than the width of a pencil eraser (about 0.75 cm) will be cut. The hair will be cut from near the base of your scalp. The hair samples will be collected by Mercury Community Coordinators and research assistants selected by your community who have been trained in this procedure. The hair samples will be tested for mercury only, at a certified laboratory, and any leftover hair will be returned to your community at a central location in case you would like it back.

### **4. Length of Time**

The hair sampling takes about 5 minutes, and the first part of the food survey focusing on fish will take about 10 minutes. There are some portions of the food survey that are not critical to understanding mercury exposure but would be of interest to the research team; if you decide to answer those additional questions the food survey will take between 30 and 40 minutes, depending on how much wild food is eaten.

### **5. Possible Risks and Discomforts**

There are no risks or discomforts to those individuals who take part in this activity. However, there is the possibility of finding out that your baseline mercury levels are above regulatory guidelines set by health agencies. Golder will directly contact any individual whose levels exceed the regulatory guidelines (note that all participants will receive a letter with their personal results a few weeks after the samples are collected).

### **6. Benefits**

Knowing your mercury levels lets you know whether the exposure you have today to mercury is safe, and whether you should continue to eat wild foods (including fish) the same way you are now. It will also let you know whether you should make any changes to the amount of fish or types of fish you are eating for optimal health.

Having data on mercury levels in people before reservoir flooding could also be used in future human health risk assessments that the Keeyask Partnership has committed to doing. The food and hair study, along with the future human health risk assessments, will provide valuable information on mercury exposure in the communities near the project, and provide a point of comparison should there be increases in mercury exposure after flooding and after the project has begun operating. All of this information will be essential for deciding, whether changes to fish consumption recommendations are needed to protect people's health in the future.

### **7. Liability Statement**

Signing this form gives us your consent to take part in this activity. It tells us that you understand the information about the activity and how the information will be used. When you sign this form, you do not give up your legal rights. Researchers or agencies involved in this activity still have their legal and professional responsibilities.

### **8. What about my privacy and confidentiality?**

Protecting your privacy is an important part of this activity. Every effort to protect your privacy will be made. However, it cannot be guaranteed. For example, we may be required by law to allow access to your records as part of this activity.

When you sign this consent form you give us permission to:

- Collect information from you
- Share information with the people conducting this activity
- Share information with the people responsible for protecting your safety

#### Access to your records

Some members of the research team will see records that identify you by name. Other people may need to look at the records that identify you by name. This might include the research ethics board. You may ask to see the list of these people. They can look at your records only when supervised by a member of the research team.

You may ask the researcher to see the information that has been collected about you at any time.

#### Use of your information

The research team will collect and use only the information they need for this activity and to support future human health risk assessments for the Keeyask Generation Project.

- This information will include your:
  - age
  - gender
  - the results of your mercury hair sampling
  - information from dietary survey questionnaires, including some personal information such as how many people live with you and whether you are pregnant
- Your name and contact information will be kept secure by the Golder research team. You will be assigned a unique participant ID number. The participant ID number will be used on the food survey and hair sample results, not your name or contact information. It will not be shared with others without your permission except as indicated above. Your name will not appear in any report or article published as a result of this activity.
- Information collected for this activity will be kept for an undetermined period because baseline data could be used for the future human health risk assessments, as well as in monitoring programs post-flooding and during operations.
- If you decide to withdraw from this activity, the information collected up to that time will continue to be used by the research team. It will not be removed. This information will only be used for the purposes of this activity.
- Information collected and used by the research team will be stored within the Golder team's secure and password-protected database. Andrea Amendola (Principal Researcher) is the person responsible for keeping it secure.

## **9. Questions or Problems**

If you have any questions about taking part in this activity, you can speak with the principal researcher who is in charge of this activity. That person is Andrea Amendola: 905-567-4444. Collect calls will be accepted.

Or, you can talk to someone who is not involved with this activity at all, but can advise you on your rights as a participant in this activity. You may contact:

Manager, Research Ethics Board Secretariat  
70 Colombine Driveway  
9th Floor, Room 941C  
Brooke Claxton Building, Postal Locator: 0909C  
Tunney's Pasture  
Ottawa, Ontario, K1A 0K9  
Phone number (613) 941-5199  
Fax (613) 941-9093  
Email: REB-CER@hc-sc.gc.ca

## Signature Page

### ***To be filled out and signed by the participant or an authorized third party:***

By signing this form, I agree that:

- |  |   |
|--|---|
| • The activity has been explained to me.   | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • All my questions were answered.  | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • The possible discomforts and the possible benefits (if any) of this activity have been explained to me.                      | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I understand that I have the right not to participate and the right to stop my participation at any time, for any reason.    | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I understand that I may refuse to participate without consequence.   | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I have a choice of not answering any specific questions.   | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I am free now, and in the future, to ask any questions about this activity.  | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I have been told that my personal records will be kept confidential.   | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I understand that should I choose to withdraw from this activity my data will remain part of the data used in this activity. | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I understand that no information that would identify me will be released or printed without asking me first.                 | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I understand that I will receive a signed copy of the consent form.  | Yes <input type="checkbox"/> No <input type="checkbox"/>                              |
| • I agree that my doctor/health care provider can receive the results of this activity.  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |

Would you like to be contacted to take part in future food surveys/hair sampling? Yes ☐ No ☐

I hereby consent to participate in this activity:

\_\_\_\_\_  
Signature of Participant or Authorized Third Party

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Participant (please print)

\_\_\_\_\_  
Name of Authorized Third Party, if applicable (please print)

### ***To be signed by the researcher or person obtaining consent:***

I have explained this activity to the best of my ability. I invited questions and gave answers. I believe that the participant/authorized third party fully understands what is involved in taking part in this activity, any potential risks associated with taking part in this activity and that he or she has freely chosen to take part in this activity.

Name of person who obtained consent: \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## Consent to Take Part in Hair Sampling/Food Survey (Minor – Under 18 years of age)

**TITLE:** Keeyask Generation Project Hair Sampling and Food Survey

**PRINCIPAL RESEARCHER:** Andrea Amendola (Phone Number: (905) 567-4444)

**SPONSOR:** Keeyask Hydropower Limited Partnership

Your child/ward has been invited to participate in mercury hair sampling and a food survey being offered in your community. **Participation in this activity is voluntary. If you choose on behalf of your child/ward to participate you can withdraw your child/ward from the activity at any time.** Before you decide, you need to understand what the activity is for, what risks your child/ward might take and what benefits your child/ward might receive. This consent form explains the activity being proposed.

**Please read this carefully.** Take as much time as you like. If you prefer, you may take this form home to think about for a while. Mark anything you do not understand, or want explained better. After you have read it, please ask questions about anything that is not clear.

The researchers will:

- Discuss the activity with you and your child/ward
- Answer questions from you and your child/ward
- Keep confidential any information which could identify your child/ward personally
- Be available during the hair sampling and food survey to deal with problems and answer questions

**If your child/ward is aged 7 to 13**, please let the Mercury Community Coordinator know whether you would like to explain the activity to your child/ward yourself or if you would like the Mercury Community Coordinator to explain instead. Once the activity is explained, please have the child read and sign the attached Assent Form.

### 1. Introduction/Background

Mercury is a metal that is “naturally” present in the environment and in fish. Since industrial times (1800s), mercury levels have risen in the environment due to industries like coal-fired power generation, incinerators, metal refining, and chemical manufacturing. All of these processes release mercury into the atmosphere from where it is deposited, onto land and water. Flooding of soil or wetlands commonly results in a temporary increase in mercury and its organic form, methylmercury. Methylmercury is taken up by the organisms that live in and use those environments. Bacteria living, for example, in soils and water change inorganic mercury to ‘methylmercury’. This type of mercury builds up and becomes more concentrated at higher levels in the food web, such as in predatory fish.

The Keeyask Project will flood some forest and wetland areas through the creation of a reservoir which will increase mercury levels in fish from Gull Lake, and to a lesser extent in Stephens Lake. Mercury concentrations in fish are expected to peak three to seven years after the creation of the Keeyask reservoir, and then slowly decline over time. We want to know whether eating fish from the reservoir will increase people’s exposure to mercury and if people’s health might be affected.

### 2. Purpose of this Activity

To collect information on baseline mercury levels from people who live or fish in the Keeyask Generation Project area.

### **3. Description of Activity Procedures**

The food survey will include questions about the number of people in your child/ward's home and their ages, if anyone is pregnant or breastfeeding, the type of hobbies your child/ward has, and the food your child/ward and your family eat, with a focus on wild foods. After the survey, a small section of hair less than the width of a pencil eraser (about 0.75 cm) will be cut. The hair will be cut from near the base of your child/ward's scalp. The hair samples will be collected from Mercury Community Coordinators and research assistants selected by your community who have been trained in this procedure. The hair samples will be tested for mercury only, at a certified laboratory, and any leftover hair will be returned to your community at a central location in case your child's/ward would like it back.

### **4. Length of Time**

The hair sampling takes about 5 minutes, and the first part of the food survey focusing on fish will take about 10 minutes. There are some portions of the food survey that are not critical to understanding mercury exposure but would be of interest to the research team; if your child/ward decides to answer those additional questions the food survey will take between 30 and 40 minutes, depending on how much wild food is eaten.

### **5. Possible Risks and Discomforts**

There are no risks or discomforts to those individuals who take part in this activity. However, there is the possibility of finding out that your child's/ward's baseline mercury levels are above regulatory guidelines set by health agencies. Golder will directly contact any individual whose levels exceed the regulatory guidelines (note that all participants will receive a letter with their personal results a few weeks after the samples are collected).

### **6. Benefits**

Knowing your mercury levels lets you know whether the exposure your child/ward has today to mercury is safe, and whether your child/ward should continue to eat wild foods (including fish) the same way they are now. It will also let you know whether your child/ward should make any changes to the amount of fish or types of fish they are eating for optimal health.

Having data on mercury levels in people before reservoir flooding could also be used in future human health risk assessments that the Keeyask Partnership has committed to doing. The food and hair activity, along with the future human health risk assessments, will provide valuable information on mercury exposure in the communities near the project, and provide a point of comparison should there be increases in mercury exposure after flooding and after the project has begun operating. All of this information will be essential for deciding whether changes to fish consumption guidelines or advisories are needed to protect people's health in the future.

### **7. Liability Statement**

Signing this form gives us your consent for your child/ward to take part in this activity. It tells us that you understand the information about the activity and how the information will be used. A separate assent form is available if your child/ward is able to understand the activity, which gives us their permission to participate in the activity. When you sign this form, you do not give up your legal rights or those of your child/ward. Researchers or agencies involved in this activity still have their legal and professional responsibilities.

### **8. What about my privacy and confidentiality?**

Protecting the privacy of your child/ward is an important part of this activity. Every effort to protect your child's/ward's privacy will be made. However, it cannot be guaranteed. For example we may be required by law to allow access to your records as part of this activity.

When you sign this consent form you give us permission to:

- Collect information from your child/ward
- Share information with the people conducting this activity
- Share information with the people responsible for protecting your safety

#### Use of your information

The research team will collect and use only the information they need for this activity and to support future human health risk assessments for the Keeyask Generation Project.

- This information will include your child's/ward's:
  - age
  - gender
  - the results of your child's/ward's mercury hair sampling
  - information from dietary survey questionnaires, including some personal information such as how many people live with your child/ward and whether your child/ward is pregnant
- Your child's/ward's name and contact information will be kept secure by the Golder research team. Your child/ward will be assigned a unique participant ID number. The participant ID number will be used on the food survey and hair sample results, not your child's/ward's name or contact information. It will not be shared with others without your permission except as indicated above. Your child's/ward's name will not appear in any report or article published as a result of this activity.
- Information collected for this activity will be kept for an undetermined period because baseline data will be used for the future human health risk assessments, as well as in monitoring programs post-flooding and during operations.
- If your child/ward decides to withdraw from this activity, the information collected up to that time will continue to be used by the research team. It will not be removed. This information will only be used for the purposes of this activity.
- Information collected and used by the research team will be stored within the Golder team's secure and password-protected database. Andrea Amendola (Principal Researcher) is the person responsible for keeping it secure.

#### Access to your child's/ward's records

Some members of the research team will see records that identify your child/ward by name. Other people may need to look at the records that identify your child/ward by name. This might include the research ethics board. You and your child/ward may ask to see the list of these people. They can look at your child's/ward's records only when supervised by a member of the research team.

You may ask the researcher to see the information that has been collected about your child/ward at any time.

### **9. Questions or Problems**

If you have any questions about taking part in this activity, you can speak with the principal researcher who is in charge of the activity. That person is Andrea Amendola: 905-567-4444. Collect calls will be accepted.

Or, you can talk to someone who is not involved with this activity at all, but can advise you on your rights and your child's/ward's rights as a participant in this activity. You may contact:

Manager, Research Ethics Board Secretariat  
70 Colombine Driveway  
9th Floor, Room 941C  
Brooke Claxton Building, Postal Locator: 0909C  
Tunney's Pasture  
Ottawa, Ontario, K1A 0K9  
Phone number (613) 941-5199  
Fax (613) 941-9093  
Email: REB-CER@hc-sc.gc.ca

## Signature Page

### ***To be filled out and signed by the parent/guardian:***

By signing this form, I agree that:

- The activity has been explained to me and my child/ward. Yes ☐ No ☐
- All our questions were answered. Yes ☐ No ☐
- The possible discomforts and the possible benefits (if any) of this activity have been explained to me and my child/ward. Yes ☐ No ☐
- I understand that I have the right not to have my child/ward participate and the right to stop his/her participation at any time, for any reason. Yes ☐ No ☐
- I understand that I may refuse to have my child/ward participate without consequence. Yes ☐ No ☐
- I have a choice of having my child/ward not answer any specific questions. Yes ☐ No ☐
- I and my child/ward are free now, and in the future, to ask any questions about the activity. Yes ☐ No ☐
- I have been told that my child's/ward's personal records will be kept confidential. Yes ☐ No ☐
- I understand that should I choose to withdraw my child/ward from this activity my child's/ward's data will remain part of the data used in this activity. Yes ☐ No ☐
- I understand that no information that would identify my child/ward will be released or printed without asking me first. Yes ☐ No ☐
- I understand that I and my child/ward will receive a signed copy of the consent form. Yes ☐ No ☐
- I agree that my child's/ward's doctor/health care provider can receive the results of this activity. Yes ☐ No ☐ N/A ☐

Would you like to be contacted for my child/ward to take part in future food surveys/hair sampling? Yes ☐ No ☐

I hereby consent to have my child/ward \_\_\_\_\_ participate in this activity:

\_\_\_\_\_  
Signature of Parent/Guardian

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Parent/Guardian (please print)

Assent Form is attached: Yes ☐ N/A ☐

### ***To be signed by the researcher or person obtaining consent:***

I have explained this activity to the best of my ability. I invited questions and gave answers. I believe that the parent/guardian fully understands what is involved in taking part in this activity, any potential risks associated with taking part in this activity and that he or she has freely chosen for the child/ward to take part in this activity.

Name of person who obtained consent: \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



**Consent to Take Part in the Hair Sampling/Food  
Survey Activity  
(Minor Assent Form – 7 to 13 years of age)**

---

**TITLE:** Keeyask Generation Project Hair Sampling and Food Survey

**PRINCIPAL RESEARCHER:** Andrea Amendola (Phone Number: (905) 567-4444)

**SPONSOR:** Keeyask Hydropower Limited Partnership

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**Why are you here?**

We want to tell you about some hair sampling that we're doing for children living in this area. We want to see if you would like to participate in this sampling. This form tells you about the sampling. If there is anything you do not understand, please ask your parent, your guardian or the staff.

**Why are they doing this sampling?**

Eating fish is very healthy, but you can overdo it. A scientist can measure how much mercury is in your hair. We are doing the mercury hair sampling to see how much fish you're eating.

**What will happen to you?**

If you want to participate in the sampling, these things will happen:

- You will be asked to have a little bit of your hair taken, and you will be asked some questions about the things that you eat.
- The hair sampling will take about 5 to 10 minutes to complete.
- The questions about the foods you eat will take about another 10 to 30 minutes.
- Your parent or guardian will be with you at all times.

**Will the sampling hurt?**

No, it will not hurt. It is like getting a haircut.

**What if you have any questions?**

You can ask questions any time, now or later. You can talk to the staff, your family or someone else.

**Who will know that I did the sampling?**

Anything that you tell or give to the staff will be kept private (or secret). Your name will not be on any reports and no one but the staff and your family doctor will know that it was you who was in the sampling.

**Do I have to have my hair sampled?**

No, you do not have to have your hair sampled if you don't want to.

If you don't want to have your hair sampled, just say so. We will also ask your parents if they would like you to have your hair sampled.

Even if you say yes now you can change your mind later. It's up to you.

**Do you have any questions? What questions do you have?**

You can also ask your questions to the sampling leader (Andrea Amendola) or to someone not involved with the sampling (Research Ethics Board). Their telephone numbers are shown on the main consent form.

When you have no more questions, please print your name and sign below.

**ASSENT**

I want to take part in the mercury hair sampling. I know I can change my mind at any time.

\_\_\_\_\_ Verbal assent given Yes ☐  
Print name of child

OR

Written assent if the child chooses to sign the assent.

\_\_\_\_\_  
Signature of Child                      Age                      Date

*This section must be completed:*

I confirm that I have explained the mercury hair sampling to the participant to the extent compatible with the participants understanding, and that the participant has agreed to be in the mercury hair sampling.

\_\_\_\_\_  
Printed name of                      Signature of                      Date  
Person obtaining assent                      Person obtaining assent

## Keeyask Generation Project Food Survey and Hair Sampling

### Participant Information

- 
1. **Date of Interview (D/M/Y):** \_\_\_\_\_
  2. **Community Name:** \_\_\_\_\_
  3. **Participant's Gender:** \_\_\_\_\_
  4. **Age Category:** 0-4 years \_\_\_\_\_ 5-11 years \_\_\_\_\_ 12-15 years \_\_\_\_\_ 16+ years \_\_\_\_\_
  5. **Female Aged 15-49:** Yes \_\_\_\_\_ No \_\_\_\_\_ Not applicable \_\_\_\_\_
    - a. **If yes, are you pregnant?** Yes \_\_\_\_\_ No \_\_\_\_\_
    - b. **Are you breastfeeding?** Yes \_\_\_\_\_ No \_\_\_\_\_
- 

6. **Do you live in the community full-time?** Yes \_\_\_\_\_ No \_\_\_\_\_
  - a. **If no, how many months in the year do you live in the community?** \_\_\_\_\_
7. **How long have you lived in this community?** \_\_\_\_\_
8. **What First Nation are you a part of?** \_\_\_\_\_
9. **How many people, including yourself, currently live in your household (include children and adults, but not visitors or guests)?** \_\_\_\_\_
  - a. **Of the above number, how many are female between 15 and 49 years?** \_\_\_\_\_
  - b. **How many people living in your household are:**  
0-4 years \_\_\_\_\_ 5-11 years \_\_\_\_\_  
12-15 years \_\_\_\_\_ 16+ years \_\_\_\_\_
10. **What type of work have you had in the past year (for example, commercial fishing, forestry, building construction, water treatment):**  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**11. Do you have any hobbies?**

Yes \_\_\_\_ No \_\_\_\_

**a. If yes, what are they?**

\_\_\_\_\_  
\_\_\_\_\_

**b. How long have you had these hobbies?** \_\_\_\_\_

**c. How often are they practiced?** Daily \_\_\_\_ Weekly \_\_\_\_ Monthly \_\_\_\_

**12. In your current job(s) or hobby(ies) are you exposed to any chemicals?** Yes \_\_\_\_ No \_\_\_\_ Don't Know \_\_\_\_

**a. If yes, which ones?**

- ☐ Metals (e.g. solders, welding, wires, greases, sheet metal, arts/crafts involving carving/grinding/etching of rocks)
- ☐ Pesticides, insecticides, herbicides, fungicides
- ☐ Dyes
- ☐ Paints, stains, caulks, sealants
- ☐ Glues or other adhesives
- ☐ Fuels, oils, greases
- ☐ Office products (e.g. inks, toners, etc.)
- ☐ Cleaning products
- ☐ Cements, landscaping materials
- ☐ Other \_\_\_\_\_

**13. Do you colour your hair?**

Yes \_\_\_\_ No \_\_\_\_

**a. If yes, how many times per year?**

\_\_\_\_\_

**14. What is your current weight?**

\_\_\_\_\_

**a. Or, please select range:**

50 lbs or less \_\_\_\_  
51 to 100 lbs \_\_\_\_  
101 to 150 lbs \_\_\_\_  
151 to 200 lbs \_\_\_\_  
200 lbs or more \_\_\_\_

**15. Do you have any silver dental fillings?**

Yes \_\_\_\_ No \_\_\_\_ Don't Know \_\_\_\_

**16. Do you wish to receive a copy of the full report?**

Yes \_\_\_\_ No \_\_\_\_

**17. Do you wish to have your personal results sent to your doctor?**

Yes \_\_\_\_ No \_\_\_\_

### For the Mercury Community Coordinator

*The Wild Foods Survey component of this service asks for information about the participant's consumption of wild foods, including the type of food, how much they are eating, and when.*

*You can tell the survey participant that answering the “core questions” (pages 4, 5, 6 and 7), which are the most important ones, will take about 10 minutes. These are questions about harvested fish and fish organs/seafood, and market fish and fish organs/seafood.*

*The rest of the questions are “optional” (pages 8 to the end) and will take about 30-40 minutes, depending on how many other wild foods the participant eats. You will see that those sections are marked with “optional” in the heading and are in italicized font.*

*If the participant is unable to remember whether they eat a certain type of food, you can use the following questions to help them remember:*

1. *If they are unsure about **where** their harvested food comes from, you can ask:*
  - a. *Do you collect the food yourself?*
  - b. *Does someone else collect the food for you?*
  - c. *If yes, do you know if they personally go somewhere close by to collect it or if they may get it from a community freezer?*
  - d. *Does someone else prepare the food you eat?*
  - e. *When you visit people in your community (e.g. visiting friends or at community events), do you think the food you eat could be locally harvested?*
2. *If they are unsure about **which types of food** they eat, you can ask:*
  - a. *Think about what you eat at each meal:*
    - i. *Breakfast: Locally harvested eggs? Local meats or fish?*
    - ii. *Lunch/Dinner: Local meats or fish? Local plants?*
    - iii. *Snacks: Local berries or other plants?*
    - iv. *Beverages: Local teas?*
  - b. *Think about the different ways you prepare your food before you eat it – do you trim away fat or skin?*
  - c. *Think about what different ways your food is cooked – frying, grilling, smoking, drying/curing, raw?*
  - d. *Do you eat the food on its own? Or as an ingredient in other dishes (e.g. soup, stew, sandwich, salad, etc.)?*
3. *When asking about berries and plants, you can ask:*
  - a. *Do you eat local berries/plants raw?*
  - b. *Do you cook local berries/plants? For example, into pies, cakes, cookies, treats?*
  - c. *Do you use local berries/plants as a side dish in your meals? E.g. in salads, with other vegetables, with grains like rice or noodles?*
  - d. *Do you make teas out of local berries or plants?*
  - e. *Do you make medicines that you swallow out of local berries or plants?*

## Core Questions: Wild Foods Survey

This questionnaire concerns wild (or harvested/traditional) food: wild food comes from the local land and environment (fish, birds, other animals and plants/berries).

For each season: **winter** (December, January, February), **spring** (March, April, May), **summer** (June, July, August), and **fall** (September, October, November), please recall as exactly as you can, how often **you personally** ate the following food **in the last year**:

### Fish

Have you eaten locally caught fish in the last year? Yes \_\_\_\_ No \_\_\_\_

If yes, from where (see map): \_\_\_\_\_ Off-system? Yes \_\_\_\_ No \_\_\_\_

#### Frequency:

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

#### Serving Size:

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Fish	Ate in the last year?	Frequency (# meals per month)				Size of Whole Fish (inch)	Serving Size (g)	Location
		Winter	Spring	Summer	Fall			
Brook Trout								
Brown Trout								
Burbot (Maria)								
Cisco								
Lake Trout								
Northern Pike (Jackfish)								
Walleye (Pickerel)								
Longnose Sucker								
White Sucker								
Sturgeon								
Tullabee								
Whitefish								
Other:								

## Core Questions: Fish Organs, Seafood or Shellfish

**Have you eaten locally caught seafood in the last year?** Yes \_\_\_\_ No \_\_\_\_

**Organs?** Yes \_\_\_\_ No \_\_\_\_  
**If yes, which organs?**  
 \_\_\_\_\_

**If yes, from where (see map):**  
**Off-system?**

Yes \_\_\_\_ No \_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Fish Organs, Seafood, Shellfish	Ate in the last year?	Frequency (# meals per month)				Size of Fish (inch)	Serving Size (g)	Location
		Winter	Spring	Summer	Fall			
Burbot (Maria) Organs								
Northern Pike Organs								
Pickarel Organs								
Whitefish Organs								
Clams								
Crayfish								
Other:								
Other:								
Other:								

You have completed the core portion of this survey.

Would you like to answer additional questions about other wild and market foods?

Yes \_\_\_\_ No \_\_\_\_



## Core Questions: Market Food Survey

This questionnaire concerns market food: market food comes from the supermarket or grocery store. For each season: **winter** (December, January, February), **spring** (March, April, May), **summer** (June, July, August), and **fall** (September, October, November), please recall as exactly as you can, how often **you personally** ate the following food **in the last year**:

## Market Fish and Seafood (Fresh or Frozen)

### Frequency:

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

### Serving Size:

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Fish	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Size of Whole Fish, if known (inch)
		Winter	Spring	Summer	Fall		
Arctic Char							
Cod							
Flounder/Turbot							
Halibut							
Rainbow Trout							
Salmon							
Swordfish							
Tilapia							
Fish sticks							
Canned tuna (light)							
Canned tuna (white)							
Canned salmon							
Canned sardines							
Crab							
Shrimp							
Other:							
Other:							

## Core Questions: Market Fish Organs (Fresh or Frozen)

**Have you eaten fish organs (e.g. liver, kidney, gonads, heart) in the last year?** Yes \_\_\_\_ No \_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Fish	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Size of Fish, if known (inch)
		Winter	Spring	Summer	Fall		
Arctic Char Organs							
Cod Organs							
Flounder/Turbot Organs							
Halibut Organs							
Rainbow Trout Organs							
Salmon Organs							
Swordfish Organs							
Tilapia Organs							
Other:							
Other:							

### Optional Wild Foods: Birds

**Have you eaten locally caught birds in the last year?**

Yes \_\_\_\_ No \_\_\_\_

**If yes, from where (see map):**

\_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month

(specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28

E – more than 800 g (28 oz)

If more than 800 g, please specify

Bird Organs	Ate in the last year?	Frequency (# meals per month)				Serving Size* (g)	Location
		Winter	Spring	Summer	Fall		
Black Duck							
Canada Goose							
Canvasback							
Eider Duck							
Greenwing Teal							
Spruce Grouse							
Sharp tailed Grouse							
Ruffed Grouse							
Mallard							
Partridge							
Pintail Duck							
Scoters							
Snow Goose							
Willow Ptarmigan							
Duck Eggs							
Gull Eggs							
Tern Eggs							
Other:							
Other:							
Other:							

\* If bird eggs are consumed, indicate the number of eggs per serving.

### Optional Wild Foods: Bird Organs

**Have you eaten locally caught bird organs in the last year (e.g. liver, kidney, gonads, heart)?** Yes \_\_\_\_ No \_\_\_\_

**If yes, from where (see map):** \_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Bird Organs	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Location
		Winter	Spring	Summer	Fall		
Black Duck							
Canada Goose							
Canvasback							
Eider Duck							
Greenwing Teal							
Spruce Grouse							
Sharp tailed Grouse							
Ruffed Grouse							
Mallard							
Partridge							
Pintail Duck							
Quail							
Scoters							
Snow Goose							
Willow Ptarmigan							
Other:							
Other:							
Other:							

### Optional Wild Foods: Mammals

**Have you eaten locally caught mammals in the last year?**

Yes \_\_\_\_ No \_\_\_\_

**If yes, from where (see map):** \_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Mammals	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Location
		Winter	Spring	Summer	Fall		
Beaver							
Black Bear							
Caribou							
Moose							
Muskrat							
Snowshoe Hare							
Other:							
Other:							
Other:							

### Optional Wild Foods: Mammal Organs

**Have you eaten locally caught mammal organs in the last year (e.g. liver, kidney, gonads, heart)?** Yes \_\_\_\_ No \_\_\_\_

**If yes, from where (see map):** \_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Mammal Organs	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Type of organ(s)	Location
		Winter	Spring	Summer	Fall			
Beaver								
Black Bear								
Caribou								
Moose								
Muskrat								
Snowshoe Hare								
Other:								
Other:								
Other:								

### Optional Wild Foods: Berries

Have you eaten locally harvested berries in the last year? Yes \_\_\_\_ No \_\_\_\_

If yes, from where (see map): \_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 75 g (1/2 cup)

B – 110 g (3/4 cup)

C – 150 g (1 cup)

D – 225 g (1-½ cups)

E – 300 g (2 cups)

F – More than 300 g (specify)

Berries	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Location
		Winter	Spring	Summer	Fall		
Bunchberry							
Crowberry							
Teaberry (wintergreen)							
Bearberry							
Wild strawberry							
Cloudberry							
Wild raspberry							
Blueberry							
Cranberry							
Gooseberry							
Rosehips berry							
Hawthorn berry							
Juniper berry							
Other:							
Other:							
Other:							



### Optional Wild Foods: Plants

**Have you eaten locally harvested plants (food or medicinal purposes e.g. tea) in the last year?** Yes \_\_\_\_ No \_\_\_\_

**If yes, from where (see map):** \_\_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 75 g (1/2 cup)

B – 110 g (3/4 cup)

C – 150 g (1 cup)

D – 225 g (1-½ cups)

E – 300 g (2 cups)

F – More than 300 g (specify)

Plants	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)	Location
		Winter	Spring	Summer	Fall		
Wihkes (sweet flag/muskrat root)							
Arrowhead							
Fiddleheads							
Cattail							
Bulrush							
Fireweed							
Dandelions							
Dock							
Raspberry leaves							
Labrador tea							
Norther Labrador tea							
Nettle leaves							
Jack pine needle tea							
Pine pitch							
Balsam poplar (bark, buds)							
Spruce (pitch, inner bark)							
Aspen (bark, twigs)							
Chanterelle							
Other:							
Other:							
Other:							

### Optional Market Foods: Livestock/Poultry

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Fish	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)
		Winter	Spring	Summer	Fall	
Beef/steak						
Chicken						
Chicken Eggs						
Ground Beef						
Lamb chops / roast						
Pork chops / roast						
Turkey						
Veal chops / roast						
Processed meat*:						
Other:						
Other:						

\* Processed meat can include cold cuts / sandwich meat, canned meat (e.g. corned beef, Spam), etc.

### Optional Market Foods: Livestock/Poultry Organs

**Have you eaten meat/bird organs**  
(e.g. liver, kidney, gonads, heart) in the last year? Yes \_\_\_\_ No \_\_\_\_

**Frequency:**

N/A – does not eat

0 – Less than once a month

X – X times per month (specify)

**Serving Size:**

A – up to 100 g (3.5 oz / ¼ lb.)

B – 100 to 400 g (3.5-14 oz)

C – 400 g (14 oz / 1 lb.)

D – 400 to 800 g (14 to 28 oz)

E – more than 800 g (28 oz)

If more than 800 g, please specify

Meat	Ate in the last year?	Frequency (# meals per month)				Serving Size (g)
		Winter	Spring	Summer	Fall	
Beef						
Chicken						
Lamb						
Pork						
Turkey						
Veal						
Turkey						
Other:						
Other:						

## TECHNICAL MEMORANDUM

**DATE** January 23, 2020

**Project No.** 1782422-004-L-Rev0

**TO** Monica Wiest  
Manitoba Hydro

**CC** Ruwan Jayasinghe

**FROM** Andrea Amendola, Cameron Ollson

**EMAIL** [Andrea\\_Amendola@golder.com](mailto:Andrea_Amendola@golder.com)

### KEYYASK GENERATION PROJECT – HAIR SAMPLING METHODOLOGY

#### Background

The Keeyask Generation Project (the project) is the development of a 695 MW hydroelectric power generating station and the associated infrastructure on the lower Nelson River. The Keeyask Generation Project is a collaborative undertaking between Manitoba Hydro and four Manitoba First Nations – Tataskweyak Cree Nation, War Lake First Nation, York Factory First Nation and Fox Lake Cree Nation – working together as the Keeyask Hydropower Limited Partnership.

As a consequence of impoundment, anticipated to begin in 2020, and the creation of the Keeyask reservoir, flooding of approximately 45 square kilometers is anticipated and will result in an increase in methylmercury levels in the environment. These increased methylmercury levels will primarily affect human health through the consumption of locally caught fish. The Mercury and Human Health Risk Management Plan developed as part of the project includes specific mitigation and monitoring commitments to address the effects of increasing mercury levels in the environment on human health, including the development and implementation of a hair sampling and a food survey study with an emphasis on wild foods.

Golder Associates Ltd. has been retained by Manitoba Hydro to undertake the hair sampling and food survey study. The purpose of this document is to provide the objectives and methodology for the hair sampling program, as well as provide justification for the methodology (via a brief literature review completed to November, 2019).

#### Objectives

The objectives of the hair sampling program are as follows:

- To offer hair mercury analysis to First Nation communities and Gilliam as part of the Mercury Human Health Risk Management Plan for the project. Three scheduled events (one pre-impoundment, two post-impoundment) are currently being proposed, although hair sampling will be offered in interim years, upon individual request.

- For individuals who wish to participate, to characterize, with reasonable certainty, maximum monthly exposures; and to understand and be able to confidently respond to mercury levels in their bodies, now and after impoundment, in conjunction with education and nutritional counselling.
- In conjunction with the food surveys, to understand the primary sources and types of fish harvested from the study area and how the hair mercury results may influence the fish consumption guidance and/or advisories.
- To use the hair sampling results and results of the food surveys as supplemental information in future human health risk assessments completed for the area.

As noted, a food survey will be conducted in tandem with the hair sampling program. Briefly the objectives for that program are:

- To understand the current consumption of wild foods (i.e. what types of foods, frequency of consumption and seasonal variability in diet).
- To contribute to the planning of communication that encourages harvesting and use of wild foods, which in turn strengthens health and culture (part of living *mino pimatisiwin* or “the good life”).
- To understand how consumption patterns may change post-impoundment.

It is noted that the intent of this program is not to sample a representative population for the purpose of conducting a detailed statistical analysis of trends or correlations, or to draw conclusions about specific age groups or sub-populations. The primary goal of the study is to offer hair sampling to community members who wish to take part on a completely voluntary basis in order to help them manage their fish consumption, with the additional goals of fulfilling the commitments made as part of the Mercury Human Health Risk Management Plan for the project and to help inform future human health risk assessments.

## Literature Review

### Hair Sampling as a Biomarker for Mercury Exposure in Fish-Eating Populations

In fish-eating human populations, fish consumption rates are well-correlated to the concentrations of mercury in hair (often measured as total mercury) and blood (as methylmercury) (e.g. Berglund et al. 2005; Björnberg et al. 2005).

Following consumption of fish containing methylmercury, absorption of methylmercury from the gastrointestinal tract is nearly complete (95%, as cited in Berglund et al. 2005; ATSDR 1999). Once in the blood, greater than 90% of methylmercury binds to hemoglobin in red blood cells, while inorganic mercury is equally distributed between red blood cells and plasma (as cited in Berglund et al. 2005). Absorption of inorganic mercury from the gastrointestinal tract is relatively poor (7% for divalent inorganic mercury and less than 1% for metallic mercury; as cited in Berglund et al. 2005).

From the blood, methylmercury is then distributed to the various target organs, particularly the brain (methylmercury has the ability to cross the blood-brain and placental barriers) (as cited in Berglund et al. 2005). It is also distributed and incorporated into the developing hair follicle, resulting in methylmercury accumulation in hair tissue. For people who eat fish, it is estimated that approximately 80% of total mercury in hair is present as methylmercury (Cernichiari et al. 1995). In populations or individuals with no or low fish consumption, mercury in

hair would then be present as inorganic mercury rather than methylmercury (Berglund et al. 2005). As a result, measuring total mercury in hair for fish-eaters will provide a good representation of methylmercury in those individuals. Additionally, total mercury measurement in hair is the typical approach used when assessing methylmercury exposure in fish-eating human populations (e.g. Berglund et al. 2005).

Accumulation of methylmercury in hair tissue is directly proportional to methylmercury content in blood and does not appear to require a threshold blood level for hair accumulation to occur (ATSDR 1999). The World Health Organization (WHO) has cited a concentration ratio of 250 (range of 250 to 300), which translates into a mercury concentration in a segment of hair of 250 times the concentration in blood over the course of that hair segment's growth period (WHO 2008; and as cited in Bartell et al. 2004). Additionally, once mercury has been incorporated into hair, its accumulation is irreversible: no metabolism or reduction in hair mercury content occurs over time (ATSDR 1999; WHO 2008). As a result, mercury exposure can be traced back as far as the length of hair allows. Although a typical hair growth rate is approximately 1 cm/month (WHO 2008), given that hair growth rates may vary somewhat not just between individuals, but within individuals, precision in associating a given hair length to a specific time period of exposure deteriorates when the segment of hair is further from the scalp (Bartell et al. 2004).

It is noted that neither the WHO (2008) nor First Nations Food, Nutrition and Environment Study (FNFNES; UNBC 2020) have indicated that a lag time should be considered when collecting hair samples; that is, these sources indicate that the 1 cm closest to the scalp represents the previous month's exposure. However, literature related to hair sampling indicates that it takes approximately 7-10 days for hair to emerge from the follicle and reach the scalp (Kintz et al. 2015). This lag time was accounted for when interpreting exposure periods corresponding to the volunteers' hair segment(s). The preferred biomarker for chronic mercury exposure is hair sampling, given that other biomarkers such as blood sampling are more appropriately used when assessing acute exposures. For example, a study by Tsuchiya et al. (2012) investigated whether instantaneous blood samples collected 3 times over the course of one year correlated with fish consumption. While the blood concentrations collected over the three events correlated well when averaged over the entire study population, the authors reported that the instantaneous blood samples did not adequately account for individual variability in exposure, given that fish consumption varied for each person over the course of the year of study and the blood mercury levels varied largely over the three sampling events. That is, blood sampling does not accurately represent chronic mercury exposure for individuals that do not have a consistent diet over the long-term.

These conclusions were also reached by Bartell et al. (2004) and Bartell and Johnson (2011) in their investigations into errors associated with steady-state exposure assumptions where consumption rates are variable. The authors found that using instantaneous blood levels to represent a 30-day steady-state blood concentration when examining total exposures of 500 days had relatively wide 95% confidence intervals for error. For example, for a mean daily intake of 2 µg/day, the 95% confidence intervals ranged from -1.06 to 1.08 µg/day, suggesting that using the instantaneous blood levels could result in an estimated daily average ranging from 50% to 200% of the actual daily average. However, for longer-term exposures (e.g. greater than 250 days), error is close to zero when using hair as a biomarker (Bartell et al. 2004).

Recent literature (Bartell et al. 2004; Bartell and Johnson 2011) has also examined the shortcomings in conducting risk assessments when non-steady-state exposure conditions are valid. Risk assessments typically assume a continuous daily consumption rate (e.g., grams per day) when exposure may in fact vary over time, from day-to-day, week-to-week, and over the longer-term. For example, if one fish meal per week is assumed,

this fish meal may occur on a different day each week, and may occur two days in a row on occasion, both of which affect the magnitude of exposure to methylmercury. The use of statistical models to better estimate variable exposure using biomarkers have been developed and this type of analysis can be included in the uncertainty assessment of the HHRA to better understand the uncertainties surrounding the exposure and risk estimates.

## Hair Sampling Methodology

The methodology used for collecting hair samples is based on that utilised by the First Nations Food, Nutrition and Environment Study (FNFNES). In brief, a 5 to 10 mm bundle of hair (approximately 100 strands) will be cut close to the scalp from the occipital region of the head. The hair bundle will then be placed into a zip closable bag (e.g. Ziploc®) and a few staples will be used to fasten the scalp end of the hair to the bag. The hair sample bag will be labelled with the date, community name, and unique participant ID number. The hair samples will then be analysed for total mercury. Any unused sample will be handled as per individual and community preferences.

Whilst the FNFNES serves as the basis for this sampling methodology, modifications have been made in order to tailor the program to be specific to the project. The key differences are as follows:

- Based upon the literature regarding a lag time of 7-10 days between the time a hair begins to grow (i.e., incorporates mercury into the growing hair at its root within the follicle) to the time the hair emerges from the scalp), it has been assumed that the hair at the scalp end represents hair that began to grow approximately 2 weeks prior. Although hair is clipped from the scalp as closely as possible, there is typically a small amount (1 mm or thereabouts) that remains. If hair samples are collected in the first week of December from the 0-1 cm closest to the scalp, this hair is considered to represent exposure that occurred from mid-October to mid-November.
- Following the completion of the food survey, participants will be assigned to one of the three groups outlined in Table 1 which are based upon Health Canada's fish consumption guidelines. The groups are based on the amount of fish that the participants consume per week.

**Table 1: Hair Sampling Methodology Participant Groupings**

Rate of Fish Consumption*	Length of Hair Analysed	Frequency of Hair Sample Collection
Low ( $\leq 1$ )	3 cm	Seasonal
Moderate (2-3)	1 cm (up to 3 segments)	Monthly / Seasonal**
High ( $> 3$ )	1 cm	Monthly

\* Rate of fish consumption during the peak season in terms of meals per *week* for the general population, and meals per *month* for sensitive subpopulations (i.e., children under 12 years of age and women of child-bearing age (15-49)).

\*\* While seasonal has been proposed at a minimum, if there are no logistical constraints, monthly sampling for the moderate group may be completed if possible.

For participants that generally indicate they do not consume a lot of fish (i.e., consume fish  $\leq 1$  time per week), a 3 cm length of hair will be sectioned and analysed for mercury. The sample collection period will correspond with the season when they are most likely to be exposed (e.g. summer). It is considered that a 3 cm length of hair is representative of this groups' exposure to mercury as the variability associated with their consumption is low and their exposure to mercury (via consumption of fish) is anticipated to be negligible.

For participants that consume a moderate amount of fish (i.e., consume fish 2-3 times a week), one or more 1 cm lengths of hair will be submitted corresponding to the month or month(s) when exposure is expected to be the highest. It is noted that the Toxicity Reference Value (TRV) for methylmercury is based on monthly exposure, and therefore submitting a 3 cm length of hair for a moderate consumer could potentially result in a false negative. In this case, the purpose of decreasing the length analyzed from 3 cm to 1 cm is to provide more certainty that maximum monthly levels are captured and to avoid potentially analysing a hair sample that is not representative of a period of moderate consumption..

For participants that consume a high amount of fish (i.e.,  $\geq 4$  times a week), multiple 1 cm lengths of hair would be submitted for analysis corresponding to the multiple months that they may be exposed and that is expected to represent a peak of exposure. The objective of multiple samples is to minimize the chance of missing the true peak of exposure.

Some individuals may have very long hair where one year or more of consumption can be determined. Although the accuracy of hair segments corresponding to months of exposure deteriorates the further the hair is from the scalp (Bartell et al. 2004), those individuals with long hair and who may also have some variability in fish consumption throughout the year could be candidates for having multiple seasons analyzed to gain an understanding of seasonal variability in hair mercury concentrations. For example, if an individual with long hair tends to eat the most fish during the spring and fall, but less during the winter and summer, 12 1-cm hair lengths corresponding to the previous year's exposure could be collected and analyzed to observe the corresponding changes in mercury levels over the course of that time. Decisions on which individuals may be candidates for this type of analysis will be discussed and determined in consideration of logistical constraints in combination with food survey results.

It is noted that it is possible that consumption practices may exist that are not accounted for in the groupings outlined above. Professional judgement will be used to assess the appropriate hair sampling methodology (specifically, peak season and 3-cm or 1-cm) for these extenuating circumstances. For example, the type of fish consumed may affect when the expected peak season would occur for that individual. It is understood that there are differences in mercury concentration between different fish species (e.g. the concentrations of mercury in pike tend to be approximately 4 times greater than the mercury concentrations in whitefish in some lakes<sup>1</sup>). Therefore, for the same consumption rate, a participant may be exposed to 4 times more mercury if the participant is consuming pickerel or northern pike rather than lake whitefish. For example, if a hypothetical individual is consuming approximately 1 fish meal of pike per week during the spring (i.e., 1 meal x 4 units of mercury exposure = 4 units of mercury exposure per week) and 3 fish meals of whitefish during the summer (i.e., 3 meals x 1 unit of mercury exposure = 3 units of mercury exposure per week), the

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<sup>1</sup> Fish ratios of mercury levels will be based on fish tissue mercury data from lakes in the Project area. The 4:1 ratio shown for pike and whitefish was assumed for demonstration purposes only.



exposure to mercury via pike would be greater than for whitefish. As a result, the spring season would be considered the peak exposure season even though the strict number of meals per week is lower in the spring than in the summer. Consideration of known variability in mercury concentrations in fish tissue will be taken into account when selecting the hair sample interval for analysis such that it correlates with the expected exposure peak. Additionally, for this same individual, the difference in mercury exposure between the spring and summer may not be very high, since they only differ slightly in terms of the estimated units of mercury exposure (i.e., 3 vs. 4). The number of fish meals per week would fall into the “high” category considering 4 fish meals per week of whitefish during the summer, which would correspond to several 1-cm hair lengths for submissions for the peak exposure season. However, since the peak exposure may occur over the spring and summer, hair lengths corresponding to both the spring and summer months from individuals with a sufficient length of hair available will be submitted for analysis to ensure that the true peak is not missed.

Consultation with community members indicated that peak fish consumption typically occurs during the late spring, summer and fall months (June – October). For this reason, hair sampling events are scheduled based on the most opportune times to collect data with a bias towards being most representative of peak fish consumption for most community members. It is acknowledged that the length of a participant’s hair varies throughout the year and does not always line up with the timing of these collection events. For scenarios where a participant’s hair is too short (i.e., < 3 cm) or the length of hair available for sampling does not align with their expected peak exposure, there is opportunity for that participant to provide hair samples during an off-cycle event. The logistics of these opportunities are explained to participants during the sampling events.

- The hair samples will be sent to Maxxam Analytics in Mississauga, ON rather than the FNIHB laboratory.
  - The analysis of hair samples will be carried out by Maxxam Analytics (Maxxam) which has been independently audited by the Standards Council of Canada (SCC) under ISO guide 17025. Details of Maxxam’s accreditation can be viewed through the following link: <http://maxxam.ca/about-maxxam/quality/accreditation-certification/>. Maxxam is accredited for mercury analysis via cold vapour atomic absorption spectroscopy (CVAAS) on a tissue matrix by SCC.
- The hair samples will not be pre-washed with acetone and water to avoid potential removal of endogenous mercury in the sample which has been suspected in some studies as summarized by Esteban et al. (2014).

The selected analytical method for analyzing total mercury in hair is CVAAS. Based upon a review by WHO (2008), CVAAS is one of the more commonly used analytical methods which allows for comparison to other studies. Additionally, it has sufficient sensitivity with Maxxam achieving detection limits on the order of 0.005 ppm (the health effect threshold considered is 2 ppm (Legrand et al. 2010) for sensitive subgroups such as women of childbearing age and children and 5 ppm (Environment Canada, Health Canada 2010) for non-sensitive subgroups such as adult men).

## Disclaimer

Due to the pandemic situation, this document could not be reviewed with the MHHIG and involved health agencies prior to submitting to meet the Project’s annual reporting requirements. These parties have discussed

the contents within and while no substantive changes are anticipated, the finalization of this document is subject to review and input from MHHIG and health agencies.

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## **APPENDIX 2: HUMAN HEALTH RISK ASSESSMENT MEMORANDUM**

# Technical Memorandum

To: Manitoba Hydro

From: Ross Wilson, M.Sc., DABT, Wilson Scientific Consulting Inc.

Date: June 8, 2020

Re: Preliminary Risk Calculations for Consumption of Plants and Wildlife Collected  
in 2017 to 2019

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## DRAFT FOR DISCUSSION

### Introduction

The Keeyask Mercury and Human Health Risk Management Plan was developed to fulfill the requirements of The Environment Act (Manitoba) License No. 3107 and outlines a range of commitments to monitor and mitigate the risks associated from increased methylmercury in the environment as a result of the operation of Keeyask Generation Project (the Project), including sampling of wildlife and plants. Wilson Scientific Consulting Inc. (Wilson Scientific) has been retained by Manitoba Hydro to assist the Keeyask Hydropower Limited Partnership in meeting Keeyask monitoring and license commitments relating to mercury and human health. This includes conducting a preliminary human health risk interpretation of reported concentrations in wildlife and plants in the Project area. This memorandum is included in the Keeyask Project's Socio-Economic Monitoring Plan (2020) in partial fulfilment of the reporting requirements outlined in the License.

In fulfilment of the Project's Terrestrial Effects Monitoring Plan (TEMP) requirements, ECOSTEM Ltd. (ECOSTEM) and Wildlife Resource Consulting Services MB Inc. (WRCS) reported concentrations of total mercury in plants and animals, respectively, in the Project area during the construction period. This memorandum provides a preliminary human health risk interpretation of the most recent concentrations of mercury reported in the various plants and wildlife species provided in the ECOSTEM (2020) and WRCS (2019) reports. The memorandum is written at a technical level and is intended to inform the Partnership and the Project's Mercury and Human Health Implementation Group (MHHIG) of the preliminary interpretation of plant and animal data from a human health perspective. Due to the pandemic situation, this document could not be reviewed with the MHHIG and involved health agencies prior to submitting to meet the Project's annual reporting requirements. Nevertheless, it is recommended that the ECOSTEM (2020; draft) and WRCS (2019) reports and this memorandum be shared with the MHHIG and the regulator with a request for review and comment before these preliminary risk calculations are considered to be final estimates.

### Data Considerations

All risk interpretation provided in this memorandum are based on the following considerations:

- Wilson Scientific did not complete critical analysis of methodology and conclusions of TEMP reports. All concentrations provided by ECOSTEM and WRCS are assumed to be accurate.

- The objective of the ECOSTEM plant sampling was not to provide upper bound concentrations of mercury in plants across the Project area for use in a human health risk assessment. Instead, the ECOSTEM plant sampling program completed from 2017 to 2019 was designed to determine if the creation of the Project reservoir had increased mercury concentrations in the utilized parts of selected plant species. Consequently, the results of this program do not apply to other plant species or upper bound concentrations within the Project area.
- Samples analyzed in WRCS (2019) were submitted voluntarily by a partner First Nation registered trapper working for the Keeyask beaver/ muskrat trapping program (*Terrestrial Mitigation Implementation Plan*). The goal of WRCS (2019) was to report concentrations of mercury in the wildlife samples provided; however, the results presented in WRCS (2019) are not representative of upper bound concentrations in the Project area and are specific only to the wildlife species for which samples were submitted.
- The TEMP provides for the analysis of wildlife and plant samples submitted by partner First Nation community members through voluntary sampling. No samples have been submitted to date.

## **Summary of the Wildlife and Plant Data Provided by Discipline Experts**

### Plant Data

During the Keeyask environmental assessment process, the partner First Nations identified various plants that were important medical or food sources: blueberries (velvet-leaf blueberry and bog bilberry); Labrador tea; northern Labrador tea; and Wikis (also known as sweet flag). Although annual reports were prepared by ECOSTEM in 2018 and 2019, the focus of this memorandum is based on the most recent results presented in ECOSTEM (2020; draft) from the Project Effects Zone and Reference Zone: two blueberries species (velvet-leaf blueberry and bog bilberry); and, Labrador tea (most recent sampling has found the highest maximum concentrations). It is noted that ECOSTEM concluded there were an insufficient number of locations for scientific design to evaluate Northern Labrador Tea and no locations found with Wikis (sweet flag) and, thus, no analytical results for these two species are available for any of the ECOSTEM sampling efforts from 2017 to 2019.

ECOSTEM (2020; draft) reported a total of 12 berry samples from the Project Effects Zone and 17 berry samples from the Reference Zone. As shown in Table A, the 2019 mercury concentrations in all of the berry samples from the Project Effects Zone area were less than the method detection limit of 0.005 µg/g, dry weight. For blueberries from the Reference Zone, all but 2 of the samples were less than the same method detection limit. It is noted that for the 2017 and 2018 samples reported by ECOSTEM, mercury concentrations were less than the method detection limit for all blueberries for both areas. ECOSTEM (2020; draft) noted that the two blueberry samples from the Reference Zone that were detectable in 2019 were from the same plants where below the method detection limit results were obtained in 2017 and 2018.

Since human health risk assessment relies on mercury concentrations in blueberries expressed in units of wet weight, ECOSTEM (2020; draft) also provided results in these units. When moisture content was used to adjust dry weight concentrations into wet weight concentrations, ECOSTEM (2020; draft) reported that the maximum concentration of any blueberry was 0.00124 µg/g wet weight while the second highest (and only other blueberry sample with a detectable mercury concentration) was 0.00101 µg/g wet weight. Once again, both of these blueberries were from the Reference Zone rather than the Project Effects Zone.

**Table A**      **Summary of Berry Data During Construction Period (Collected in 2019) (from ECOSTEM, 2020; draft)**

Plant Type	Total Mercury Concentration	
	Project Effects Zone	Reference Zone
Blueberry	All samples less than method detection limit of 0.005 µg/g, dry weight (n =12)	All but two samples less than method detection limit of 0.005 µg/g, dry weight (n =17); maximum concentration of 0.008 µg/g, dry weight

In the case of Labrador tea, detectable concentrations of mercury were reported in numerous samples from both the Project Effects Zone and the Reference Zone. As shown in Table B, the maximum concentrations for total mercury in Labrador tea were 0.0070 µg/g, dry weight for the Project Effects Zone and 0.0071 µg/g, dry weight for the Reference Zone. It is noted that since Labrador tea is expected to be often consumed in a somewhat dried form, the expression of concentrations in dry weight did not require a conversion into concentrations as wet weight.

**Table B**      **Summary of Labrador Tea Data During Construction Period (Collected in 2019) (from ECOSTEM, 2020)**

Plant Type	Total Mercury Concentration	
	Project Effects Zone	Reference Zone
Labrador tea	Arithmetic mean = 0.0054 µg/g, dry weight*  Maximum = 0.0070 µg/g, dry weight (n =11)	Arithmetic mean = 0.0054 µg/g, dry weight*  Maximum = 0.0071 µg/g, dry weight (n =15)

\* Arithmetic mean concentration was calculated and reported by ECOSTEM (2019) using an assumption that concentrations reported as less than the method detection limit were set to 75% of the method detection limit.

ECOSTEM (2020; draft) has indicated that the concentrations summarized in Tables A and B cannot be concluded to be upper bound values and would not apply to other plant species. These concentrations also only apply to pre-flooding conditions. ECOSTEM has also indicated that the “reference” zone samples would continue to be representative of unaffected areas after the reservoir is created. Furthermore, ECOSTEM has indicated that the concentrations would be representative of areas that have burned in the past approximately 15 to 25 years. They would not be representative of concentrations in areas that burned in wildfires in the past 15 years.

#### Wildlife Data

In June 2019, WRCS prepared a report that provided mercury tissue concentration results for beaver, muskrat and river otter trapped by a TCN registered trapline holder (through the TMIP) in 2017 and 2018 within the Keeyask Project area (WRCS, 2019). The focus of this human risk evaluation is on the beaver and muskrat data as the partner First Nations have not indicated to date that river otter is consumed by community members.

WRCS (2019) indicated that six beaver specimens (i.e., two specimens in 2017 and four specimens in 2018) were trapped and submitted for analysis of total mercury in various tissues. Of the six beavers, four were adults and two were juveniles. All beaver specimens had muscle tissue submitted for analysis while three beavers had kidneys submitted for analysis (none were submitted for liver)<sup>1</sup>. The results of the beaver samples are summarized below in Table C (see Table 2 of WRCS (2019) for more details).

**Table C                      Summary of Beaver Tissue Data During Construction Period (Collected in 2017 and 2018) (from WRCS, 2019)**

Tissue Type	Total Mercury Concentration (µg/g; wet weight)		
	Minimum	Maximum	Arithmetic mean
Beaver leg muscle (n=6)	0.003	0.0124	0.0064
Beaver kidney (n=3)	0.0086	0.0428	0.030

In the case of muskrat, WRCS (2019) indicated that one specimen was submitted for analysis of muscle, kidney and liver; however, the laboratory was not successful in providing a muscle and kidney result and mercury concentrations were only reported for the liver sample. Table D below provides the result of this one muskrat sample (also provided in Table 2 of the WRCS [2019]).

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<sup>1</sup> The mercury analysis was completed as total mercury (as opposed to methylmercury). This is considered to be acceptable at the current time but could be re-evaluated in the future (archiving a subset of methylmercury analysis may provide useful information during post-impoundment conditions if the total mercury concentrations are found to be unexpectedly high in the future as it will allow for more precise estimate of risks).



**Table D                      Summary of Muskrat Tissue Data During Construction Period (Collected in 2018) (from WRCS, 2019)**

<b>Tissue Type</b>	<b>Total Mercury Concentration (µg/g; wet weight)</b>
Muskrat liver (n=1)	0.0039

Communications with WRCS have indicated that due to the small sample size, the concentrations summarized in Tables C and D cannot be concluded to be upper bound values. This concern has been particularly focused on muskrat data for which only one sample is available and does not represent muscle.

### **Preliminary Risk Estimates from Consumption of Various Foods**

Health Canada and World Health Organization (WHO) human health risk assessment guidance was the primary source of technical methodological information used to complete preliminary risk estimates. The WHO (2010) toxicity reference value for total mercury was considered to be appropriate for these preliminary risk estimates. This approach is consistent with Wilson Scientific's (2013) HHRA submitted as part of the Project's EIS, which underwent extensive review by multiple agencies. More specifically, although a tolerable daily intake (TDI) of is available for methylmercury from Health Canada (2010), WHO (2010) recommended a provisional tolerable weekly intake (PTWI) of 4 µg/kg bw/week for dietary assessment of total mercury measurements in foods other than fish and shellfish. As a daily intake estimate, the WHO toxicity reference value is equivalent to a tolerable daily intake (TDI) for total mercury of 0.57 µg/kg bw/day for all persons (i.e., 4 µg/kg bw/week x 1 week/7 days = 0.57 µg/kg bw/day). It is noted that overall conclusions would not have changed if the Health Canada TDI of 0.2 µg/kg bw/day for methylmercury for sensitive individuals was used; however, it needs to be clear that exposure estimates would have been closer to the TDI if this value was used. Nevertheless, there is no current information from Health Canada that the WHO value for foods other than fish and shellfish should not be used for such purposes.

### **Preliminary Risk Estimates from Wild Plant Consumption**

Preliminary risk estimates from wild plant consumption suggest that blueberries and Labrador tea samples are unlikely to be an important source of mercury under current conditions for the locations that were sampled. From a mercury risk perspective, there is no reason to discourage consumption of blueberries and Labrador tea from these locations under current conditions.

In the case of blueberries, the preliminary risk analysis indicates that these plants would not represent an appreciable source of mercury under current conditions and reported concentrations for the specified locations. As noted in the ECOSTEM (2020; draft) report, mercury in 2019 was not detected in any of the 12 blueberry samples from the Project Effects Zone while only 2 samples had detectable concentrations from the Reference Zone. The maximum concentration of mercury in blueberries reported to date was 0.00124 µg/g, wet weight (once again this was from the Reference Zone). It is noted that the partner First Nations did not provide berry consumption rates as part of the previously discussed workshop setting in

2009; however, even if daily consumption at a rate of 150 g or 5 ounces per day (i.e., about 1 ¼ cups of berries is about 150 g) was assumed for adults and half this much (i.e., 75 g per day) was assumed for toddlers, berries would not represent an appreciable source of mercury when the maximum concentration is assumed (i.e., intake rates of 0.0026 and 0.0056 µg/kg bw/day for adults and toddlers, respectively, would be estimated from berries versus the WHO acceptable intake rate of 0.57 µg/kg bw/d; see Table E). Consequently, from a preliminary risk perspective, unacceptable risk due to mercury in blueberries is considered to be unlikely and there continues to be no need to discourage consumption from the locations where they have been collected under current, pre-flooding conditions.

With respect to Labrador tea, it also does not seem likely that these plants represent an appreciable source of mercury from a preliminary risk perspective under current conditions and reported concentrations for the specified locations. Although mercury was detected in Labrador tea, the concentrations reported by ECOSTEM (2020; draft) are unlikely to pose a concern. As summarized by InterGroup in 2009, the partner First Nations indicated that Labrador tea could be used on a daily basis by some; however, the actual rate of intake was not estimated during the workshop setting in 2009. Preliminary calculations assumed that an adult may consume 9 g per day (i.e., typical herbal or conventional tea sold in stores contains about 2 to 3 g of dried plant material per tea bag). Daily consumption at this rate would result in intakes that are appreciably lower than the previously discussed WHO acceptable intake rate for total mercury (i.e., ., intake rates of 0.0039 and 0.0009 µg/kg bw/day for adults and toddlers, respectively, versus 0.57 µg/kg bw/d) (see Table E).

**Table E Estimated Intake Rate from Consumption of Berries and Labrador Tea**

Receptor	Assumed Mercury Concentration	Assumed Consumption Rate	Estimated Intake Rate
Berries			
Toddler (body weight of 16.5 kg)	0.00124 µg/g, wet weight (maximum of any reported concentration from 2017 to 2019)	75 g/meal; 3 meals per week	0.0056 µg/kg bw/d
Adult (body weight of 60 kg)		150 g/meal; 3 meals per week	0.0026 µg/kg bw/d
Labrador Tea			
Toddler (body weight of 16.5 kg)	0.0071 µg/g, wet weight (maximum of any reported concentration from 2017 to 2019)	3 g/serving, 21 servings per week (all age groups)	0.0039 µg/kg bw/d (based on maximum concentration)
Adult (body weight of 60 kg)			0.00090 µg/kg bw/d (based on maximum concentration)

Although it is beyond the scope of the plant sampling program to predict concentrations of mercury in plants from other areas, other species or under post-flooding conditions, there are some limitations that need to be considered in the interpretation of human health risks. The interpretation of human health risks relies on an understanding of upper bound concentrations. For the purposes of this preliminary risk analysis, the results from the Projects Effects and Reference Zones have essentially been pooled and the calculations then based on the maximum from either of these zones. Based on these values, the concentrations of mercury would need to be much higher than those reported thus far to be associated with unacceptable risks. As noted earlier, the plants identified in the TEMP were based on input from the partner First Nations during the environmental planning process; therefore, the data are limited to blueberries and Labrador Tea and does not represent other plant species. With the approach to operations phase, it may be timely to work with partner First Nations to re-evaluate plants of concerns and consumption frequencies. Lastly, the data are specific to areas that have burned in the past approximately 15 to 25 years for the project study area.

Overall, the low mercury concentrations in berries and Labrador tea suggest that these foods are unlikely to represent an appreciable source of exposure to mercury from a preliminary risk interpretation basis.

Nevertheless, this is a conclusion restricted to these plants in areas that have burned in the past approximately 15 to 25 years in the Project study area and to current, pre-flooding conditions and has not addressed the potential for upper bound concentrations within the Project area.

#### Preliminary Risk Estimates from Wildlife Consumption

Preliminary risk estimates indicate that it is unlikely that consumption of beaver would be an important source of mercury for those consuming these animals when the maximum concentrations reported by WRCS (2019) are assumed. Consequently, from a mercury risk perspective, there is currently no reason to discourage consumption of beaver based on these concentrations; however, more representative data (additional samples) would provide improved certainty.

In the case of interpretation of the beaver leg muscle results, a 2009 workshop with the partner First Nations (confidential memorandum provided by InterGroup Consultants Ltd.) indicated upper bound beaver consumption rates of three times per week with a serving size of 2 ounces (57 grams) for young children and 7 ounces (200 grams) for adults would be reasonable. It is noted that the workshop did not specify if people would focus consumption on muscle tissue or would also consume organs; however, this analysis is primarily focused on muscle because leg and other muscle consumption is most likely the part of the beaver most consumed (nevertheless, this should be confirmed through dialogue with the partner First Nations). Assuming beaver leg muscle consumption occurred at these rates with the arithmetic mean concentration of 0.0064 µg/g (wet weight) or maximum concentration of 0.0124 µg/g (wet weight), the intake rates would be low and appreciably less than the WHO acceptable intake rate for total mercury (see Table F). More specifically, the intake rate of 0.018 µg/kg bw/d of beaver muscle tissue at maximum concentration for both toddler and adult is appreciably lower than the WHO acceptable intake rate of 0.57 µg/kgbw/d.

Overall, this indicates low and acceptable risks from the concentrations of mercury reported in beaver muscle by WRCS (2019).

**Table F Estimated Intake Rate from Consumption of Beaver Leg Muscle**

Receptor	Assumed Mercury Concentration	Assumed Consumption Rate	Estimated Intake Rate
Toddler (body weight of 16.5 kg)	0.0064 µg/g, wet weight (average)	57 g or 2 ounces/meal; 3 meals per week	0.0095 µg/kg bw/d (based on average concentration)
	0.0124 µg/g, wet weight (maximum)		0.018 µg/kg bw/d (based on maximum concentration)
Adult (body weight of 60 kg)		200 g or 7 ounces/meal; 3 meals per week	0.0092 µg/kg bw/d (based on average concentration)
			0.018 µg/kg bw/d (based on maximum concentration)

In the case of beaver kidney consumption, there was no information on how often community members may consume this organ. Nevertheless, the reported concentrations are low and would not exceed the WHO acceptable intake rate for total mercury if these kidneys were consumed at a rate similar to beaver leg muscle. More specifically, when persons are assumed to consume beaver kidney at the leg muscle consumption rate (i.e., serving sizes of 2 and 7 ounces for children and adults, respectively, 3 times per week) and with the arithmetic mean concentration of 0.030 µg/g (wet weight) or maximum concentration of 0.0428 µg/g (wet weight), the intake rates would be low and appreciably less than the WHO acceptable intake rate for total mercury (i.e., maximum intake rate of 0.063 µg/kg bw/d for toddler and 0.061 µg/kg bw/d for adult are appreciably less than the WHO acceptable intake rate of 0.57 µg/kg bw/d for total mercury).

In the case of muskrat consumption, there are very little data in WRCS (2019) that pertain to mercury concentrations and as a result it is difficult to provide a current risk interpretation for consumption of muskrat. WRCS (2019) reported one muskrat muscle and one kidney sample were collected and submitted for laboratory measurement of mercury concentrations; however, the laboratory was not successful in providing results for either tissue. Results for the one muskrat liver sample indicated a mercury concentration of 0.0039 µg/g (wet weight) (WRCS 2019). In the 2009 workshop reported by Intergroup, partner First Nations representatives estimated that one meal per week of muskrat was considered to be a reasonable upper bound consumption rate (with a serving size of 2 ounces [57 grams] for young children and 7 ounces [200 grams] for adults); however, similar to beaver consumption, there was no information on whether this consumption rate was specific to muscle or organ tissues. Although muskrat kidney is considered to represent a low concentration, it is difficult to provide meaningful estimates of risks based on this dataset (i.e., no muscle tissue results and only 1 organ tissue result). The intake rates from consuming muskrat liver with this mercury concentration at a rate of one meal per week (2 ounces [57 grams] for children and 7 ounces [200 grams] for adults) would be low and appreciably less than the WHO acceptable intake rate for total mercury (i.e., intake rate of 0.0019 µg/kg

bw/d for toddler and adult versus the WHO acceptable intake rate of 0.57 µg/kg bw/d). Nevertheless, there is currently no information available that indicates the partner First Nations would consume muskrat liver at this rate.

Consumption of river otter tissue was not evaluated in this preliminary risk interpretation as there was no indication from KCN representatives in 2009 workshop that members consumed river otter. Nonetheless, in limited sampling, WRCS (2019) reported mercury concentrations in river otter muscle that were much higher than in beaver muscle (due to the river otter's fish-eating diet). Specifically, mercury concentrations in river otter muscle (n=2) were substantially greater than reported in beaver leg muscle. Kidney mercury concentrations were also much higher in river otter (n=2) as compared to beaver kidney (no muskrat kidney concentrations were measured). Similarly, liver mercury concentrations were much higher in river otter (n=2) as compared to the one muskrat liver sample (no beaver liver concentrations were measured). Given these high concentrations, it may be important to reaffirm the lack of consumption of river otter by the partner First Nations.

With the above in mind, the preliminary risk calculations are associated with certain limitations. Specifically, the small sample size precludes conclusions reporting of upper bound concentrations in beaver from the WRCS (2019) dataset. In addition, there are no muscle data for muskrat or other wildlife that have been communicated as key diet concerns by the partner First Nations. Similar to the plant sampling program, it may also be a reasonable time to review with KCN representatives to confirm whether the identified wildlife species for sampling and consumption frequencies are applicable and current.

Overall, there is no information from WRCS (2019) to indicate that consumption of beaver would be an important source of mercury under current, pre-impoundment conditions. As noted earlier, the wildlife sampling and analysis relied on volunteer submission of wildlife tissues and the participation rate has been low. Consequently, the wildlife mercury concentrations summarized in Tables C and D cannot be concluded to be upper bound values and should be confirmed as part of ongoing monitoring. In addition, these results apply to current, pre-flooding conditions and do not apply to other animals.

## **Conclusions**

The preliminary risk analysis has indicated that the reported concentrations of blueberries, Labrador tea or beaver are unlikely to pose unacceptable health risks under pre-flooding conditions.

In the case of plants, the results of the preliminary risk calculations indicate that there is no reason to suggest that the partner First Nations should be discouraged from consuming blueberries or Labrador tea under current, pre-flooding conditions from the specific locations where ECOSTEM (2020; draft) collected these plants. Although ECOSTEM (2020; draft) has indicated that sampled berries and Labrador tea are not representative of upper bound concentrations, ECOSTEM (2020; draft) does consider these to be representative of typical blueberries and Labrador tea in areas that have burned within the past approximately 15 to 25 year in the Project study area. Since the maximum concentrations of either plant species did not pose unacceptable risks, it would seem reasonable to conclude that consumption of blueberries and Labrador tea from the Project study area would be associated with acceptable risks from a

preliminary risk analysis perspective. Nevertheless, additional information would be required if conclusions are to be made on risks from upper bound concentrations of these plants, other locations or for risks from consumption of other plant species. If future sampling of blueberries and Labrador tea and other plants at other locations within the Project area indicate similar concentrations, these conclusions could likely be extended to these locations/plants. Finally, it is noted that these preliminary risk conclusions are specific to current, pre-flooding conditions and should not be considered to be representative of concentrations following flooding.

Similarly, beaver tissue submitted as part of the Project's trapping program (TMIP) have indicated low and acceptable concentrations under current, pre-flooding conditions. It is noted that only a small number of beaver samples were submitted, and no data were available for muscle tissue from other wildlife. Additional sampling would increase the certainty of this preliminary risk analysis. Nevertheless, there is no reason to suggest that the partner First Nations should be avoiding beaver consumption under current, pre-flooding conditions based on the results reported by WRCS (2019). Since these conclusions are specific to current, pre-flooding conditions and may not be representative of upper bound concentrations across the entire Project area, ongoing monitoring is recommended.

Due to the pandemic situation, this document could not be reviewed with the MHHIG and involved health agencies prior to submitting to meet the Project's annual reporting requirements. These parties are aware of this document and while no substantive changes to content are anticipated, the finalization of this draft document and preliminary risk calculations, are subject to review and input from MHHIG and health agencies.

## **Statement of Limitations**

This report has been prepared by Wilson Scientific Consulting Inc. (Wilson Scientific) for the sole benefit of Manitoba Hydro. Any use that a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Wilson Scientific accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional staff in accordance with generally accepted scientific practices current at the time the work was performed.

Any site-specific information provided by Manitoba Hydro, Wildlife Resource Consulting Services MB Inc., ECOSTEM Ltd or other parties has been assumed by Wilson Scientific to be accurate. Conclusions presented in this report should not be construed as legal advice.

This risk assessment was undertaken exclusively for the purpose outlined herein and was limited to those contaminants, exposure pathways, receptors, and related uncertainties specifically referenced in the report. This work was specific to the site conditions and land use considerations described in the report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations.

This report describes only the applicable risks associated with the identified environmental hazards, and is not intended to imply a risk-free site. Should any conditions at the site be observed or discovered that differ from those at the sample locations, or should the land use surrounding the identified hazards change significantly, Wilson Scientific requests that to be notified immediately to reassess the conclusions provided herein.

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# **APPENDIX 3: NORTHERN ROAD TRAFFIC MONITORING QUARTERLY DATA COLLECTION SUMMARY APRIL 2020**

# NORTHERN ROAD TRAFFIC MONITORING QUARTERLY DATA COLLECTION SUMMARY MARCH 2020

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*Grading Activity on PR280*

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## Summary

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### Background

Construction-related activities associated with the development of the Keeyask Project, Keewatinohk Converter Station Project and Bipole III Transmission Project (BPIII) generated additional traffic on various segments of the Provincial Road (PR) network, in particular, on PR 280 and PR 290. Three types of traffic are being realized - local traffic, workforce traffic, and traffic generated from shipping materials and equipment for both local and site specific needs.

The Environmental Impact Statements (EIS) for both the Keeyask Project and the Bipole III Transmission Project (BPIII) contain requirements for continual traffic monitoring throughout the lifespan of these Projects. While the Environmental Impact Statements (EIS) for both the Keeyask and BPIII Projects predicted that existing transportation networks and plans for PR 280 upgrades would be able to accommodate the changes associated with Project construction, communities in the area expressed concerns regarding traffic safety and road conditions. Manitoba Infrastructure (MI) is responsible for the existing provincial highway system, including maintenance and upgrades to PR 280 and PR 290. Monitoring has been ongoing and continues with information from MI, Manitoba Public Insurance (MPI), and the Keeyask site access gates to assess EIS predictions and respond to community concerns.

Traffic monitoring stations have been installed at five locations on PR 280 and PR 290 – Site 1, 2, 3, 10 and 11. Refer to **Appendix A** for a map of the traffic monitoring station locations and monitoring station failures. MI installed the stations in 2015 with funding provided by Manitoba Hydro (MH) and MI provides ongoing maintenance of the equipment. MI collects data from the stations and submits the information on a monthly basis to MH. Induction loops are able to differentiate various vehicle types based upon axle count and spacing. Vehicle classifications have been grouped into small, medium and large vehicles as shown in **Appendix B**.

### Notable Quarterly Results:

**During the month of March 2020 measures were implemented to address the Covid-19 global pandemic. These measures included the restriction of access on and off the site resulting in a reduction of traffic and gate counts.**

#### **Site 1** *PR 280 – between PR 391 and Split Lake*

- Traffic decreased by 7% during the quarterly time period for January and February. March comparison could not be determined due to a monitoring station failure during March 2020.

#### **Site 2** *PR 280 – between Split Lake and west of Keeyask gate*

- Traffic volume decreased by 41% during the quarterly time period compared to the previous year.

#### **Site 3** *PR 290 – east of PR280 / 290 intersection*

- Traffic volume decreased by 34% during the quarterly time period compared to the previous year.

#### **Site 10** *PR 280 – between PR 290 and Gillam*

- Traffic volumes decreased by 22% during the quarterly time period compared to the previous year.

#### **Site 11** *PR 280 – between east of Keeyask gate and PR 290*

- Traffic volumes decreased by 21% during the quarterly time period compared to the previous year.

### **Keeyask Gate North Access**

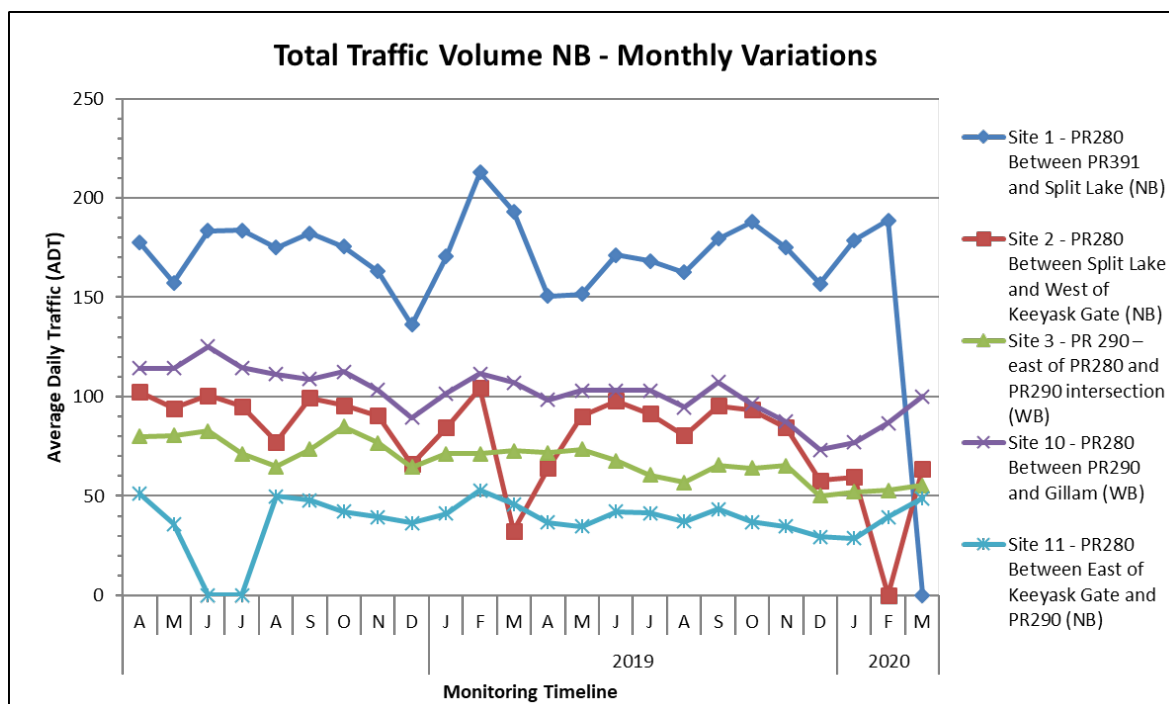
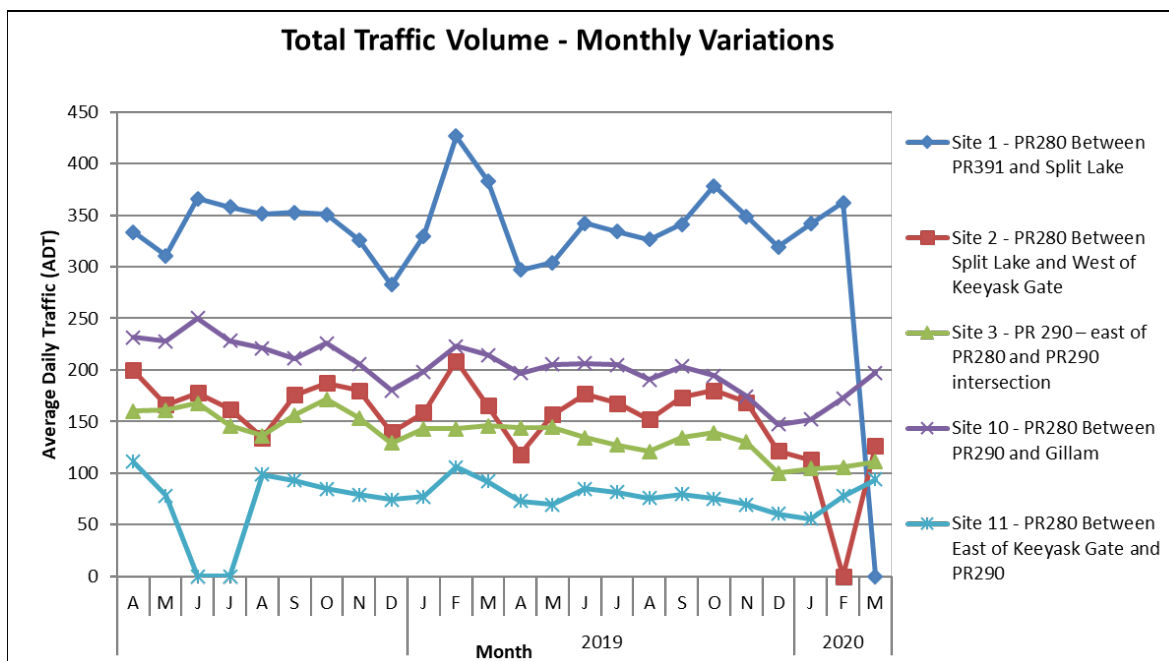
- Gate access has decreased significantly during this quarter when compared to the previous year due to Covid-19 restrictions.

### **Keeyask Gate South Access**

- Gate access decreased significantly during this quarter when compared to the previous year due to Covid-19 restrictions.

## Data Collection Results

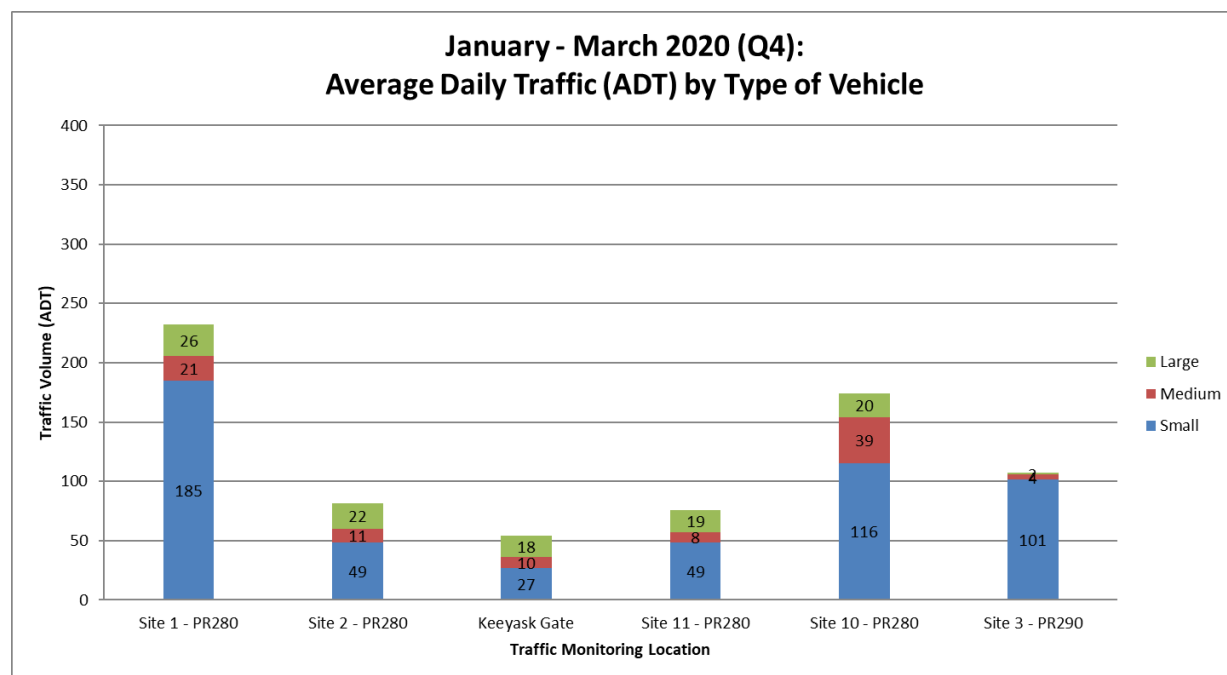
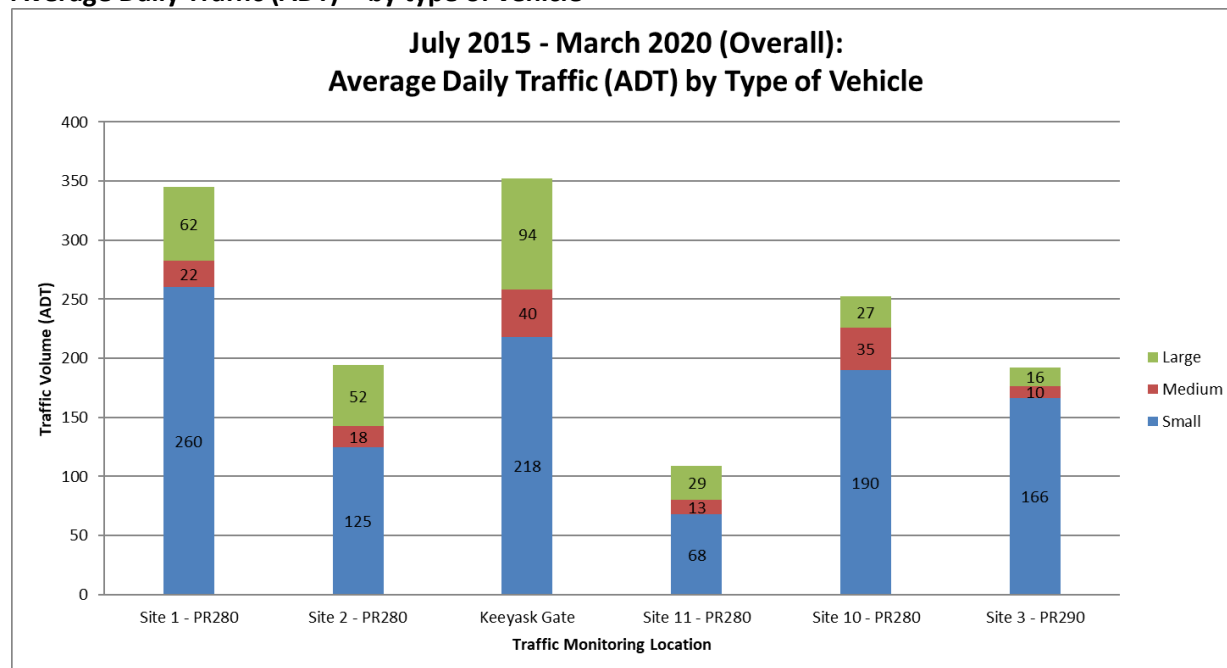
### Total Traffic Volume – Monthly



### Summary

- A comparison could not be made due to Covid-19 traffic reductions and Site 1 station failure.
- Site 11 monitoring station failure – June and July 2018.
- Site 1 monitoring station failure March – Present 2020.

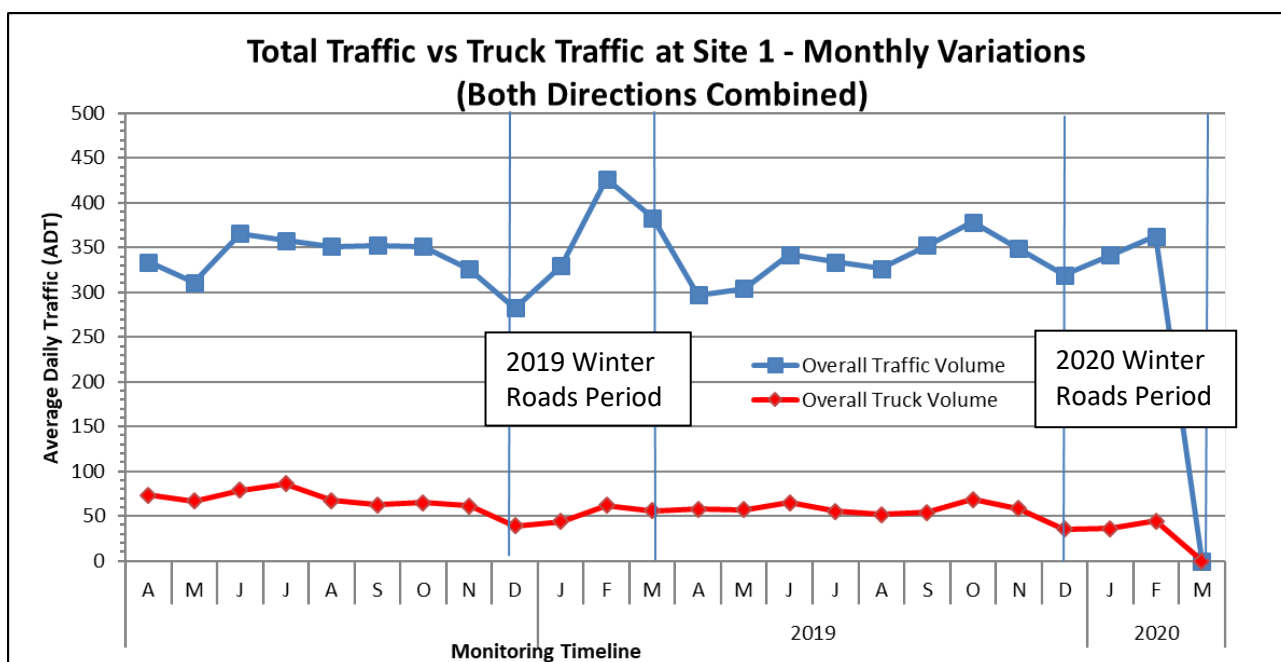
## Average Daily Traffic (ADT) – by type of vehicle



## Summary

- Small vehicles result in the highest percentage of vehicle type.
- ADT vs traffic type graphs by site location are given in **Appendix C**.
- Site 1 is missing March data due to an issue at the monitoring station.

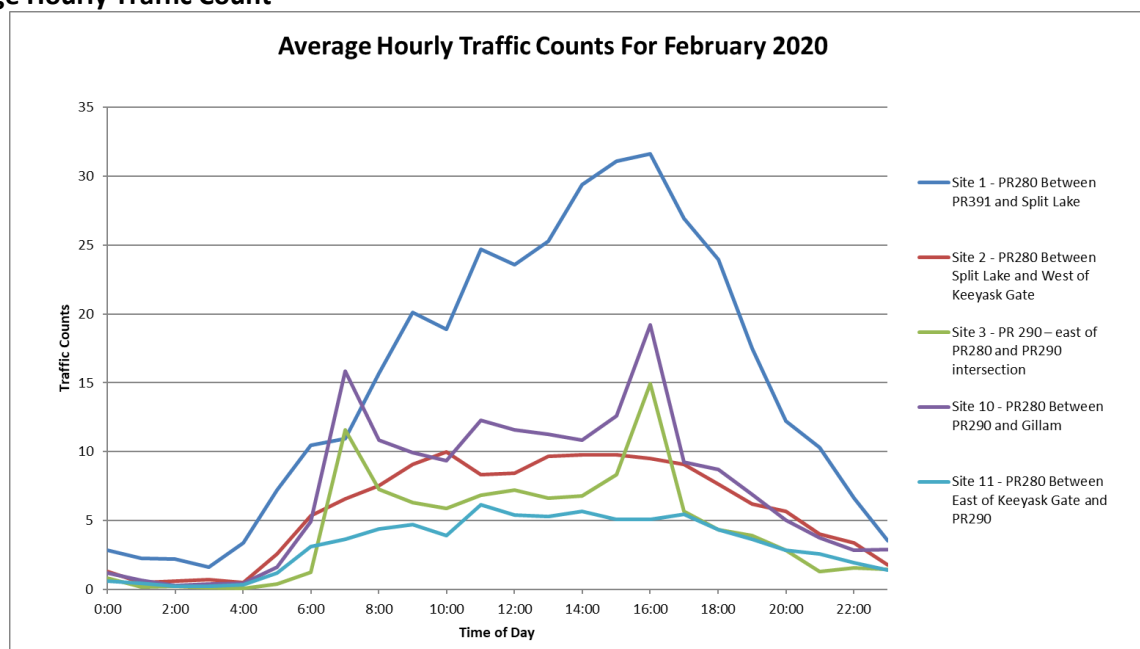
## Total Traffic vs Truck Traffic



### Summary

- Truck traffic (i.e. large vehicles) graphed against overall traffic does not indicate a correlation to increased volume.
- Truck traffic vs overall traffic graphs for other sites are given in **Appendix D**.
- Site 1 is missing March data due to an issue at the monitoring station.

## Average Hourly Traffic Count



### Summary

- Peak travel time between 12 and 6 pm.



## Keeyask Security Gate Records

The security gates on the North Access Road and South Access Road into Keeyask collect data on vehicles entering the site. Security personnel located at the gate tracks the type and number of vehicles that enter and leave the site.

KEYYASK NORTH ACCESS ROAD SECURITY GATE				KEYYASK SOUTH ACCESS ROAD SECURITY GATE			
	Period	Gate Count Total	Daily Average		Period	Gate Count Total	Daily Average
2018	April	3,581	119	2018	April	3,721	124
	May	3,971	128		May	3,568	115
	June	3,884	129		June	3,365	112
	July	3,869	125		July	3,340	108
	August	3,606	116		August	3,274	106
	September	3,156	105		September	1,833	61
	October	3,465	112		October	1,346	43
	November	3,031	101		November	1,663	55
	December	2,181	70		December	2,136	69
2019	January	2,565	83	2019	January	4,169	134
	February	2,823	101		February	2,810	100
	March	2,689	87		March	3,415	110
	April	3,380	113		April	1,232	41
	May	3,363	108		May	884	29
	June	3,566	119		June	1,073	36
	July	3,242	105		July	995	32
	August	2,948	95		August	876	28
	September	3,431	114		September	857	29
	October	3,302	107		October	1,699	55
	November	2,915	97		November	1,902	63
	December	1,737	56		December	1,605	52
2020	January	1,699	55	2020	January	1,045	34
	February	1,753	60		February	1,246	43
	March	1,460	47		March	873	28

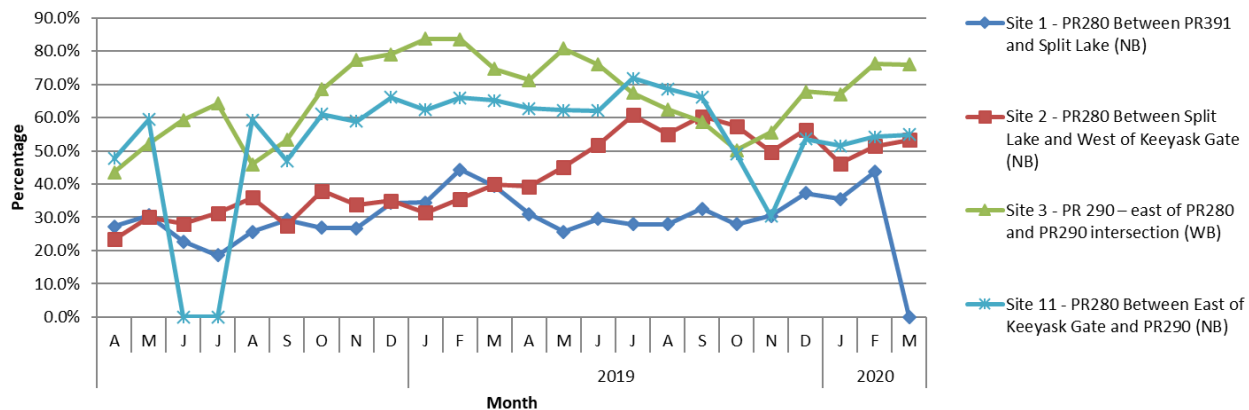
### Summary

- Gate data shows a significant decrease through the North and South Access Gates due to restricted site access during the month of March 2020. A comparison year over year could not be made for the quarter.

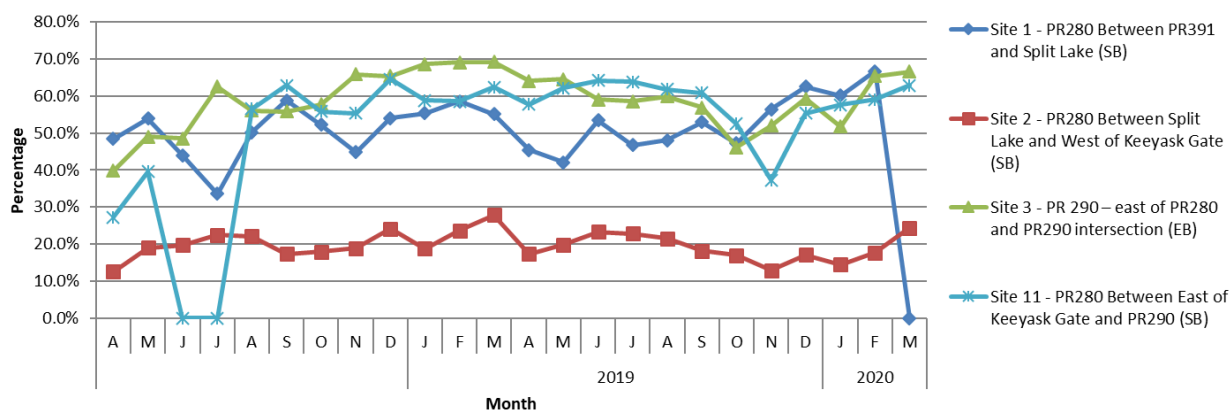


## Speeding Analysis

**Total Percentage Vehicles Exceeding Posted Speed in Northbound Directions**



**Total Percentage Vehicles Exceeding Posted Speed in Southbound Directions**



## Summary

- Graphs are representative of vehicles exceeding the posted speed limit (>90 km/hr.) as recorded by monitoring stations.
- Site 1 is missing March 2020 data due to an issue at the monitoring station

## Average Vehicle Speed

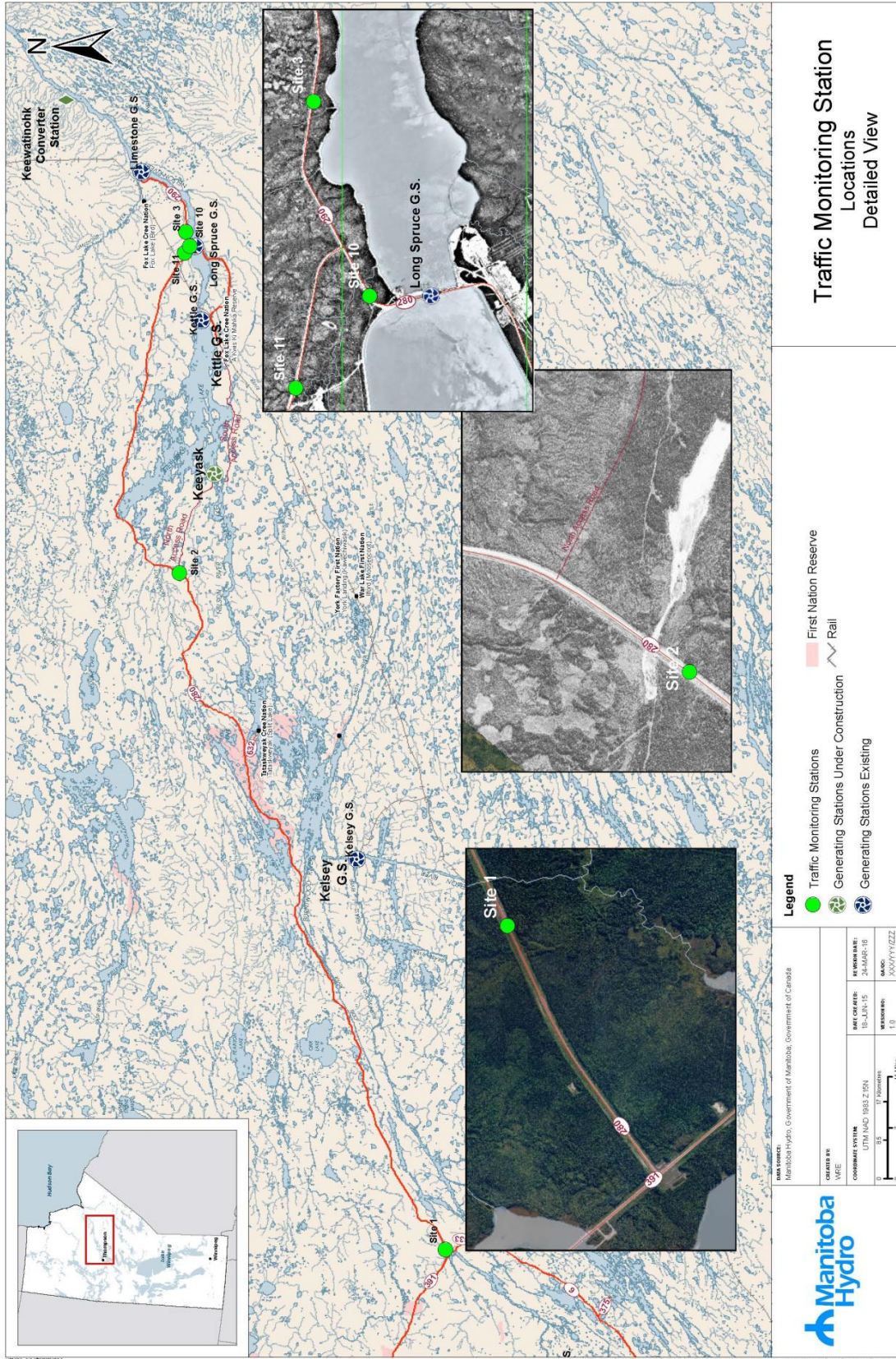
### Average Vehicle Speed

Station	Posted Speed	Avg Speed (Apr to June 2019)			Avg Speed (July to Sept 2019)			Avg Speed (Oct to Dec 2019)			Avg Speed (Jan to Mar 2020)		
		Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Site 1 – PR280 between PR391 and Split Lake	90 - NB	84	82	73	73	62	61	86	80	76	87	87	80
	90 - SB	91	83	78	82	70	67	94	86	82	95	98	85
Site 2 – PR280 between Split Lake and Keeyask	90 - NB	90	92	75	93	87	77	93	95	81	91	92	77
	90 - SB	77	73	69	80	72	69	74	70	63	77	73	67
Site 3 – PR290 east of PR280/290 intersection	90 - WB	99	96	96	92	87	80	91	88	85	97	89	87
	90 - EB	95	88	84	93	96	83	90	84	84	93	87	84
Site 11 – PR280 north of the PR280/290 intersection	90 - NB	98	90	83	97	95	84	87	82	83	92	86	83
	90 - SB	97	90	84	93	88	84	91	82	80	94	87	84

### Summary

- Average Vehicle Speed data results in the small vehicle category averaging the highest speeds.
- Average speed is higher in winter months which can be attributed to frozen road conditions that tend to be smoother and free of dust.
- Speeding has varied throughout the years with a decrease in spring and fall due an increased likelihood of poor road conditions related to weather, road reconstruction, or even to driver awareness initiatives being implemented by MH and MI.
- Monitoring locations give data related to that specific location only.
  - Site 1 station shows higher speeding rates for SB traffic compared to NB traffic due to the monitoring station being in close proximity to the PR 391 intersection.
  - Site 10 located at curve on north side of Long Spruce Generating Station. Vehicles are slowing down to navigate the curve or have just come out of the curve and are still speeding up; therefore speed data for Site 10 was not included in this analysis.
- Speeding information by vehicle type by Station is given in **Appendix E**.

# Appendix A – Traffic Monitoring Locations and List of Failures






**Monitoring Station Failures:**

- Station 1: November 2015 approximately two weeks.
  - Average daily traffic was extrapolated based on the partial month's data collection.
- Station 1: June 2016 approximately three days.
  - Results have been based on a 27 day period rather than 30 days.
- Station 1: July 2016 approximately three weeks.
  - Results are skewed.
- Station 1: July 31, 2017.
  - Loss of data.
- Station 2: September 2017 approximately 2 weeks.
  - Loss of data.
- Station 11: September 2017 approximately 1 week.
  - Loss of data.
- Station 11: June and July 2018 for Station 11.
  - Loss of data due to a recording device error.
- Station 2: March 12 2019 approximately 2 weeks.
  - Loss of data due to recording device error.
- Station 1: March 2020 to Present
  - Loss of data due to recording device error.



## Appendix B - Vehicle Classifications

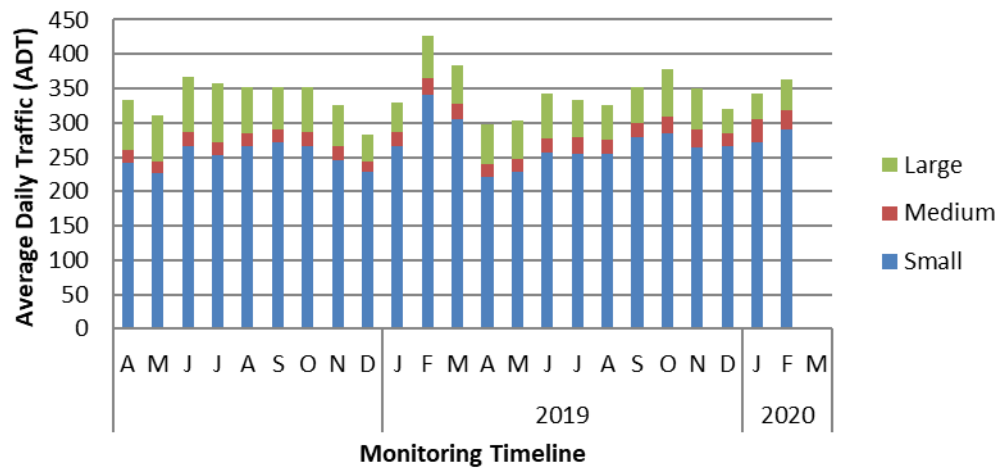
The induction loops that are buried within the roadway are spaced at a given interval. The time it takes for the front axle and rear axle to cross the loops gives an indication of the speed of the vehicle within an accuracy range of +/- 5 km/h. This information is reflective of vehicle speed tendencies at the traffic monitoring station location. The specific location of the traffic monitoring station may impact the speed tendencies dependent upon road geometry in each direction.

Vehicle Category		Vehicle Description	
Small			
Medium			
Large			
Bin 1	Class 1	Small	Cars, truck and vans
Bin 2	Class 2, 3, 4	Medium	Buses, single dual & tandem dual trucks, dual steering with tandem drive
Bin 3	Class 5 and 6	Large	Trucks 5 axles and up

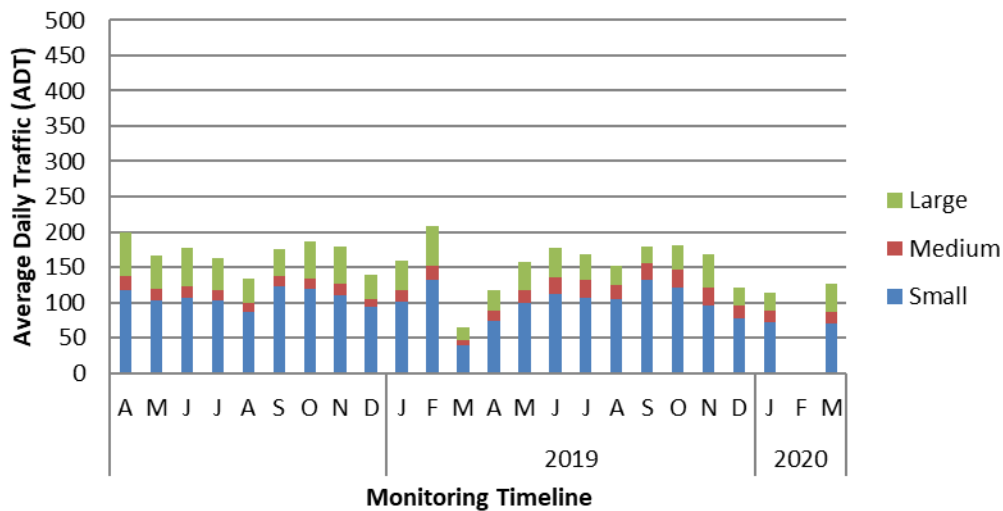
- Small vehicles are categorized as all passenger cars, trucks and vans.
- Medium vehicles are categorized as all buses and dual or tandem axle trucks.
- Large vehicles are categorized as all vehicles with five axles and more.

## Appendix C – Monthly Traffic Counts

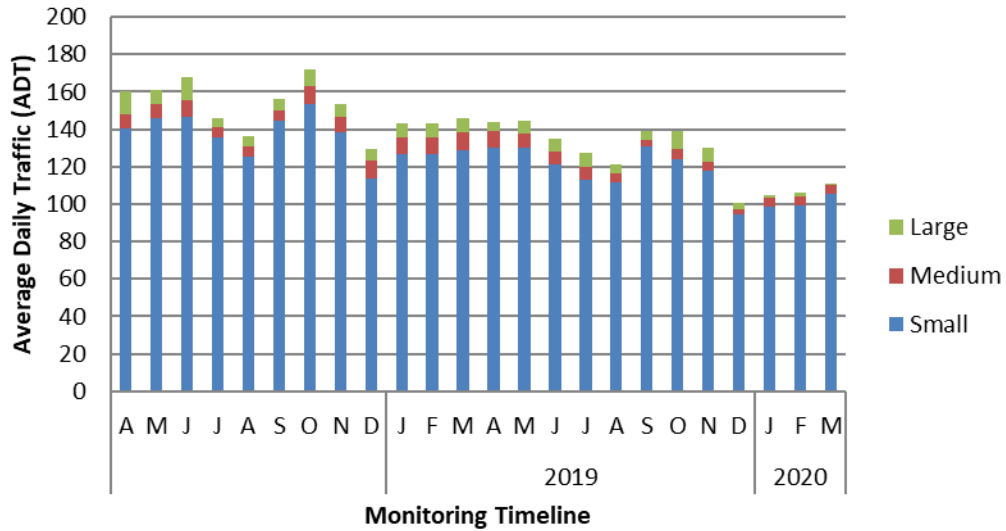
**Site 1 - ADT by Traffic Types**



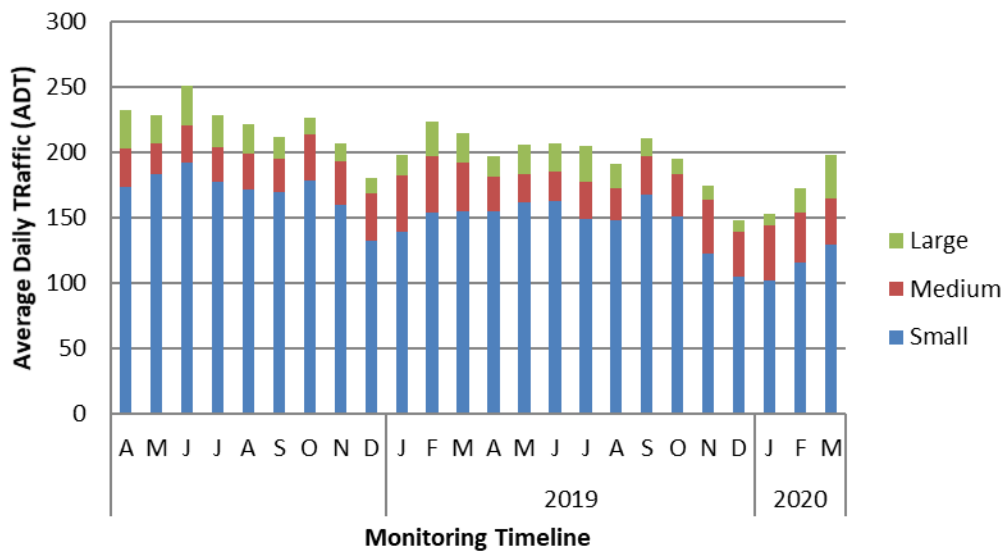
**Site 2 - ADT by Traffic Types**



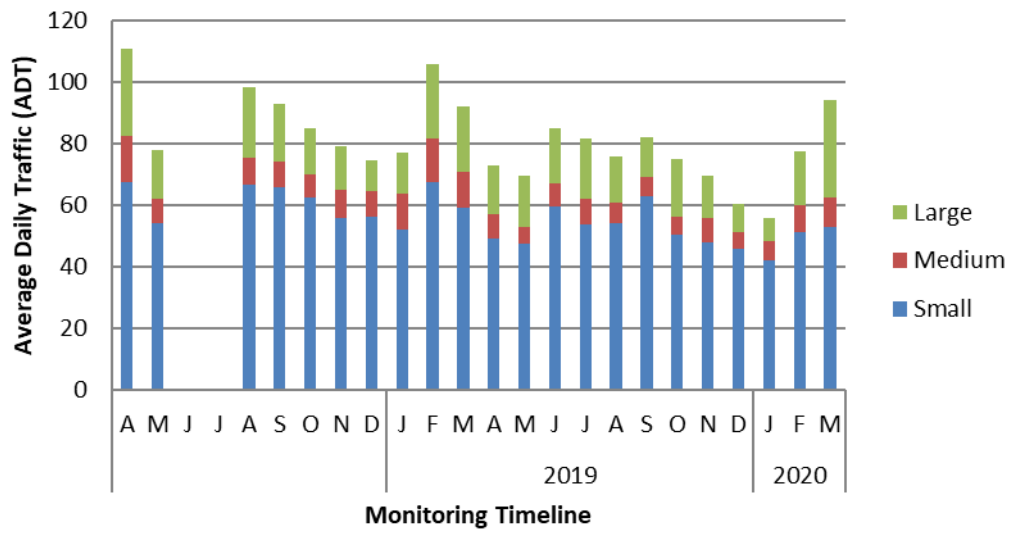
### Site 3 - ADT by Traffic Types



### Site 10 - ADT by Traffic Types



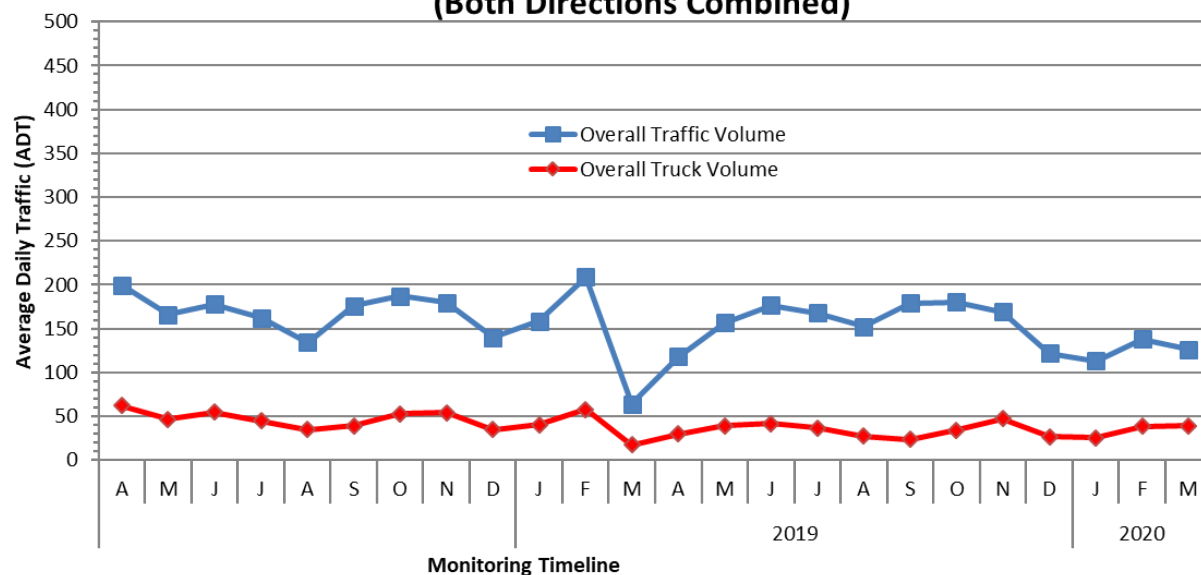
## Site 11 - ADT by Traffic Types



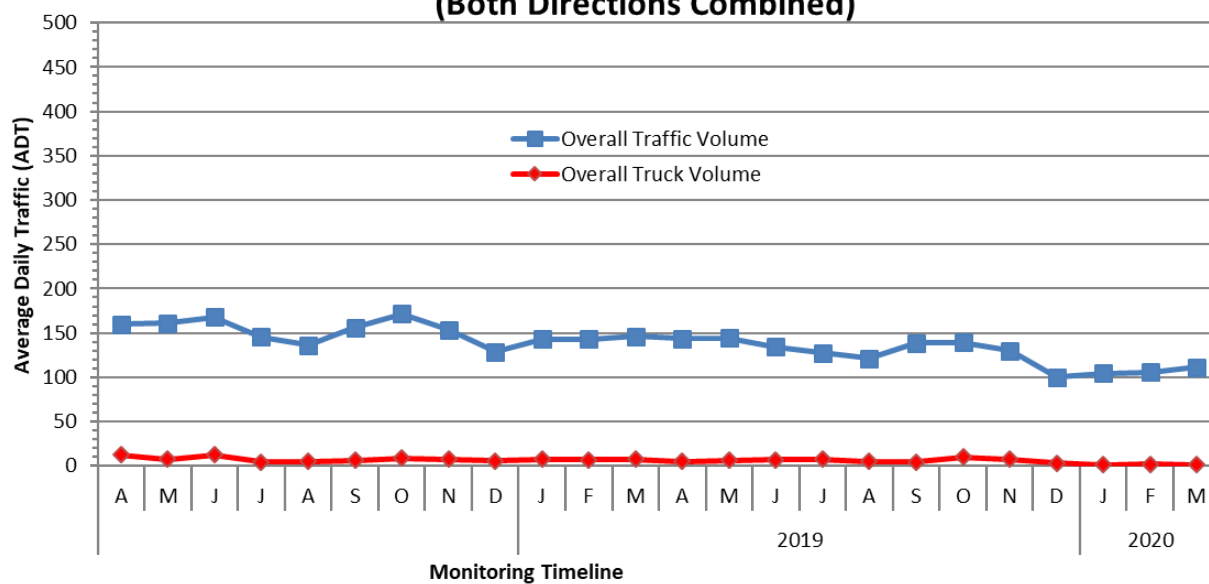


## Appendix D – Truck Traffic vs Total Traffic

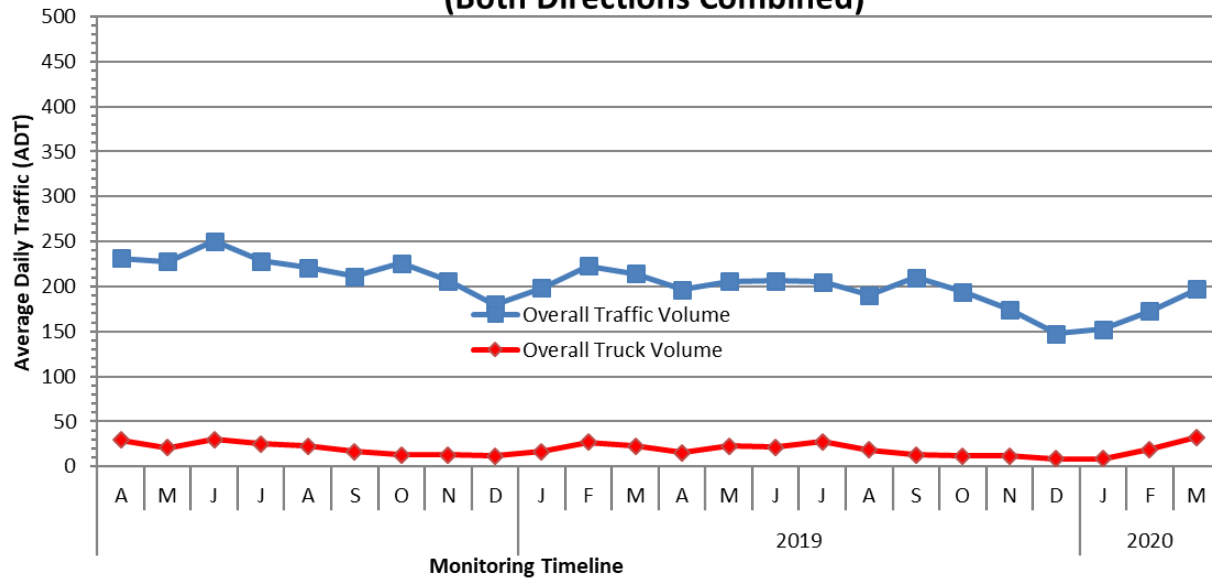
**Total Traffic vs Truck Traffic at Site 2 - Monthly Variations  
(Both Directions Combined)**



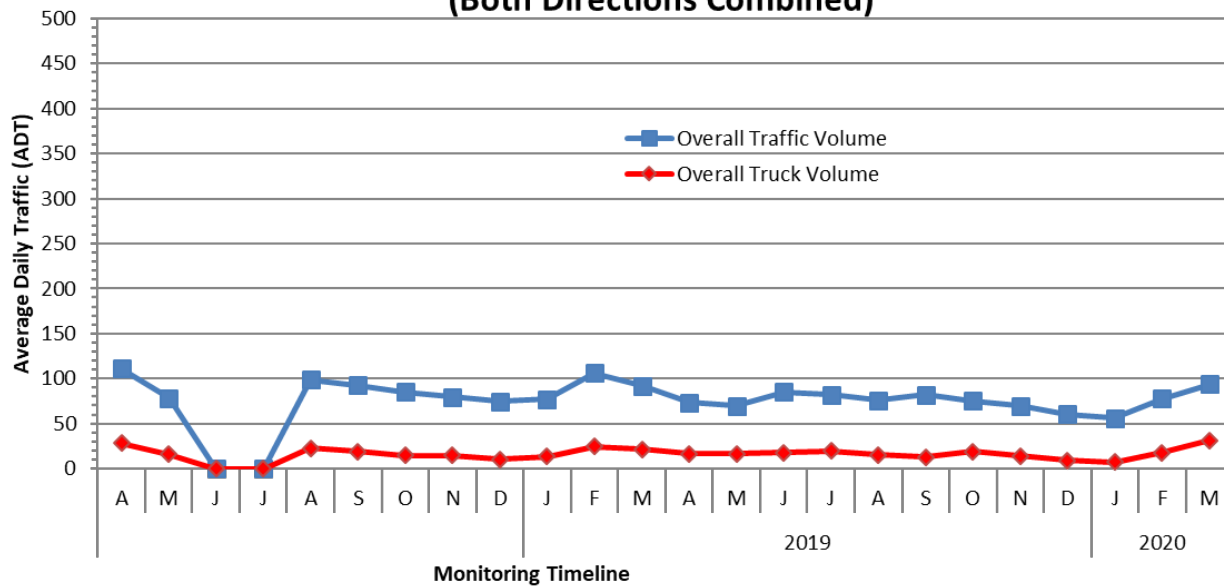
**Total Traffic vs Truck Traffic at Site 3 - Monthly Variations  
(Both Directions Combined)**



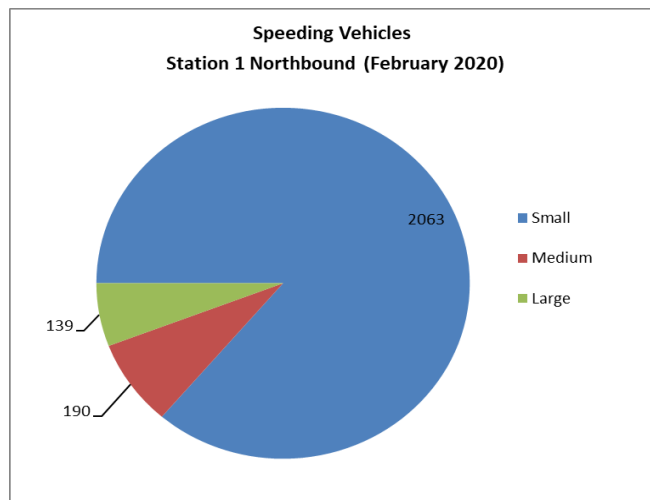
**Total Traffic vs Truck Traffic at Site 10 - Monthly Variations  
(Both Directions Combined)**



**Total Traffic vs Truck Traffic at Site 11 - Monthly Variations  
(Both Directions Combined)**

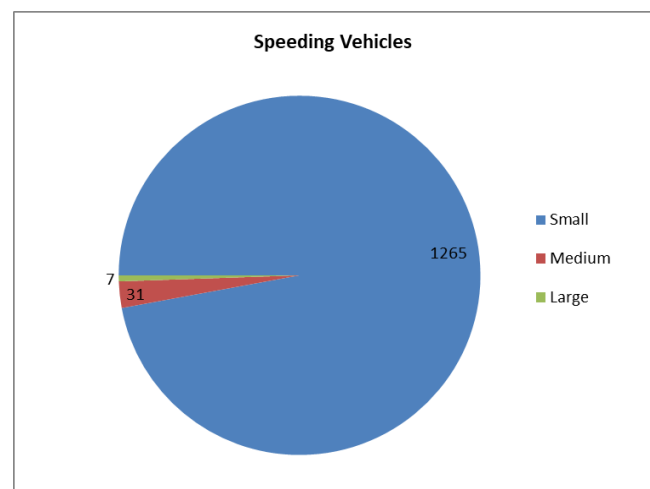


## Appendix E – Speed Data by Vehicle Type



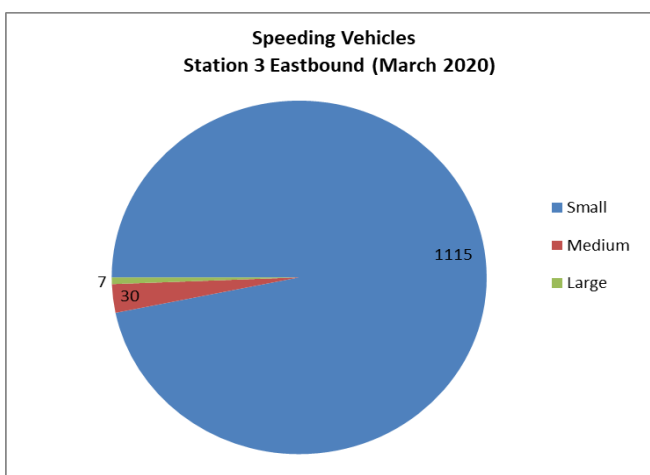
Northbound - Station 1 February 2020				
	Vehicle Length (cm)			Total
	Bin #1	Bin #2	Bin #3	
	0-702	703-1202	1203-3500	
<= 90 kph	2283	265	530	3078
	52.5%	58.2%	79.2%	56.3%
> 90 kph	2063	190	139	2392
	47.5%	41.8%	20.8%	43.7%
> 100 kph	787	64	22	873
	18.1%	14.1%	3.3%	16.0%
> 110 kph	202	17	1	220
	4.6%	3.7%	0.1%	4.0%
Total	4346	455	669	5470

Station 1 – PR 280 between PR 391 and Split Lake (Southbound)



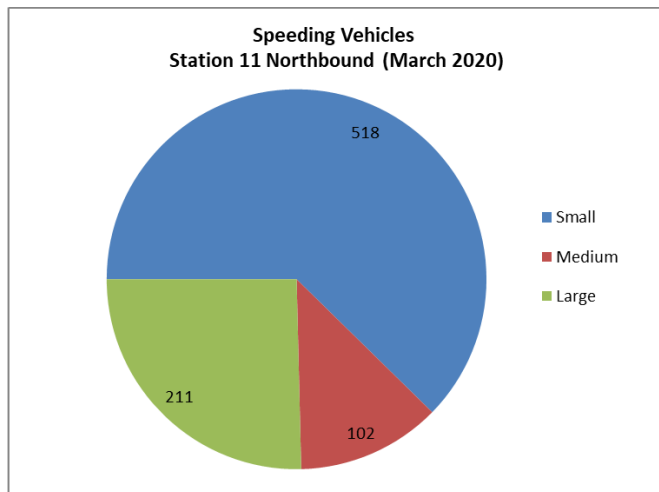
Speed Data Westbound - Station 3 March 2020				
	Vehicle Length (cm)			Total
	Small	Medium	Large	
	0-702	703-1202	1203-3500	
<= 90 kph	372	32	8	412
	22.7%	50.8%	53.3%	24.0%
> 90 kph	1265	31	7	1303
	77.3%	49.2%	46.7%	76.0%
> 100 kph	706	7	3	716
	43.1%	11.1%	20.0%	41.7%
> 110 kph	307	2	0	309
	18.8%	3.2%	0.0%	18.0%
Total	1637	63	15	1715

Station 3 – PR 290 East of PR 280 and PR290 Intersection (Westbound)



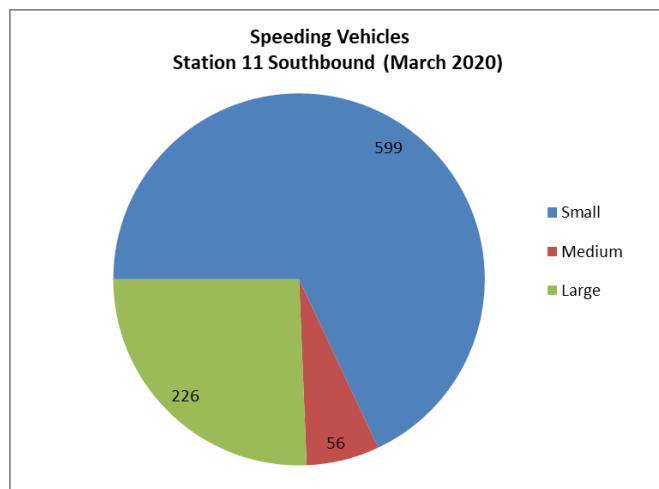
Speed Data Eastbound - Station 3 March 2020				
	Vehicle Length (cm)			Total
	Small	Medium	Large	
	0-702	703-1202	1203-3500	
<= 90 kph	521	41	16	578
	31.8%	57.7%	69.6%	33.4%
> 90 kph	1115	30	7	1152
	68.2%	42.3%	30.4%	66.6%
> 100 kph	503	14	2	519
	30.7%	19.7%	8.7%	30.0%
> 110 kph	206	3	1	210
	12.6%	4.2%	4.3%	12.1%
Total	1636	71	23	1730

Station 3 – PR 290 East of PR 280 and PR290 Intersection (Eastbound)



Speed Data				
Northbound - Station 11				
March 2020				
	Vehicle Length (cm)			Total
	Small	Medium	Large	
	0-702	703-1202	1203-3500	
<= 90 kph	303	90	290	683
	36.9%	46.9%	57.9%	45.1%
> 90 kph	518	102	211	831
	63.1%	53.1%	42.1%	54.9%
> 100 kph	312	50	35	397
	38.0%	26.0%	7.0%	26.2%
> 110 kph	145	8	7	160
	17.7%	4.2%	1.4%	10.6%
<b>Total</b>	<b>821</b>	<b>192</b>	<b>501</b>	<b>1514</b>

**Station 11 – PR 280 between East of Keeyask Gate and PR 290 (Northbound)**



Speed Data				
Southbound - Station 11				
March 2020				
	Vehicle Length (cm)			Total
	Small	Medium	Large	
	0-702	703-1202	1203-3500	
<= 90 kph	216	53	251	520
	26.5%	48.6%	52.6%	37.1%
> 90 kph	599	56	226	881
	73.5%	51.4%	47.4%	62.9%
> 100 kph	374	25	99	498
	45.9%	22.9%	20.8%	35.5%
> 110 kph	154	8	18	180
	18.9%	7.3%	3.8%	12.8%
<b>Total</b>	<b>815</b>	<b>109</b>	<b>477</b>	<b>1401</b>

**Station 11 – PR 280 between East of Keeyask Gate and PR 290 (Southbound)**

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## Appendix F – Annual Collision Summary

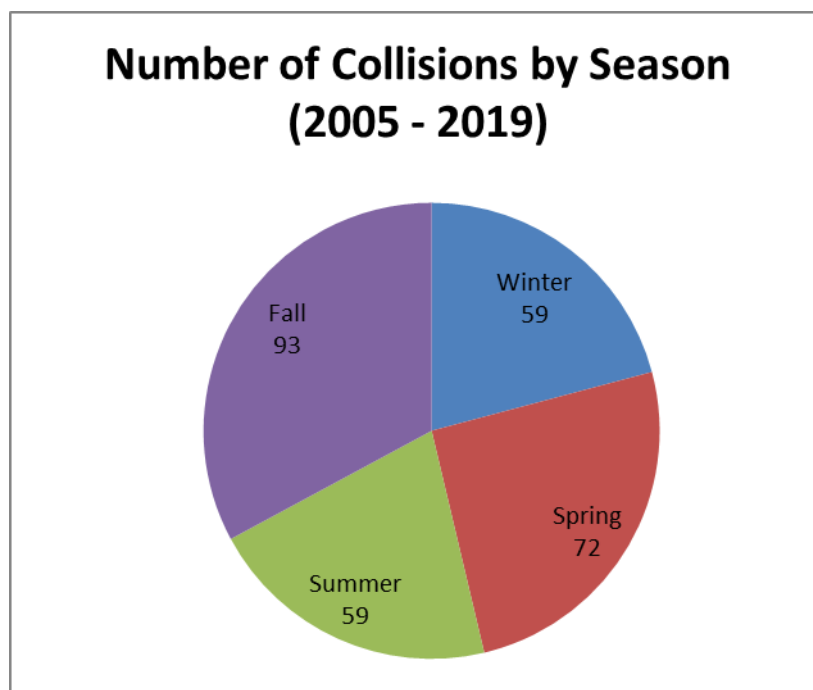
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Reported collision data has been tracked by MPI up to the end of 2019. MPI is only able to log collisions that are reported and the details are limited to what is provided. In addition, the local RCMP detachment provides information on reported collisions.

Collision data is provided by MPI annually in January for PR 280. Collision data for PR 290 is very low and ranges from 0 collisions to a high of 2 collisions per year. For this reason, this data is not included in the following tables and graphs.

A collision is defined as any reported incident involving a personal injury or property damage to a vehicle. Property damage can be attributed to collisions with wildlife, running off the road into a fixed object, head on or side swipe collisions with other vehicles, overturned vehicles, and damage to vehicles as a result of hitting potholes/ruts. It does not include cracked or broken windshields from rocks kicked up by passing vehicles as this would not constitute a reportable collision.

### PR 280 Number of Collisions by Season (2005-2019)



### Summary

- There were a total of 283 collisions on PR 280 between 2005 and 2019.
- Average of 19 collisions per year.
- 25% of collisions occurred during the spring - March, April and May.
- 33% of collisions occurred during the fall - September, October and November.
- Single vehicle collisions accounted for approximately 100% percent of all collisions during the analysis period.

## PR 280 Collision Severity and Contributing Factors

Year	Severity			Contributing Factor		
	Property Damage	Non-Fatal Injury	Fatality	Wildlife	Ran-off Road	Other/Unknown
2005	12	4	0	2	8	6
2006	11	6	0	3	13	1
2007	9	3	1	0	4	9
2008	6	2	0	1	4	3
2009	10	4	1	0	9	6
2010	8	1	0	1	3	5
2011	2	2	0	0	1	3
2012	2	0	0	0	1	1
2013	3	0	1	0	1	3
2014	26	4	0	6	3	21
2015	23	1	0	6	6	12
2016	34	3	0	7	8	22
2017	46	0	0	15	9	22
2018	28	1	0	8	6	14
2019	29	1	0	7	6	16
Total	249	32	3	56	82	144

*\*Data available annually.*

### Summary

- Approximately 88% of collisions along PR 280 were property damage.
- Running off the road was the contributing factor in 29% of collisions.
- Other factors, including collisions with other vehicles and overturning in the roadway accounted for approximately 51% of all reported collisions.
  - Typical causes are considered to be: loss of control, fatigue, speeding along curved sections or attempting to avoid another vehicle or wildlife.

## PR 280 Collision Rate

Year	Collision Rate (incidents per MVKT)
2005	0.98
2007	0.79
2009	0.82
2011	0.19
2013	0.14
2015	0.66
2016	0.97
2017	1.14
2018	0.71
Average	0.71
MI Threshold	1.5

*\*2016 collision rate revised to correct previous reporting error.*

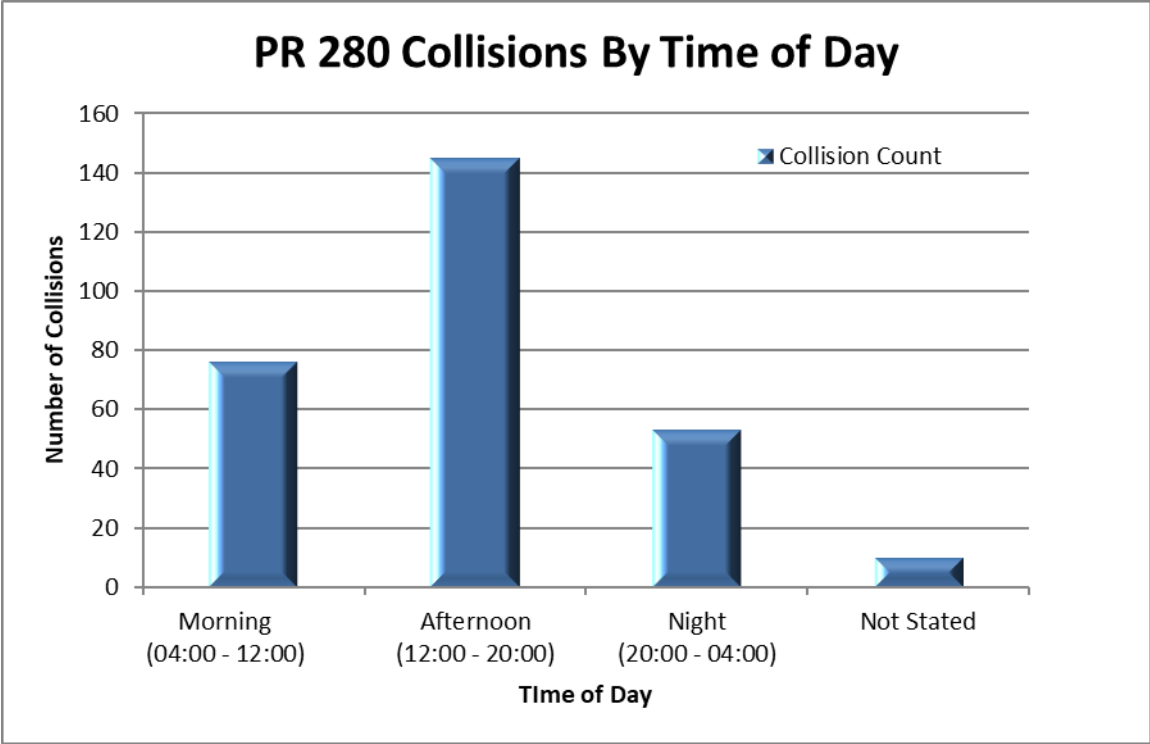
### Calculation Notes:

- Collision rate (CR) is based on the number of collisions that occurred and the volume of traffic on a section of roadway during a specified period.
- CR is measured as the number of collisions per million vehicle-kilometres of travel (MVKT) on a section of roadway during the analysis period.
- Traffic volumes used in calculating the collision rate are the average of the annual average daily traffic (AADT) volume recorded each year over the eleven year period.
- Many agencies consider road sections with collision rates exceeding 1.5 incidents per MVKT as warranting further review.
- AADT counts used to calculate collision rate are based on a collection period of two weeks. Counts are extrapolated from two week count.

### Summary:

- Based on the AADT and the number of collisions for 2005, 2007, 2009, 2011, 2013, 2015, 2016, 2017 and 2018 PR 280 has an average collision rate of approximately 0.71 incidents per MVKT over the study period.
- Low number in collisions in 2018 resulted in a low collision rate.
- The collision rate of 0.71 remains below the industry standard threshold of 1.50 incidents per MVKT.
- 2019 data not available at this time.

**PR 280 Collisions by Time of Day**



*January 1, 2005 – December 31, 2019  
Data available annually.*

**Summary:**

- Approximately 51% of collisions occur in the afternoon.
- Approximately 27% of collisions occur in the morning.
- Daytime collisions are predominant.