



MANITOBA – MINNESOTA TRANSMISSION PROJECT
Environmental Impact Statement

ASSESSMENT OF POTENTIAL SOCIAL EFFECTS ON COMMUNITY HEALTH AND WELL-BEING

CHAPTER 19
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ABBREVIATIONS AND ACRONYMS

ACS	ambulatory care sensitive
ATK	Aboriginal traditional knowledge
CEAA	<i>Canadian Environmental Assessment Act, 2012</i>
EIS	environmental impact statement
EMF	electromagnetic frequency
EMS	emergency medical response services
EMT	emergency medical technician
ER	emergency room
ESA	environmental and socio-economic assessment
FNFNES	First Nations Food, Nutrition and Environment Study
FNIHB	First Nations and Inuit Health Branch
FNMEP	First Nation and Metis engagement process
FTE	full-time equivalent
GI	gastrointestinal
HIA	health impact assessment
IARC	International Agency for Research on Cancer
kV	kilovolt
KPI	key person interviews
LAA	local assessment area
MMTP	Manitoba–Minnesota Transmission Project
MRI	magnetic resonance imaging
NEB	National Energy Board
PDA	Project development area
PTH	provincial trunk highway
PY	person-years
RAA	regional assessment area
RHA	regional health authority



RHS	regional health survey
RM	rural municipality
ROW	right-of-way
RVTC	Riel–Vivian Transmission Corridor
SLTC	Southern Loop Transmission Corridor
STARS	shock trauma air rescue
STI	sexually transmitted infection
TDR	technical data report
VC	valued component
WHO	World Health Organization

GLOSSARY OF TECHNICAL TERMS

All-cause mortality	The rate of people who die from all causes
Community sense of place	Those characteristics that make a location special or unique, as well as foster a sense of authentic human attachment and belonging
Cultural continuity	The activities and supportive factors that enable the transmission of cultural knowledge from one generation to the next
Infant mortality	The rate of death among infants under one year of age
Morbidity	The relative incidence of disease
Premature mortality	The rate of death in people younger than 75 in a population
Potential years of life lost	The average number of years lost due to death before age 75

19 Assessment of Potential Social Effects on Community Health and Well-being

19.1 Introduction

Manitoba Hydro is proposing construction of the Manitoba–Minnesota Transmission Project (MMTP, or the Project), which involves the construction of a 500 kilovolt (kV) AC transmission line in southeastern Manitoba. The transmission line would originate at the Dorsey Converter Station northwest of Winnipeg, continue south around Winnipeg and within the Existing Transmission Corridor (Existing Corridor), the Southern Loop Transmission Corridor (SLTC) and the Riel–Vivian Transmission Corridor (RVTC), to just east of Provincial Trunk Highway (PTH) 12. The transmission line then continues southward on a New Right-of-way (New ROW) across the rural municipalities of Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn and Piney to the Manitoba–Minnesota border crossing south of the community of Piney. The Project also includes the construction of terminal equipment at the Dorsey Converter Station, electrical upgrades within the Dorsey and Riel converter stations, and modifications at the Glenboro South Station requiring realignment of transmission lines entering the station.

Based on the above description, the assessment of the Project is divided into three components:

- transmission line construction in the Existing Corridor, extending from Dorsey Converter Station to just east of PTH 12
- transmission line construction in a New ROW, extending south from the Anola area to the border by Piney
- station upgrades—at Glenboro South Station, Dorsey Converter Station and Riel Converter Station—and transmission line realignment work at Glenboro South Station.

The assessment of community health and well-being focusses on social and economic influences on human health, such as those caused by sudden changes in the composition or socio-economic condition of a local population. These are distinguished from human health effects (Chapter 18), which are Project effects resulting from environmental change, such as change in air quality or water quality.

Community health and well-being is a valued component (VC) because social and economic changes resulting from the Project may have health effects on residents within the local assessment area (LAA). Such effects may be manifested as increased stress or annoyance, or as changes in the physical health of some LAA residents, potentially resulting in an increased demand for health services. While there are no First Nation reserves located in the LAA, the Project may cause health effects on specific Aboriginal groups, including changes in food

security, diet and nutrition through increased access to land and competition for hunting and trapping activities; and clearing vegetation resulting in the loss of traditional foods.

This chapter assesses potential effects on community health and well-being caused by the introduction of the Project, including:

- changes in social and economic conditions, such as an increase in population (*i.e.*, a temporary, mobile workforce) and enhanced economic activity in the region;
- stress and annoyance in the local population due to factors such as a lengthy environmental and regulatory review process and disturbance caused by the new transmission towers;
- change in Aboriginal health due to alteration of the landscape and subsequent potential decrease in the consumption of subsistence foods and traditional medicines; and
- effects on health care services and infrastructure, such as the effects of additional demand for services.

For further discussions linked to community health and well-being, see:

- Chapter 11 – Traditional Land and Resource Use: The ability to undertake traditional activities is dependent on many factors, including access to healthy lands and resources (including animal and plant species), a sustainable environment, having the knowledge of where and how to conduct these activities, and sites such as trails, sacred areas, campsites, and harvesting areas.
- Chapter 13 – Infrastructure and Services: Potential effects on local health care services are associated with discussions on the availability and effect on emergency and protection services (fire, ambulance, and police) and health services.
- Chapter 14 – Employment and Economy: Potential effects on community health and well-being discussed in this chapter are linked to employment and economy because income and employment are social determinants of health.
- Chapter 17 – Visual Quality: Potential effects on visual quality discussed in this chapter can contribute to stress and annoyance due to the perception that aesthetic quality, recreation values, or property values will be affected.
- Chapter 18 – Human Health Risk: Potential changes and effects on air quality, herbicide use, electromagnetic frequency (EMF) exposure and noise may effect community health and well-being, by affecting health outcomes at the community level (*i.e.*, rates of illnesses).

19.1.1 Regulatory and Policy Setting

19.1.1.1 Primary Regulatory Guidance

A list of the various regulatory requirements that were considered in developing this environmental impact statement (EIS) can be found in the Project description (Chapter 2, Section 2.3). Particular consideration was given to the following federal and provincial legislation and guidelines in the preparation of this environmental assessment:

- the Project Final Scoping Document, issued on June 24 2015 by Manitoba Conservation and Water Stewardship's Environmental Approvals Branch, which represents the Guidelines for this EIS
- the relevant filing requirements under the *National Energy Board Act* (R.S.C., 1985, c. N-7), and guidance for environmental and socio-economic elements contained in the National Energy Board (NEB) Electricity Filing Manual, Chapter 6
- the *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52) and its applicable regulations and guidelines

19.1.1.2 Additional Federal and Provincial Guidance

In addition to the requirements pursuant to NEB (2014) and CEAA 2012, the federal and provincial organizations outlined in Table 19-1 are most relevant to the management of community health and well-being in Manitoba.

Sustainable Development Policy

Manitoba Hydro has adopted a sustainable development policy and 13 guiding principles that influence corporate decisions, actions and day-to-day operations to achieve environmentally sound and sustainable economic development (Manitoba Hydro 1993). Manitoba Hydro applies the principles of sustainable development in all aspects of its operations (Chapter 23). Through corporate decisions and actions to provide electrical services, Manitoba Hydro endeavors to meet the needs of the present without compromising the ability of future generations to meet their needs (Manitoba Hydro n.d.1).

Table 19-1 Government Organizations Relevant to Community Health and Well-being

Provincial and Federal Organizations	Role
Federal	
Aboriginal Affairs and Northern Development	Supports Aboriginal people (First Nations, Inuit and Metis) and residents of the North in improving their social well-being and economic prosperity and promoting healthy, sustainable communities; responsible for providing and administering services related to education, emergency management, employment, lands and economic development, infrastructure and housing, and social programs.
Health Canada	Manages and communicates to Canadians health risks and benefits associated with food, products, substances, and environmental factors; supports delivery of, and access to, health programs and services for Aboriginal peoples.
Public Health Agency of Canada	Promotes health of Canadians; prevents and controls chronic diseases and injuries; prevents and controls infectious diseases; prepares for and responds to public health emergencies; strengthens intergovernmental collaboration on public health and facilitates national approaches to public health policy and planning.
Provincial	
Manitoba Health	Provides strategic direction and leadership to the provincial health system; manages the insured benefits claims payments for residents of Manitoba related to the cost of medical, hospital, personal care, Pharmacare and other health services. Most direct services are delivered through RHAs and other health care organizations; however, the department manages the direct operations of Selkirk Mental Health Centre, Cadham Provincial Laboratory and provincial nursing stations (Government of Manitoba n.d.).
Manitoba Housing and Community Development	Provides policy direction on matters relating to housing and community development; provides financial and administrative support for the development, delivery and management of housing and community development programs and operations; assists Manitobans in accessing safe, appropriate and affordable housing; fosters community capacity and engages the broader community to participate in and contribute to decision-making; and provides respectful and appropriate delivery of programs and services (Government of Manitoba n.d.).
Manitoba Aboriginal and Northern Affairs	Supports services related to safe, healthy and secure environments, concluding agreements related to adverse effects of hydro development, treaty land entitlement and other land-related matters, accounting, fiscal management and control, financial analysis and reporting, and policy development and review for the Department (Government of Manitoba n.d.).
Manitoba Education and Advanced Learning	Provides direction and allocates resources in support of youth programming and kindergarten to grade 12 education in public and funded independent schools (Government of Manitoba n.d.).

SOURCE: AANDC 2015; Health Canada 2008; Public Health Agency of Canada 2014

19.1.2 Engagement and Key Issues

19.1.2.1 First Nation and Metis Engagement Process

During the First Nation and Metis engagement process (Chapter 4), which included leadership meetings, open houses/community information sessions, ATK studies, routing workshops, Project site tours, and tours of similar projects, Manitoba Hydro heard concerns about the Project's potential effects on human and wildlife health.

19.1.2.2 Public Engagement

As part of Manitoba Hydro's Public engagement process, input was collected from local municipalities, stakeholder groups, government departments, local landowners, and the public concerning the Project.

Key issues regarding community health and well-being identified through these processes and the sections in the EIS where they are addressed are summarized in Table 19-2.

Table 19-2 Key Issues and Concerns Addressed in the EIS

Comment/Concern	EIS Reference
Stress and annoyance related to perceived risks associated with interference of current and planned land uses (e.g., proximity to residences, property values, tourism, recreation, quality of life and cultural identity)	Chapter 16 – Land and Resource Use Chapter 19 – Community Health and Well-being (Sections 19.4.1.5, 19.5.4 and 19.6.2)
Concerns related to the proximity of a work camp and how close it might be located to local communities	Chapter 3 – Public Engagement Chapter 13 – Infrastructure and Services
Demand by Project workforce on the capacity of primary care and episodic care	Chapter 19 – Community Health and Well-being (Section 19.5.7)
Traffic safety and ambulance access in construction areas	Chapter 3 – Public Engagement Chapter 13 – Infrastructure and Services

Consideration of these issues and feedback from the engagement processes were incorporated into transmission line routing (Chapter 5) and was considered during the assessment and development of mitigation measures for potential effects.

19.2 Scope of Assessment

19.2.1 Community Health and Well-being Spatial Boundaries

The spatial boundaries for community health and well-being are listed here and shown in Map 19-1 – Regional Study Area Community Health and Well-being:

- **Project development area (PDA):** encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project (see Map Series 7-100 - Project Development Area).
- **local assessment area (LAA):** includes the PDA and the boundaries of all RMs traversed by the PDA. Communities outside the RMs with a reasonable likelihood of being used by the Project to provide health services are also considered (*e.g.*, City of Steinbach, Town of Ste. Anne, Town of Glenboro, City of Brandon, and City of Winnipeg). The LAA represents the area where direct and indirect effects on community health and well-being are likely to be the most pronounced or identifiable.
- **regional assessment area (RAA):** is the same as the LAA, as it is a sufficiently broad area to provide context for the assessment of Project effects, and the area in which cumulative effects are assessed.

19.2.2 Temporal Boundaries

Subject to the timing of regulatory approval, the following temporal boundaries are used to assess residual and cumulative social effects of the Project on community health and well-being.

- **Construction:** Construction of the transmission lines will span from Q3 2017 to Q1 2020, and modifications to Dorsey and Riel converter stations and Glenboro South Station will span from Q4 2017 to Q4 2019. The potential effects on community health and well-being are most likely during the construction phase because of the presence of the mobile workforce, stress and annoyance related to the construction of new infrastructure and potential for change in accessibility and quality of traditionally harvested foods.
- **Operation and maintenance:** The Project is expected to be in-service in 2020 and have a service life of about 100 years. Fewer effects are expected during the operation and maintenance phase because of a limited operation and maintenance workforce.

19.2.3 Administrative Boundaries

Health care services in Manitoba are provided by geographically defined regional health authorities (RHAs), which are further divided into districts (one or more municipalities) and zones (groupings of districts). Some health outcome data are available only at the level of the RHA, whereas many health care utilization indicators are available at the zone and district level. Data are therefore presented at the RHA level, except for indicators for health care utilization, which are presented at both RHA and district levels, depending on data availability. It should be noted that all data available at the RHA level, and some data at the district level, are not necessarily representative of the communities and RMs in the LAA, whose geographic boundaries may be smaller than those for which the data were collected.

The communities and RMs included in the LAA correspond to four of those five RHAs and related health districts, as shown in Table 19-3 and Map 19-1 - Regional Assessment Area Community Health and Well-being.

Table 19-3 LAAs and Corresponding Health District and RHA

LAA Communities and RMs	Health District	RHA
RM of Headingley	Cartier/St. Francois Xavier	Southern Health (Population: 175,230)
RM of La Broquerie	Ste. Anne/La Broquerie	
Town of Ste. Anne		
RM of Ste. Anne		
RM of Macdonald	Macdonald	
RM of Piney	Rural East	
RM of Stuartburn		
RM of Ritchot	Niverville/Ritchot	
RM of Tache	Tache	
City of Steinbach*	Steinbach	
RM of South Cypress/Village of Glenboro	Spruce Woods	Prairie Mountain Health (Population: 161,325)
City of Brandon*	Brandon	
RM of Rosser	Stonewall/Teulon	Interlake-Eastern (Population: 123,215)
RM of Springfield	Springfield	
City of Winnipeg *	Winnipeg	Winnipeg (Population: 678,405)

NOTES:

The City of Brandon, City of Winnipeg, and City of Steinbach were included in the LAA/RAA for community health and well-being for the assessment of healthcare infrastructure and services.

In May 2012, the Province merged its 11 operational RHAs into five RHAs (Table 19-4) (Government of Manitoba 2012). This merger is relevant to the existing conditions for the community health and well-being VC because some data from prior to the 2012 merger are available only at the level of the (smaller) former RHAs. The communities included in the LAA are represented in four of those five RHAs (Table 19-4).

Table 19-4 Current and Former RHAs

RHA prior to 2012	Current RHA
Central	Southern Health
South Eastman	
Winnipeg	Winnipeg
Churchill	
Assiniboine	Prairie Mountain Health
Brandon	
Parkland	
Interlake	Interlake-Eastern
North Eastman	
Burntwood	Northern
NOR-MAN	

19.2.4 Learnings from Past Assessments

To ensure the assessment of community health and well-being was both comprehensive and addressed the appropriate effects, documentation related to the regulatory review of Manitoba Hydro's past EISs (Bipole III and the Keeyask Generation projects) was considered in the scoping of Project effects. Additionally, a review of relevant large transmission lines and linear development projects was undertaken to identify related issues and concerns, as well as residual effects and conclusions. The review of these environmental assessments and related monitoring programs informed the application of mitigations needed to manage similar effects.

Manitoba Hydro has demonstrated a trajectory of learning that continues with the EIS for the Project. The Bipole III EIS was critiqued for gaps in the baseline and assessment of effects, a too-narrow definition of health, and lack of specific public health mitigation measures. The EIS for the Keeyask Generation Project was more successful in this regard. As stated in the submission made by CAC Manitoba and the Public Interest Law Centre of Manitoba (Habitat Health Impact Consulting 2013):

...the Keeyask EIS presents a much broader examination of the Project's effects on health of the local population....Overall, this EIS provides a very detailed assessment of the potential impact of

the Keeyask Generation Project. It includes information on important health determinants and predicts potential health effects that may be associated with the Project.

All the health-related topics raised in the regulatory reviews of both the Bipole III Transmission Project and the Keeyask Generation Project that are relevant to the Project, as well as health-related topics raised in other transmission line and linear development projects, have been addressed in this assessment or other sections of this EIS (Table 19-5). For this Project, additional issues have been added to this list as appropriate (e.g., diet and nutrition), and the approach has been modified to fit the setting of the Project (southern Manitoba rather than northern Manitoba) and the type of facility being proposed (transmission line rather than a generating station).

Table 19-5 Health Topics Raised in Relation to Other Assessments

Topic	Where addressed in MMTP EIS
Health effects associated with social and economic change	Chapter 19 – Community Health and Well-being
Infectious disease transmission	Chapter 19 – Community Health and Well-being
Diet and nutrition	Chapter 19 – Community Health and Well-being
Injury and public safety	Chapter 19 – Community Health and Well-being
Stress and mental well-being	Chapter 19 – Community Health and Well-being
Emergency health response	Chapter 19 – Community Health and Well-being
Health care services	Chapter 19 – Community Health and Well-being
Noise	Chapter 18 – Human Health Risk
EMF	Chapter 18 – Human Health Risk
Exposure to contaminants	Chapter 18 – Human Health Risk
Accidents and malfunctions	Chapter 21 – Accidents, Malfunctions and Unplanned Events

A review of the following large transmission lines and linear developments was undertaken to ensure that the community health and well-being elements included in this EIS were both comprehensive and appropriate:

- Interior to Lower Mainland Transmission Project, British Columbia (Golder Associates 2008)
- Northwest Transmission Line Project, British Columbia, British Columbia Transmission Corporation (BCTC 2010)
- North Montney Mainline Project, British Columbia (Stantec 2013)

Community health and well-being issues and concerns, and residual effects and conclusions from the environmental assessments undertaken for these projects are summarized in Table 19-6. These projects identified similar issues and concerns to those identified in the public and First Nation and Metis engagement processes for MMTP.

Table 19-6 Community Health and Well-being Issues from Other Projects

Issue/Concern	Residual Effect/Conclusion
Noise and sensory disturbance from construction	Residents near the Project may be able to hear construction noises, and may be annoyed from the increases in daytime noise; however, the elevated noise levels would be short term and would not occur at night. No adverse significant health effects were predicted (BCTC 2010)
Acute or chronic effects from EMF emissions due to short-term exposure (e.g., hunting, berry picking, hiking, along the ROW) or long-term exposure (living adjacent to the ROW) Potential EMF effects on livestock, wildlife, and vegetation	No potential residual adverse health effects were predicted for short-term or long-term exposure to EMF (Golder 2008; BCTC 2010) No significant adverse effects from EMF on flora or fauna were predicted (Golder 2008; BCTC 2010)
Increased demands on healthcare and emergency Project construction (e.g., fires along the PDA, construction traffic-related accidents, worker accidents and altercations)	Given the size of the workforce, the staggered and short-term construction schedule, and the capacity of emergency services to respond to additional demand, the Project is not predicted to noticeably affect emergency or medical services and facilities or cause delays or disruptions to the level of service presently available to area residents (BCTC 2008)

From the review of Manitoba Hydro's prior experience, the experience of other large transmission projects and from feedback from the engagement processes, it was concluded that the scope of assessment of community health and well-being was appropriate.

19.3 Methods

19.3.1 Existing Conditions Methods

The description of baseline community health and well-being conditions provide information and context to:

- identify health vulnerabilities, challenges and opportunities in the potentially affected population so that the Project does not exacerbate problems, and where possible, leverages the opportunity to improve health;
- identify the current status of health conditions such that predictions can be made about the extent of change;
- identify potentially vulnerable subsets of the population; and
- create a reference point for measuring or gauging future change in health status.

Most health outcomes are multi-factorial. They are influenced by a wide variety of causes, and change in health outcomes can rarely be ascribed to a single factor. As such, a future change in health outcomes from current conditions cannot be easily connected to Project activities or to another single source. However, this difficulty in measuring change implies that the focus of a community health assessment includes predicting quantitative change from baseline conditions, where appropriate, but also correctly identifying the pathways of influence and appropriate mitigation and enhancement strategies that align with predicted effects.

19.3.1.1 Sources of Information

The following sources of information were used to characterize the baseline conditions for community health and well-being:

- Feedback from the public engagement and First Nation and Metis engagement processes. In accordance with HIA beneficial practice, the expertise and experience of affected members of the public (local knowledge) is a legitimate and necessary source of evidence, which should be factored into the assessment (Bhatia *et al.* 2014). Community feedback was particularly helpful for assessing Project effects related to stress and annoyance.
- Information provided in related chapters (e.g., Chapter 11 – Traditional Land and Resource Use, Chapter 13 – Infrastructure and Services, Chapter 14 – Employment and Economy, and Chapter 18 – Human Health Risk).
- Learnings from past projects: This information contributed to the understanding of the nature of project interactions and the pathways and effects from such interactions. Relevant and applicable mitigation measures from past projects were also carried forward into this EIS.
- Relevant academic and gray literature.
- Key person interviews (KPIs): Qualitative data from KPIs provided detailed and context-specific information about local conditions at the appropriate geography and service level.

This enabled the assessment of Project effects at the LAA scale, since much of the quantitative baseline data is available at larger, unrepresentative geographies or lacks specificity.

- Workforce injury prediction: Workplace injury statistics available from Safe Work Manitoba (2014) was used to estimate the number of Project workers that may require medical attention. This was estimated using the following relationship:

$$\text{Number of workers requiring medical attention} = IR \times PWF$$

where:

IR = 2013 Heavy construction all injury rate

PWF = Project workforce in person years or person months

This estimate assumes that all injured workers will require medical attention. In reality, many injured workers are treated by first aid attendants on-site, and will not require medical attention. In 2013 less than half of the injuries reported to Safe Work Manitoba were time loss injuries (requiring time off in addition to the day of the injury).

19.3.1.1.2 Desktop Analysis

Both primary and secondary data gathering were used to develop a profile of existing conditions relevant to the health of residents in the LAA and RAA, on a community level where possible. As noted in Section 19.2.3, data at the community level are commonly unavailable for health-related indicators.

Desktop analysis was undertaken using the health impact assessment (HIA) methodology, which in Canada and internationally, is considered an accepted practice in terms of a method to identify, characterize and act on the potential health effects of development projects on community health outcomes. Several relevant guidance documents describe beneficial HIA practice, which are followed in this assessment. These guidelines include:

- Bhatia R, Farhang L, Heller J, Lee M, Orenstein M, Richardson M and Wernham A. *Minimum Elements and Practice Standards for Health Impact Assessment, Version 3*. September 2014.
- International Finance Corporation. 2009. *Introduction to Health Impact Assessment*. Washington, D.C., US: International Finance Corporation.
- International Council on Mining and Metals. 2010. *Good Practice Guidance on Health Impact Assessment*. London, UK.
- National Research Council Committee on Health Impact Assessment (2011). *Improving Health in the United States: The Role of Health Impact Assessment*. National Academies Press.

19.3.1.1.3 Key Person Interviews

To supplement secondary data, KPIs were undertaken with representatives from the RHAs and the Government of Manitoba (Office of Disaster Management and Medical Officers of Health). Interviewees were selected based on their professional expertise, knowledge and position in relation to the health areas examined.

Verbal or written consent to participate in the interview was obtained from each interviewee. The interview protocol was sent electronically to each participant prior to the interview and verbally reviewed at the beginning of each interview; this included the assurance that their names would not be directly attached to any of the information shared. Six interviews were conducted via telephone, three of which consisted of groups of two or more interviewees who held similar positions. One participant replied to the interview questions in writing and returned their responses by email, and one participant provided written information by email (without the guidance of interview questions) at the request of another interviewee.

The KPIs followed a semi-structured interview approach. Relevant information collected during the Public engagement and First Nations and Metis engagement processes, as well as the route selection process, was also considered in the assessment.

19.3.1.1.4 Addressing Uncertainty

There are a number of limitations with respect to the availability and quality of data used in the assessment of current community health and well-being. Health data are often less precise than would be ideal, and can sometimes be several years old, which may introduce error in rapidly changing communities. As well, health data are commonly aggregated at the level of the health region to protect confidentiality and to provide stability for estimates of uncommon diseases or other health outcomes. This means that data may not precisely align with health status at a community level, particularly for smaller communities with a population profile that differs with the larger health region are inherently dynamic. Finally, community health status is not static, but rather continuously evolving as a product of social and environmental influences.

The assessment of change in community health and well-being uses a combination of qualitative and quantitative information to identify and characterize potential effects of proposed developments. These data are validated to the extent possible with key informants in the fields of health care service provision and public health in the assessment area; with experience of past projects and related effects; and through the application of beneficial practices in health impact assessment.

19.3.2 Assessment Methods

The overall socio-economic effects assessment methods are presented in Chapter 7. The specific techniques used for the assessment of community health and well-being include:

- assessment approach
- potential effects, effects pathways and measureable parameters

- effects description criteria for the VC
- significance thresholds for residual effects

19.3.2.1 Assessment Approach

19.3.2.1.1 Community Health and Well-being

Although the existing conditions description for community health and well-being is primarily comprised of quantitative data, the assessment has been largely qualitative, based on health impact assessment beneficial practices guidelines. These guidelines state that the assessment of health effects should be based on a synthesis of available evidence, which includes existing data, empirical research, professional expertise, and the products of original investigations (Bhatia *et al.* 2014; IFC 2009; ICMM 2010; NRC 2011).

19.3.2.2 Potential Social Effects, Effects Pathways and Measurable Parameters

Potential Project effects on community health and well-being were identified based on anticipated Project activities and physical works, regulatory and policy setting, and issues identified through the Public engagement and First Nation and Metis engagement processes (Section 19.1.2) as well as learnings from past assessments (Section 19.2.4).

The following potential issues and concerns related to transmission line development were considered in the selection of effects:

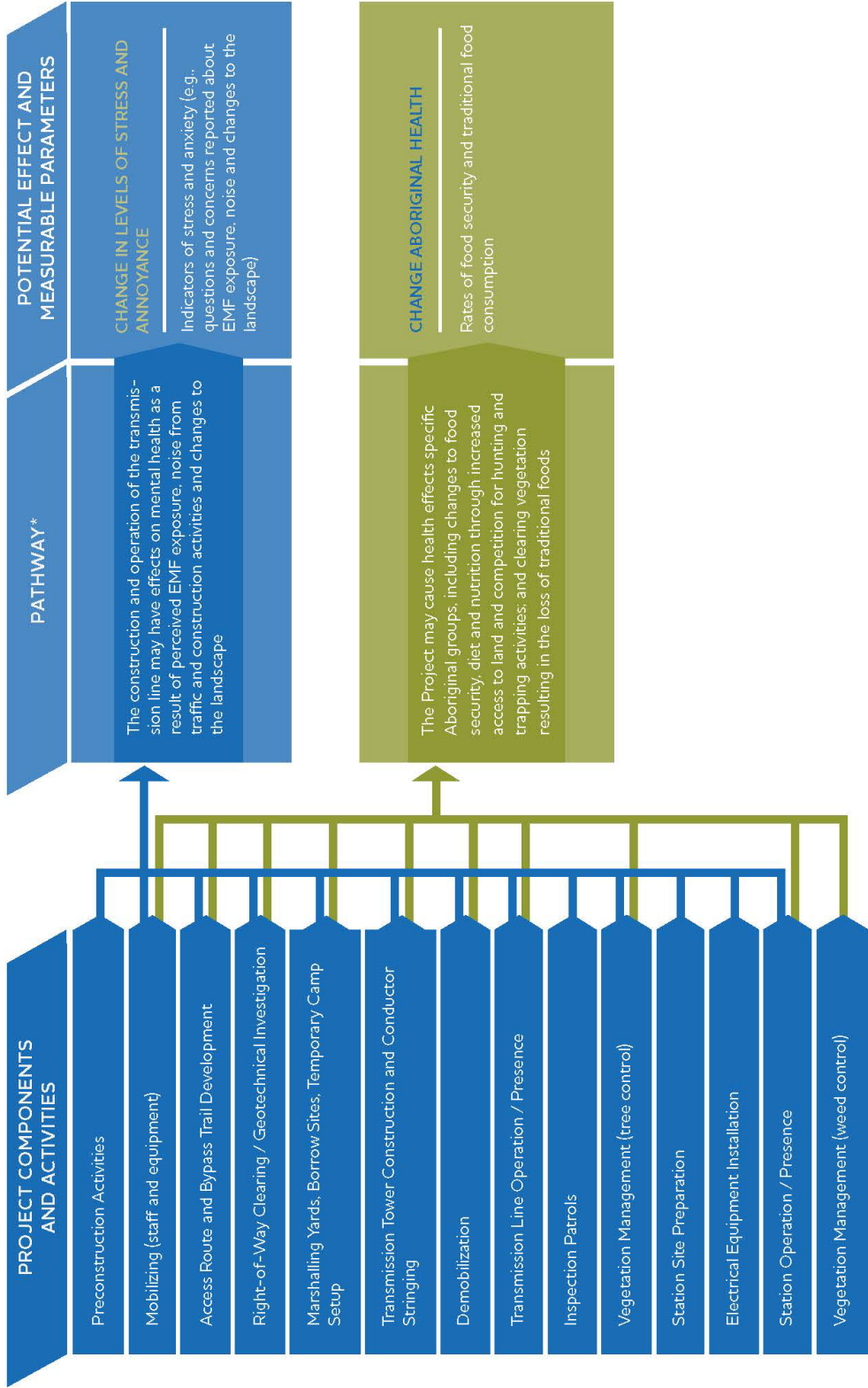
- change in health resulting from socio-economic change
- change in health associated with mobile workforce
- change in levels of stress and annoyance
- change in Aboriginal health
- change in capacity of or demand on health care services and infrastructure

The pathways through which the potential effects may occur as a result of Project components or activities are shown in Figure 19-1.

The 'social determinants of health' can be described as the social conditions that influence the outcomes of a person's individual health (Dennis 2004 and Commission on SDH). A person's well-being is also determined by the availability of and access to health and social services, and a persons' ability to obtain quality education, food, and housing, among other factors (Mikkonen and Raphael 2010).



Community Health

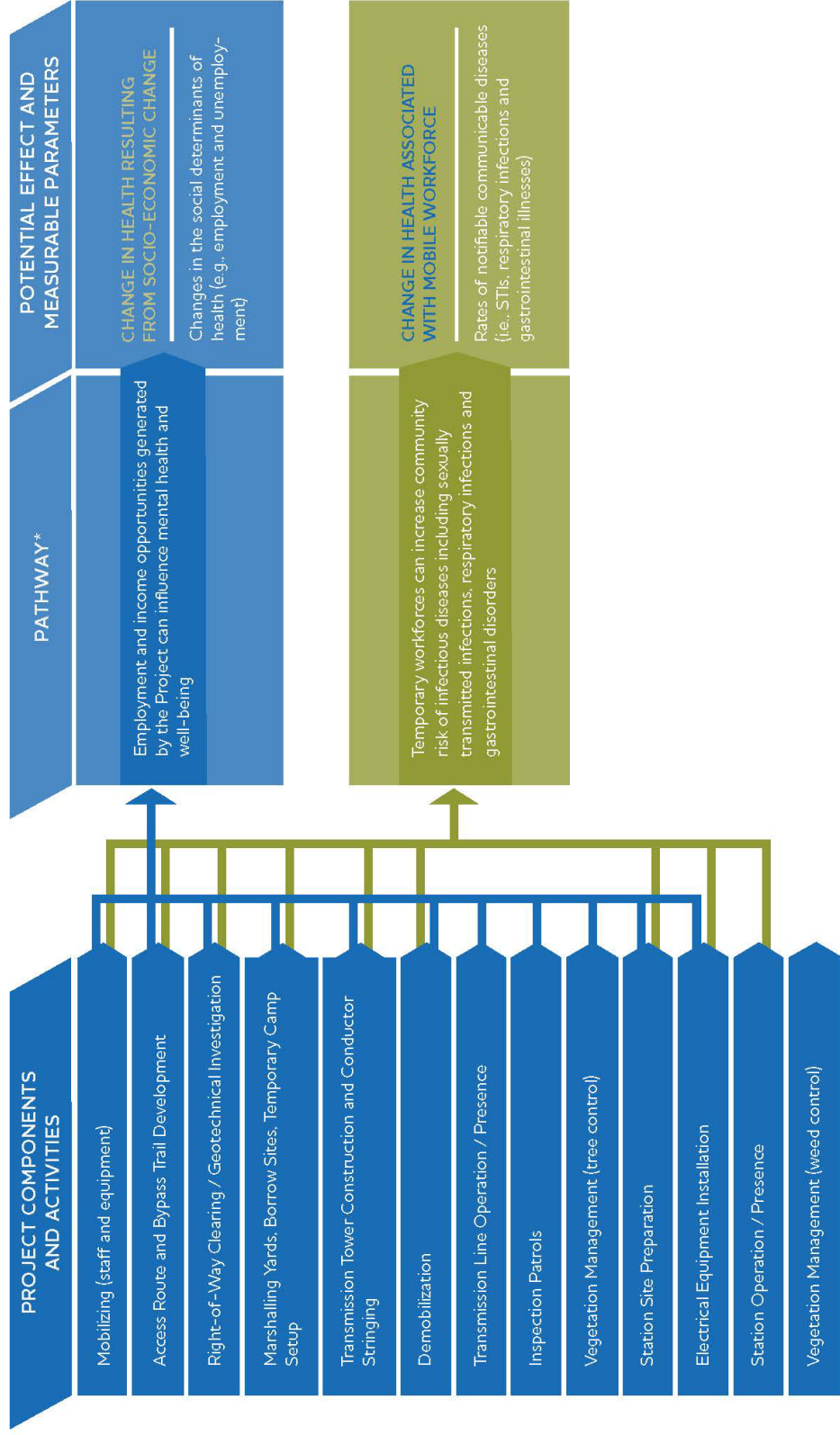


* A cause-and-effect relationship linking a project activity or component to a potential project effect

Figure 19-1 Effect Pathways



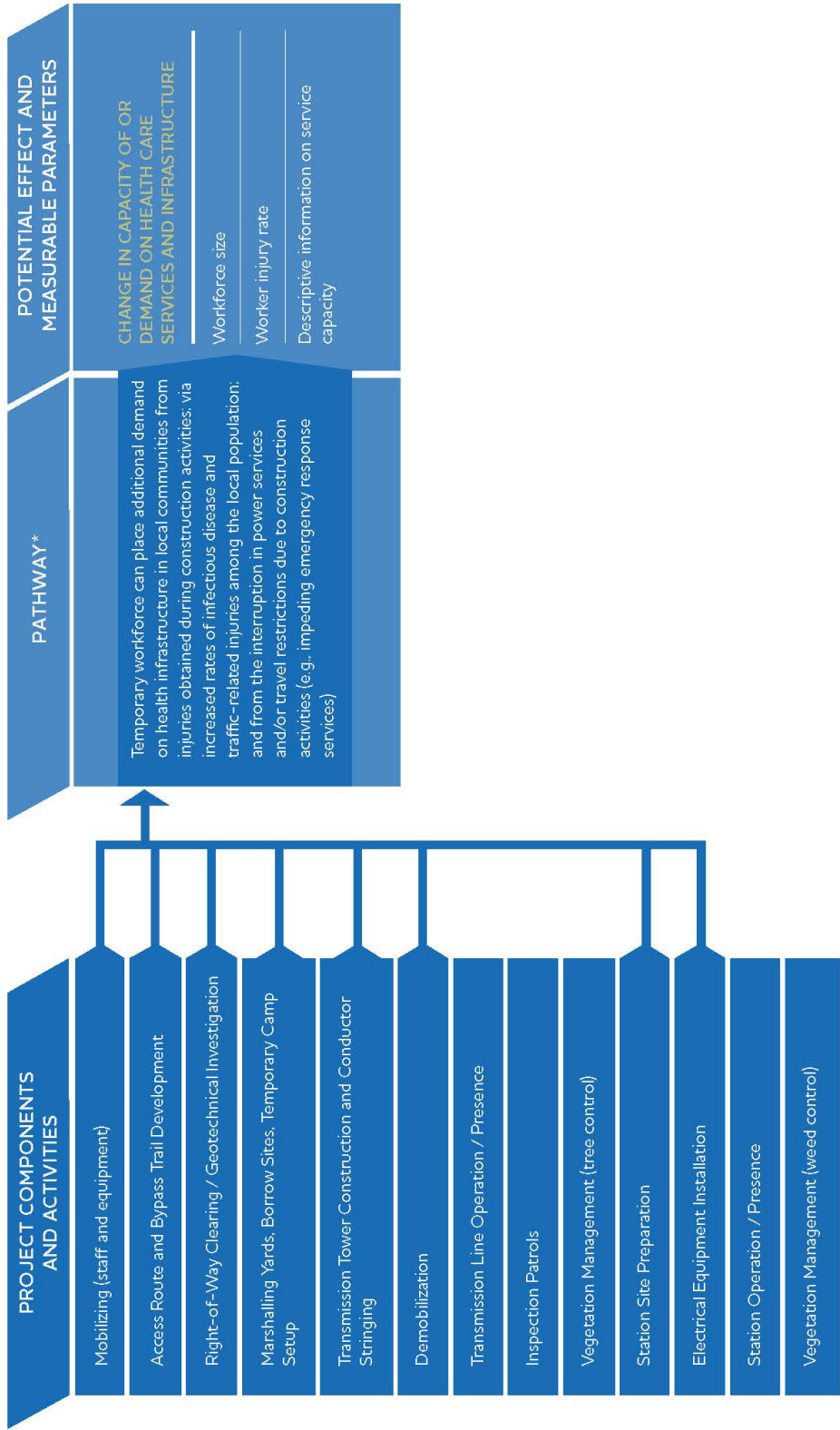
Community Health



* A cause-and-effect relationship linking a project activity or component to a potential project effect

Figure 19-1 Effect Pathways (continued)

Community Health



* A cause-and-effect relationship linking a project activity or component to a potential project effect

Figure 19-1 Effect Pathways (continued)

Within a Canadian context, there are 14 ‘social determinants’ of health that are proven to have effects on the health of people and the communities in which they live. The 14 social determinants of health are income and income distribution, education, unemployment and job security, early childhood development, food insecurity, housing, social exclusion, social safety networks, Aboriginal status, gender, race, and disability.

Only those “social determinants” of health that can be directly affected by the Project were included in the assessment, namely:

- Income and employment, which are linked to Project effects on changes in health resulting from other socio-economic changes (e.g., the potential for the Project to employ local residents for construction activities).
- Access to and use of healthcare infrastructure and services, which are linked to Project effects on changes in health associated with the mobile workforce (e.g., increases in communicable diseases from the presence of a temporary and transient population, and increased potential for accidents or injuries related to Project construction and motor vehicle incidents).
- Food security, which is linked to changes in Aboriginal health (e.g., changes in access and use of traditional lands and wildlife species as they relate to hunting and gathering activities).

Some social determinants of health were not included in the assessment as they lacked direct pathways from which Project activities and physical works could interact resulting in an adverse effect. For example, the Project would have limited to no adverse effects on housing because most of the workforce will be accommodated in temporary accommodations.

Effects of the Project on social determinants of health are addressed in the following sections:

- Section 19.5-2 – Income and employment is addressed in the assessment of effects on health and well-being
- Section 19.5.6 – addresses effects on health care infrastructure
- Section 19.5.5 and Section 19.6.3 – Food security is addressed in sections that address Aboriginal health

Measurable parameters were selected to facilitate qualitative and quantitative measurement of potential effects (Table 19-7). The measurable parameters for the assessment of community health and well-being allow for identification of baseline health vulnerabilities within the LAA population and act as a baseline measure from which to assess potential effects. However, because community health indicators result from numerous contributing environmental and social stressors it is not possible to predict or attribute changes in most of them due to Project activities. Instead, the assessment is based on consideration of baseline conditions, Project activities, and effects pathways.

Table 19-7 Potential Social Effects, Effect Pathways and Measurable Parameters for Community Health and Well-being

Potential Social Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement	Notes or Rationale for Selection of the Measurable Parameter
Change in health resulting from socio-economic change	Employment and income opportunities generated by the Project can influence mental health and well-being	Changes in selected social determinants of health (e.g., employment and unemployment)	Social determinants of health can affect health outcomes. However, the Project has potential to influence only a sub-set of the social-determinants of health related to income and employment
Change in health associated with mobile workforce	Temporary workforces can increase community risk of infectious diseases, including sexually transmitted infections, respiratory infections and gastrointestinal disorders.	Rates of notifiable communicable diseases (i.e., STIs, respiratory infections and gastrointestinal illnesses)	Infectious disease risk is a public health issue associated with temporary worker populations
Change in levels of stress and annoyance	The construction and operation of the transmission line may have effects on mental health as a result of perceived EMF exposure, noise from traffic and construction activities and changes in the landscape.	Indicators of stress and anxiety (e.g., questions and concerns reported about EMF exposure, noise and changes in the landscape)	Stress and annoyance can be caused by multiple measurable and perceived contributing factors.
Change in Aboriginal health	The Project may cause health effects on specific Aboriginal groups, including changes in food security, diet and nutrition through increased access to land and competition for hunting and trapping activities; and clearing vegetation resulting in the loss of traditional foods.	Rates of food security and traditional food consumption	Food security is a social determinant of health
Change in capacity of or demand on health care services and infrastructure	Temporary workforce can place additional demand on health infrastructure in local communities from injuries obtained during construction activities; via increased rates of infectious disease and traffic-related injuries among the local population; and from the interruption in power services or travel restrictions due to construction activities (e.g., impeding emergency response services).	Workforce size Worker injury rate Descriptive information on health care service capacity	Provides an indication of increase in direct demand for health care services due to Project Provides an indication of ability of health care services to meet increased demand.

19.3.2.3 Residual Social Effects Description Criteria

Residual effects are those that remain after mitigation measures have been applied, and are described in terms of direction, magnitude, geographic extent, frequency, duration, reversibility, and socio-economic context. The characterization of residual effects on community health and well-being is based on the criteria defined in Table 19-8.

Table 19-8 Characterization of Residual Social Effects on Community Health and Well-being

Characterization	Description	Definition
Direction	The trend of the residual effect	<p>Positive – Changes may improve health and well-being</p> <p>Adverse – Changes that may detract from health</p> <p>Neutral – Net health effects will be neither positive nor negative</p>
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<p>Negligible – No measurable change from baseline conditions</p> <p>Low – Above baseline conditions, but within normal variation of community health and within current capabilities of health infrastructure/service management systems</p> <p>Moderate – Above baseline conditions and predicted to result in a decline in community health that results in a deterioration of the capabilities of health infrastructure and service management systems</p> <p>High – Above baseline conditions and predicted to result in a decline in community health indicators that exceeds the capabilities of health infrastructure/ or service management systems</p>
Geographic Extent	The geographic area in which an environmental, effect occurs	<p>PDA – Residual effects are restricted to the PDA</p> <p>LAA – Residual effects extend into the LAA</p> <p>RAA – Residual effects interact with those of other projects in the RAA</p>
Frequency	How often during the Project or in a specific phase	<p>Single event – residual effect occurs once</p> <p>Multiple irregular event (no set schedule) – residual effect occurs multiple times at irregular intervals</p> <p>Multiple regular event – residual effect occurs multiple times at regular intervals</p> <p>Continuous – residual effect occurs continuously</p>
Duration	The period of time during which a Project effect can be measured or perceived	<p>Short-term – Residual effect restricted to construction phase</p> <p>Medium-term – Residual effect extends more than the construction phase</p> <p>Permanent – Residual effect extends for the lifetime of the Project or more</p>

Characterization	Description	Definition
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases	<p>Community Health</p> <p>Reversible – Effects on community health and well-being are temporary and able to return to existing conditions</p> <p>Irreversible – Effects on community health and well-being may be chronic or permanent</p>
Socio-economic context	Refers primarily to the sensitivity and resilience of the VC. Consideration of context draws heavily on the description of existing conditions of the VC, Project interactions may have a more pronounced effect if they occur in areas or regions that have already been affected by human activities	<p>Low resilience – Community health is poor and is highly vulnerable to social, economic and environmental stressors</p> <p>Moderate resilience – Community health is moderate and only slightly vulnerable to social, economic and environmental change</p> <p>High resilience – Community health is robust and able to accommodate social, economic and environmental stressors</p>

19.3.2.4 Significance Thresholds for Residual Social Effects

COMMUNITY HEALTH AND WELL-BEING

There are no regulatory-defined or commonly accepted significance thresholds for community health and well-being. Therefore, the significance threshold for this chapter was based on the significance thresholds for community health and well-being used in other environmental effects assessments (LNG Canada 2014; Pacific Northwest LNG and Stantec 2014). An adverse residual effect on community health and well-being is considered significant if any of the following occurs:

- The Project results in exceedance of available capacity, or a substantial decrease in quality, of health care infrastructure and services provided on a persistent and ongoing basis, and cannot be managed with current or anticipated programs, policies, or mitigation measures.
- The Project causes acute or chronic physical or mental health outcomes, either directly, or indirectly via adverse changes in one or more social determinants of health, that are irreversible and detectable at a population level using existing population health indicators.

19.4 Existing Conditions

19.4.1.1 Overview

The subsections below provide an overview of the existing health conditions for the assessment of community health and well-being.

Additional detail on the following topics can be found in the Socio-economic and Land Use Environment – Technical Data Report ([TDR] Stantec 2015):

- measures of general health
- chronic conditions
- personal health behaviors
- infectious diseases
- rates of reportable gastrointestinal illnesses
- stress and mental well-being
- injury
- food security, diet and nutrition
- First Nations and Metis health
- food security
- health care services and infrastructure (by health regions)

Outcomes from the Aboriginal Traditional Knowledge Studies related to health and well-being for those communities actively engaged in traditional food harvesting, gathering and consumption activities are described in Section 19.4.1.9.3. Further details on the findings of the Aboriginal Traditional Knowledge Studies can be found in Appendix A of the EIS.

19.4.1.1.1 Desktop Review

The desktop review included a literature review, KPIs, provincial and federal health-related data, issue-specific studies and reports, and peer reviewed data.

19.4.1.2 General Health Conditions

General health indicators are used to describe population health on a broad level and to compare the health of different population groups. While these health indicators include both the Aboriginal and non-Aboriginal population, it should be noted that indicators specific to Aboriginal health are discussed in Section 19.4.1.8.

General health measures differ among the four RHAs, with Southern Health and the Winnipeg RHA having overall better health than the provincial average, and the Interlake-Eastern and Prairie Mountain health authorities having overall worse health than the provincial average, as

measured by indicators such as infant mortality, all-cause mortality, premature mortality and potential years of life. As described in Section 19.2.3, many health indicators are available only at the level of the RHA, and not at a community level. The experiences of the different communities within the LAA may vary substantially.

19.4.1.3 Chronic Conditions

Chronic conditions are diseases such as diabetes, cancer and heart disease that last for months or years, are the leading causes of death and disability. Chronic conditions can considerably impair an individual's overall quality of life and ability to function.

Within the LAA, all regional health authorities have a similar rate of chronic conditions: between 43 and 49 percent of the population has at least one chronic condition (after adjustment for age and sex differences in the different area). Cancer, circulatory disease and respiratory disease—all chronic conditions—are among the top causes of death across all health authorities in the RAA.

The prevalence of specific chronic conditions varies among the different health authorities, and rates of arthritis, diabetes and high blood pressure are higher in the Interlake-Eastern RHA and Prairie Mountain Health and lower in Southern Health and Winnipeg RHA.

19.4.1.3.1 Personal Health Behaviours

Personal health behaviours such as daily smoking and heavy drinking can negatively affect health, while physical activity and a healthy diet can beneficially affect health. These behaviours interact with environmental and biological factors to contribute to the prevention or onset of disease.

The prevalence of daily smokers is substantially higher in Interlake-Eastern Health Authority (21.2%) compared to the other RHAs and the Manitoba average of 14.8%. Although there is less regional variation in heavy drinking, Interlake-Eastern Health Authority has the highest rate at 22.4%, also above the provincial average. The Winnipeg RHA has the highest rates of leisure time physical activity and fruit and vegetable consumption, both exceeding the provincial averages. Overweight and obesity were lowest in the Winnipeg RHA and higher in all other areas of the province.

In terms of alcohol misuse, Southern Health had the lowest rates of both heavy drinking and substance (alcohol or drug) abuse. While Prairie Mountain Health had the highest rate of substance abuse and the Interlake-Eastern RHA had the highest rate of heavy drinking, regional trends could not be identified based on the available information.

19.4.1.4 Infectious Diseases

Infectious diseases, also known as communicable diseases, include any disease that can be transmitted from one person to another. There are three types of infectious diseases that are relevant in the context of the Project and are described below: sexually transmitted infections, gastrointestinal disorders, and respiratory infections.

Sexually transmitted infections (STIs) include gonorrhea, chlamydia, syphilis and HIV/AIDS as well as others such as Hepatitis B and C, genital herpes and the human papillomavirus. Effects from STIs range from irritating symptoms to more serious consequences such as infertility or sterility, and in rare cases, death. Their ability to spread quickly through the population and increasing antibiotic resistance is a large public health concern (BC Centre for Disease Control, 2011).

According to Manitoba Health, Healthy Living and Seniors, STIs are the most common infectious diseases of public health importance in North America.

Southeastern Manitoba has the lowest rates of STIs in the province, although it is uncertain whether this is due to a truly lower incidence or less frequent testing (KPI, pers. comm.). Syphilis has recently resurged as an STI of concern; current rates of syphilis in Winnipeg are the highest they have been in 30 to 40 years, and there is also an increased number of syphilis cases in the Southern Health region (KPI, pers. comm.).

Although there are no identified challenges with STI testing and treatment capacity in the relevant RHAs, there are challenges with cultural and religious dynamics in some Southern Health communities where harm reduction and prevention activities are less well-received (KPI, pers. comm.).

Gastrointestinal (GI) illnesses such as *E.coli*, norovirus and hepatitis A are caused by a variety of bacterial and viral pathogens. GI illnesses are spread by direct contact from person to person but can also be spread through contaminated food, water, or surfaces, and may be linked to poor food-handling practices or sanitation.

There can be substantial differences in year-to-year rates of GI illnesses in a single region due to localized outbreaks. In 2013 salmonellosis (salmonella poisoning), campylobacteriosis and giardiasis (giardia) were the most common infections in Manitoba, with the largest difference between health regions observed in campylobacteriosis infection (from 9.1 cases per 100,000 population in the Winnipeg RHA to 33.6 cases per 100,000 population in Southern Health). Although rates of specific illnesses varied across the health regions, there did not appear to be any regional trends of statistical significance.

Common respiratory infections include the common cold, strep throat, influenza (flu), pneumonia, bronchitis, measles and chicken pox. Table 19-9 shows the rates of reportable respiratory illnesses in Manitoba, many of which are vaccine preventable. Southern Health does not have a high incidence of vaccine-preventable diseases, but it does have lower rates of immunization across all age groups (KPI, pers. comm.). People who have not been fully immunized against vaccine-preventable diseases are at greater risk of becoming infected and spreading the disease than those who have been fully immunized.

Table 19-9 Rates of Reportable Respiratory Illnesses by RHA, 2013 and 2014

Regional Health Authorities	Southern Health	Interlake-Eastern	Winnipeg	Prairie Mountain Health	Manitoba Average
Measles	NA	NA	NA	NA	0.0
Mumps	NA	NA	NA	NA	0.1
Pertussis	1.6	0.8	0.3	0.0	0.5
Pneumococcal disease (invasive)	10.1	11.9	8.2	7.2	10.2
Streptococcal disease (invasive)	13.3	17.4	26.3	15.9	24.3
Influenza A (laboratory confirmed)	49.6	73.1	22.2	74.2	54.1
Influenza B (laboratory confirmed)	8.0	1.6	5.7	3.6	5.5

NOTE:

Rates are per 100,000 population; NA – data not available at RHA level

SOURCES: Government of Manitoba 2013, Government of Manitoba 2013/14

19.4.1.5 Stress and Mental Well-being

Stress is thought to contribute to the development of many adverse health conditions including heart disease, stroke, high blood pressure, upper respiratory disease and poor immune response (Schneiderman *et al.* 2005). Exposure to stress can also contribute to behaviours such as smoking, over-consumption of alcohol and less-healthy eating habits.

A number of studies have linked how power transmission lines have increased levels of stress and annoyance in relation to perceived changes in property values, noise, aesthetic concerns, and health and safety concerns (*i.e.*, the presence of EMF). Furby *et al.* (1987) found the siting of transmission line development resulted in increased concerns about property values and implication of conventional compensation procedures. Thomas and Evans (1996) found residents living near a transmission line reported experiencing moderately negative effects on their health and safety, property values and aesthetics. McMahan and Meyer (1995) found the closer individuals live to a transmission line the greater the increase of concerns related to perceived health risks. A number of studies have assessed the link between the exposure of EMF and the perceived health risks that are thought to be associated with the presence of transmission lines (Linder 1995, MacGregor *et al.* 1994, and Morgan and Granger 1985). While most studies found no definitive health risk, there are often increased levels of stress and anxiety that result from the presence or siting of transmission line development.

Data relevant to understanding existing conditions for a number of stress, anxiety and mental well-being dimensions across the RHAs in Manitoba are shown in Table 19-10. Rates of perceived mental health (“very good or excellent”), perceived life stress, and life satisfaction (“satisfied or very satisfied”) were reasonably similar across the health regions. However, Prairie Mountain Health had the highest rates of mood and anxiety disorders.

Table 19-10 Overall Mental Health by RHA, 2011 to 2012

Regional Health Authorities	Southern Health	Interlake-Eastern	Winnipeg	Prairie Mountain Health	Manitoba
Perceived mental health – very good or excellent (%) (2011–2012)	68.3	69.8	68.6	67.7	68.4
Life satisfaction – satisfied or very satisfied (%) (2011–2012)	93.4	89.3	90.2	91.7	90.8
Perceived life stress (%) (2011–2012)	20.3	18.8	21.6	22.8	21.3
Mood and anxiety disorders (%) (age-sex adjusted) (2008/2009 to 2012/2013)	18.8	20.7	23.1	24.0	22.1

SOURCES: Government of Manitoba 2012-2013, Statistics Canada 2013

19.4.1.6 Injury

Injury was the second most frequent cause of death in the Interlake-Eastern Health Authority between 2007 and 2011, and the third most common cause of death for Southern Health, Winnipeg RHA, and Prairie Mountain Health. While injury mortality and injury hospitalization rates were below the provincial average in the Southern Health and Winnipeg RHAs, both measures were above average for Interlake-Eastern and Prairie Mountain Health (Table 19-11).

Details on the causes of injury deaths and injury hospitalizations were not available at the current RHA level. However, older data available at the provincial level indicate that the top five most common causes of injury deaths in Manitoba between 1992 and 1999 were suicide, motor vehicle traffic injuries, falls, fractures, and suffocation and choking (Government of Manitoba 2004). Over the same period, the most common causes of injury hospitalizations were falls, motor vehicle traffic injuries, self-inflicted injuries, assault and injuries from being struck by or against an object.

Table 19-11 Rates of Injury and Causes of Death

Regional Health Authorities	Southern Health	Interlake-Eastern	Winnipeg	Prairie Mountain Health	Manitoba
Injury mortality rate per 1,000 residents (age- and sex-adjusted) 2011/12	0.42	0.6	0.47	0.69	0.55
Injury hospitalization rate per 1,000 residents (age- and sex-adjusted) 2012/13	6.7	7.5	5.7	9.5	7.1

SOURCE: Government of Manitoba 2012-2013

The Workers Compensation Board of Manitoba reports annually on workplace injury statistics for Manitoba. Table 19-12 provides the time loss injury rate and total injury rate per 100 full-time equivalents (FTEs) for the heavy construction sector in Manitoba between 2000 and 2013. Injury rates have been on the decline through this period.

Table 19-12 Occupational Injuries for Manitoba's Heavy Construction Sector, 2000 to 2013

Injury Type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Time loss injury	7.5	6.8	7.9	7.6	7.3	7.4	6.9	6.7	4.8	4.7	4.9	5.1	4.5	4.5
All injuries	15.3	13.2	16.2	14.7	14.8	14.9	14.4	13.3	11.5	11.1	11.0	10.3	9.5	9.7

NOTE:

Injury rates include injuries due to traffic collisions while at work

Rates of injuries are per 100 FTEs

SOURCE: WCB 2013

19.4.1.7 First Nation and Metis Population in or near the LAA

No First Nations reserves are located within the LAA. First Nation communities included in the First Nations and Metis engagement process (FNMEP), and their reported population sizes, are described in Table 19-13.

Table 19-13 First Nation Population

Community	On-Reserve	On Other Reserve	Off-Reserve ¹	Total
Black River First Nation	911	11	352	1,274
Brokenhead Ojibway Nation	672	3	1,255	1,931
Buffalo Point First Nation	33	5	90	128
Dakota Plains Wahpeton First Nation	167	11	89	267
Dakota Tipi First Nation	195	2	198	395
Long Plain First Nation	2,190	49	2,013	4,252
Peguis First Nation	3,568	125	6,125	9,818
Roseau River Anishinabe First Nation	1,152	28	1,390	2,570
Sagkeeng First Nation ²	3,349	25	4,253	7,627
Sandy Bay Ojibway First Nation	3,929	38	2,432	6,399
Swan Lake First Nation	581	17	785	1,383

NOTES:

¹ Indicates combined off-reserve First Nation population with one of the four other reported categories (On Own Crown Land, On Other Crown Land, On Other Band Crown Land, On No Band Crown Land)

² Data for Sagkeeng First Nation are referenced from AANDC's First Nations Community Profile, which refers to the Nation by its previous name, "Fort Alexander"

SOURCE: Aboriginal Affairs and Northern Development Canada (AANDC) 2015

Population data for the Metis population residing within the LAA are available at the former RHA level (prior to amalgamation in 2012) as well as the Manitoba Metis Federation region. The data in Table 19-14 are presented at the former RHA level, along with the corresponding current RHA.

Table 19-14 Metis Population in or near the LAA

Current RHA	RHA prior to 2012	Population	Year
Southern Health	Central	5,688	2010
	South Eastman	4,558	2010
Winnipeg	Winnipeg	31,647	2010
Prairie Mountain Health	Assiniboine	2,127	2010
	Brandon	2,336	2010
	Parkland	5,976	2010
Interlake-Eastern	Interlake	8,817	2010
	North Eastman	3,470	2010

SOURCE: Manitoba Centre for Health Policy and Manitoba Metis Federation 2010

19.4.1.8 First Nation and Metis Health

For many Aboriginal peoples, health is a concept that is holistic in nature and deeply rooted in the inter-relationships between land, water, culture and identity (Loppie-Reading and Wien 2009; First Nations Health Society 2010). The concept of an inter-relationship between nature and people supports a link between the well-being of the environment and the physical, social, cultural and mental well-being of individuals and communities. To many Aboriginal peoples, these factors cannot be considered separate from one another.

It is therefore important to recognize that health, for many Aboriginal peoples, comprises an array of factors that is much broader than measures of mortality and morbidity. For example, the ability to access the land and participate in traditional activities, cultural events and ceremonies is an important support for positive health, and many of the Aboriginal groups in southern Manitoba are active in these activities (KPI, pers. comm.).

19.4.1.8.1 Overall Health Status of First Nation Populations in Manitoba

In order to determine how the health of First Nations people in Manitoba compares to that of the non-First Nations population, the First Nations Regional Health Survey (RHS)—a First Nations - governed, national health survey—was conducted by the Assembly of Manitoba Chiefs. Phase 2 of the RHS gathered data between 2008 and 2010. It found that First Nations in Manitoba experienced lower rates of several chronic conditions, including high blood pressure, arthritis, and heart disease. However, rates of diabetes, overweight or obesity, daily smoking, and heavy drinking were substantially higher in the First Nations populations compared to the non-Aboriginal population.

19.4.1.8.2 Overall Health Status of Metis Population in Manitoba

Data for Metis health were collected by the Manitoba Centre for Health Policy in collaboration with the Manitoba Metis Federation, and are available in *Profile of Metis Health Status and Healthcare Utilization in Manitoba: A Population-Based Study* (Martens *et al.* 2010). For all of the health measures included in reporting on the following health indicators: mortality, general health and chronic conditions and health behaviors, some level of variation can be seen between each of the former RHAs. However, premature mortality and total mortality rates are generally higher for the Metis populations compared to the rest of Manitoba, and, excluding the former RHA of Assiniboine, self-rated health is substantially lower for the Metis populations compared to the rest of Manitoba. A similar pattern can be observed for rates of chronic conditions and personal health behaviours, with Metis populations in most of the former RHAs experiencing higher rates of chronic conditions and adverse personal health behaviours than other Manitobans.

19.4.1.9 Food Security, Diet and Nutrition

The ability to access sufficient safe and healthy food is an important determinant of health. Food insecurity occurs when the quality or quantity of food in a household is insufficient, and is usually associated with limited financial resources. Food insecurity has been linked to a number of chronic diseases and conditions, including heart disease, diabetes, high blood pressure, food allergies and stress (Mikkonen and Raphael 2010).

Of households in Manitoba, 12.4% reported experiencing food insecurity in 2011 (Manitoba Health n.d.). In 2014, Manitoba food banks assisted 61,691 people, an increase of more than 50% from 2008 (Food Banks Canada 2014). The Steinbach food bank, South East Helping Hands, currently serves more than 1000 people each month (South East Helping Hands, n.d.). Although there is also a food bank located in Ste. Anne (Healthy Child Coalition 2013), details on its usage could not be located.

19.4.1.9.1 Traditional Food Consumption

Traditional foods are important to First Nations and Metis for nutritional, cultural and economic reasons. Traditional subsistence diets are relatively healthy and also have considerable social and cultural value. Because Aboriginal populations in Canada and elsewhere have transitioned away from a subsistence diet to a more Western diet and lifestyle, rates of obesity, diabetes and other chronic diseases have drastically increased (Kuhnlein and Receveur 1996). Moreover, traditional diets are associated with higher levels of physical activity and the continuity of cultural practices, both of which are supportive of physical and mental wellbeing (Chandler and Lalonde 1998). Health effects resulting from changes in diet and nutrition are therefore a major concern when development activities affect populations reliant on subsistence foods.

Data on traditional food consumption patterns and food security for Manitoba First Nations are available through the First Nations Food, Nutrition and Environment Study (FNFNES), which examines traditional food consumption patterns and levels of contaminants in traditional foods for on-reserve First Nations populations across Canada (2010). In Manitoba, nine First Nations

communities (including three communities engaged in the Project) participated in the FNFNES, and results were grouped according to the affiliated ecozone. Data in Table 19-15 are presented for the three ecozones (Map 19-2 – FNFNES Participating First Nations Communities and Ecozones).

Table 19-15 Food Sources for Ecozones in the RAA

Ecozone Description	Prairies	Boreal Plain	Boreal Shield	All Manitoba First Nations Communities
Ecozone	1	2	3	
Percent (%) consuming traditional foods in the last year				
Fish	73	94	79	83
Land mammals	87	92	83	86
Birds	57	71	47	56
Berries and nuts	63	58	73	68
Wild plant roots, shoots and greens	19	8	38	27
Mushrooms	0	4	1	2
Traditional food harvest practices (%)				
Hunt or set snares for food	20	21	21	21
Fished	25	30	29	29
Traditional food gathering practices (%)				
Collected wild plant food	16	4	15	12
Planted a garden	7	9	18	13
Other				
Percent (%) who eat fruits and vegetables from their gardens or community gardens	48	23	47	39
Percent (%) of households that would like more traditional food	79	76	57	66

NOTE:
Data from 2010
SOURCE: Chan *et al.*, 2012

The FNFNES combined ecozone/culture area framework was used to ensure that the diversity in ecozones and cultural areas are represented in the sampling strategy (Chan *et al.* 2011). Ecozones are classified by features such as oceans, deserts or high mountain ranges that formed barriers to plant and animal migration (Chan *et al.* 2011).

As shown in Table 19-15, the First Nations communities represented in the three ecozones transected by the LAA have a high consumption of animal food sources, with between 73% and 94% consuming fish in the last year, between 83% and 92% consuming land mammals, and between 47% and 71% consuming birds. A substantial proportion of participants (between 58% and 73%) reported consuming berries and nuts in the last year, while somewhat fewer reported consuming wild plants, shoots and greens (8% to 38%) and mushrooms (zero to 4%). In addition, between 57% and 79% of households reporting in the Prairies ecozone reported that they would like to consume more traditional foods. Perceived benefits to consuming traditional foods include their nutritional value, safety, taste, low or no cost, cultural and educational value, and freshness (Chan *et al.* 2012). These data highlight the importance of subsistence foods as part of the diet of First Nations communities in these regions.

Data regarding the consumption of traditional foods for the Metis population could not be located.

19.4.1.9.2 First Nation Food Security

The FNFNES study found the provincial rate of food insecurity for First Nations communities at 38% (Chan *et al.* 2012). Within the ecozones traversed by the Project, food insecurity ranged from 21% to 44% (Table 19-16). These rates are much higher than those of Manitoba's population as a whole. According to Manitoba Health (n.d.), 12.4% of households in Manitoba experienced some food insecurity in 2011, of which 1.4% was severe.

First Nations communities may also experience food insecurity in relation to traditional foods. The FNFNES study reported that 27% of respondents "sometimes" worried about running out of traditional food and 13% "often" worried about running out of traditional food (Chan *et al.* 2012).

Data regarding food security within Metis population could not be located.

Table 19-16 Rates of Food Insecurity

Ecozone Description	Prairies	Boreal Plain	Boreal Shield	All Manitoba First Nations Communities	Manitoba Average
Ecozone	1	2	3		
Food insecurity, moderate (%)	19	20	35	31	5.7
Food insecurity, severe (%)	10	1	9	8	1.7
Food insecurity, total (%)	29	21	44	38	12.4

SOURCE: Chan *et al.* 2012, Government of Manitoba, n.d.

19.4.1.9.3 Aboriginal Traditional Knowledge Studies

Aboriginal traditional knowledge (ATK) studies were undertaken by some of the First Nation communities engaged by Manitoba Hydro with respect to the Project. These studies, although not representative of every community, indicated that some members of these communities are actively engaged in traditional food harvesting, gathering and consumption activities.

The Roseau River Anishinabe First Nation (2015), for example, reported in their ATK report that plant gathering is a tradition that is alive and well in the community, practiced by both the younger and older generations. Medicinal plants, berries and nuts can be collected in many areas within the community, as well as east towards the Ontario border and as far north as the Sandilands Provincial Forest. Plants used for medicines, such as sweet grass, sage, Seneca, and cedar, and wild berries such as plums, chokecherries, raspberries, blueberries, blackberries and hazelnuts are “plentiful right in our back yards”. There are still a handful of people who hunt wild game such as moose, deer, fox and beaver for food, for the hides and for sport. Only a few members of the community still use and maintain trap lines, while fishing is a tradition still practiced by the young and older generations (though mainly as a sport due to perceived mercury contamination). Community members have noticed that the spawning areas for the fish have declined dramatically in the last ten years, and that the birthing areas for deer, fox, and rabbits along the Red, Roseau and Rapids Rivers have been disturbed or affected by natural or farming activities.

In their ATK report (2015), Black River, Long Plain and Swan Lake First Nations also indicated that their communities have and do exercise their rights in the study area, including berry-picking, plant and medicine gathering, hunting and trapping. The area from Marchand south to Watson P. Davidson WMA, including Pocock Lake Ecological Reserve and Sandilands Provincial Forest in the RAA is noted in their TLU study as an area past and presently used for hunting, trapping and other traditional practices. The RAA areas south of the Watson P. Davidson WMA ranging southeast to the Spur Woods WMA and south of Piney, was identified as containing moose habitat, especially near Piney. Black River First Nation Elders stated that otter, mink, beaver, coyote, wolf and rabbit were trapped in this area while deer, elk, moose and black bears were hunted in this area.

Long Plain First Nation Elders stated in the ATK Report that young people no longer trap animals, and that hunting areas are becoming too small to sustain livelihoods. Fox, coyotes and raccoons were trapped (area not specified) and the presence of Prairie chickens, grouse, ducks and turkeys were noted (area not specified).

Peguis First Nation indicated in the Land Use and Occupancy Interview Project Report (2015) that community members gathered cedar, ginger, sweet grass, Seneca root, yarrow and *weekay* (also referred to as *wee-kai*, *weke*) near Roseau River Anishinabe First Nation reserve lands for medicinal and cultural purposes. Community members hunt game such as deer and mentioned the presence of bears in the RAA on a trail between Ste. Anne and Woodridge MB. Community members trap rabbit and prairie chickens in the RAA, north of Ste. Anne, and east of Steinbach near Woodridge as well as along the Whitemouth River and near Whitemouth Lake. The TLU

report notes that ducks and geese are hunted in these areas, as well as adjacent to the Rat and Seine Rivers in the RAA.

Additional information is provided in Chapter 11 – Traditional Land and Resource Use.

19.4.1.9.4 Aboriginal Health Care Service Provision

Health care services for First Nations in Manitoba are provided through a combination of community-based programs funded by the federal First Nations and Inuit Health Branch (FNIHB) and off-reserve services administered provincially through the RHAs (Allec 2005). In general, for First Nations, the Province is responsible for any insured service (e.g., physician, hospital stays, medication while in hospital), while the federal government is responsible for anything that falls outside that realm in terms of public health and non-insured health benefits (e.g., occupational therapy, physiotherapy, medical supplies, drugs, glasses, dental care) (KPI, pers. comm.). However, responsibility for service delivery also varies depending on the location and remoteness of the community. For example, some communities may have physician services within the community, while others may need to access services through the RHA (KPI, pers. comm.). Health care service delivery is often negotiated between the provincial and federal governments; many communities would like to run their own health and primary care, or at least have more control over it (KPI, pers. comm.).

The RHAs are autonomous with respect to how they engage with Aboriginal communities; not all RHAs have a dedicated Aboriginal Health Program (KPI, pers. comm.). The Winnipeg RHA and Southern Health both have Aboriginal Health Programs, while Interlake-Eastern Health Authority does not have a long history of working with Aboriginal communities within its geographic boundaries. Some Aboriginal communities feel Prairie Mountain Health has no role in their care and has done little to help them (KPI, pers. comm.).

19.4.1.10 Health Care Services and Infrastructure

Health care services are those services that are responsible for meeting the primary health care needs of residents in the LAA, including diagnosis and treatment of disease and the promotion of health and well-being. Health care infrastructure includes hospitals and health care clinics, and allied health services such as pharmacy, public health, mental health and addictions services, laboratory services, health promotion and other specialty areas.

19.4.1.10.1 Hospitals and Health Centres

The region is serviced by hospitals and health centres in Ste. Anne, Vita and Glenboro. hospitals with 24/7 emergency care in surrounding areas are located in Steinbach, Brandon and Winnipeg.

SOUTHERN HEALTH

In terms of primary care, there are few services in the areas immediately surrounding Winnipeg; residents must access services in the city or small one-to-two person clinics in Ste. Anne, Niverville, or St. Pierre (KPI, pers. comm.). Steinbach (located outside the LAA) has most of family physicians, an access centre, and a walk-in clinic. Sprague has a community health clinic staffed by a Nurse Practitioner. A recent addition to the Health Authority's primary care service delivery is a mobile clinic that travels around Stuartburn and Piney. Staffed by a Nurse Practitioner and Registered Nurse, the clinic provides primary care to residents who are less mobile.

Ste. Anne has a 21-bed bilingual facility that provides residents with medical, cardiac, surgical, obstetrical and palliative care. Its Emergency Room (ER) is open 24/7. The Vita and District Health Centre is a 10-bed acute care facility offering limited health services, but its ER is no longer staffed (KPI, pers. comm.). There are limited ER services in the southern RMs of Manitoba. Although it is not located within the LAA, the Bethesda Regional Health Centre in Steinbach acts as the main ER for residents of southeast Manitoba.

The Bethesda Regional Health Centre in Steinbach is also the main provider of secondary care in the southeast region of the province, serving a population of approximately 80,000 people (KPI, pers. comm.). Its ER receives 25,000 visits per year. In addition, the Bethesda Regional Health Centre provides most of the surgical services for residents in the region. People living between Steinbach and Winnipeg can choose between services in either centre, although if specialist care is needed, residents must travel to Winnipeg.

The Bethesda Regional Health Centre has a mini-intensive care unit. Motor vehicle accidents and other trauma cases in southeast Manitoba come to Bethesda Regional Health Centre before Winnipeg, unless they require a tertiary level of care. Because the Bethesda Regional Health Centre does not perform heart or brain surgery, very serious cases go directly to a tertiary care facility in Winnipeg, such as St. Boniface Hospital or the Health Sciences Centre. Patients requiring intubation and ventilation for more than 12 hours will also be triaged into the city for intensive care units. The Bethesda Regional Health Centre offers all diagnostic and laboratory services apart from magnetic resonance imaging (MRIs), which is provided at the Boundary Trails Health Centre in Winkler (outside the LAA).

The Bethesda Regional Health Centre is currently meeting patient demand but is struggling with bed management and patient flow; it is aiming for 82–92% bed occupancy, although current occupancy is running close to 95%. This occupancy rate is partly the result of bed management issues with the elderly population, who need to be located in the appropriate care setting. Southern Health is presently planning to increase the number of personal care homes in the region.

Staffing shortages are experienced at the Bethesda Regional Health Centre across all disciplines (KPI, pers. comm.). Like other rural communities, Steinbach experiences challenges with health care recruitment and retention since many people choose to live and work in the city rather than in rural areas. Staffing shortages are likely to be a continuing challenge.

PRAIRIE MOUNTAIN HEALTH

The Glenboro Health Centre is a small facility with intermittent ER services; full services were suspended due to a lack of physicians (KPI, pers. comm.). Currently, the Glenboro Health Centre shares on-call services with the health centre in Carberry, so while each site offers acute care and ER services, neither site is open 24/7. All of the health centres in the region are struggling with staffing shortages across all disciplines.

If emergency care is required in the region, the closest EMS station will respond to the call and transfer the patient to the nearest open emergency room. The dispatch centre in Brandon then determines what mode of transport is appropriate (e.g., STARS, Lifeflight) for the situation in consultation with the attending physician and dispatches as needed. Patients may be transferred to a larger centre in Brandon (Brandon Regional Health Centre), which is located outside the LAA or in Winnipeg based on the type of care needed.

The Brandon Regional Health Centre is a one-hour drive from Glenboro. It services all of southwest Manitoba up to the border of Southern Health in the east and currently has 313 beds open and in operation. The Brandon Regional Health Centre provides general surgery, orthopedic surgery, intensive care and all diagnostic services, including X-rays, MRIs and computerized tomography scans. Patients requiring cardiac catheterization, cardiac surgery or brain surgery (i.e., head trauma), and all pediatric patients requiring surgery, are transferred to Winnipeg.

In terms of mental health services, the Brandon Regional Health Centre has an adult in-patient unit and an outpatient child and adolescent treatment centre. Prairie Mountain Health also offers outpatient community mental health services, such as counseling, across all age spectrums in Brandon.

Despite staffing shortages among all disciplines, the Brandon Regional Health Centre is presently able to meet the demand of the Brandon population and there are no planned or predicted changes in the future that might affect health service capacity. The hospital bed occupancy rate is currently around 90%.

INTERLAKE EASTERN HEALTH AUTHORITY

Around Rosser, patients requiring emergency care are transferred to the nearest facility in Winnipeg (e.g., Seven Oaks, Grace Hospital) or Stonewall (KPI, pers. comm.).

WINNIPEG RHA

Winnipeg houses a large number of primary health centres, community and tertiary hospitals and ancillary services, and acts as the referral centre for the entire province. Southern Winnipeg relies on the services from Victoria General Hospital (KPI, pers. comm.). Although there are no problems of note with hospital staffing in Winnipeg, the wait times to see physicians at certain hospitals are longer than in some other Southern RHA communities. Winnipeg also has 'quick care clinics' that help to deflect some types of patients from going to emergency.

19.4.1.10.2 Health Care Utilization

Table 19-17 presents key indicators that describe how health care is used in different regions of Manitoba. The proportion of residents in the Southern Health area with access to a regular medical doctor is slightly above the Manitoba average.

Table 19-17 Rates of Health Care Utilization (RHA Level)

Regional Health Authorities	Southern Health	Interlake-Eastern	Winnipeg	Prairie Mountain Health	Manitoba
Regular medical doctor (% of population 12 and older who report having a regular medical doctor) 2011/12	85.6	89.6	85.4	83.9	85.3
Hospital bed supply (number of setup hospital beds per 1,000 residents) 2011/12 ¹	2.5	1.9	3.05	5.4	3.1

NOTE:

¹ Value is approximate; data available in bar graph form only

SOURCES: Manitoba Centre for Health Policy 2013, Statistics Canada 2013

Table 19-18 shows a number of indicators of health care utilization that are available at much finer scales. Most relevant are the data for hospitalization rates for ambulatory care sensitive (ACS) conditions, which represent cases that are seen in hospital but that could have been treated with primary care if that care were available. The indicator thus can signify a lack of access to good quality primary care (Manitoba Centre for Health Policy 2013). Rates for hospitalization for ACS conditions were highest in the Spruce Woods (RM of Cypress and Village of Glenboro) and Rural East (RMs of Stuartburn and Piney) health districts.

Table 19-18 Rates of Health Care Utilization (District Level)

Health Districts	Niverville/Richot	Tache	Ste. Anne/ LaBroquerie	Rural East	Macdonald	Cartier/St. Francois Xavier	Spruce Woods	Springfield	Stonewall/Teulon	Manitoba
Physician use (age-sex adjusted % of residents who used physician services) 2011/12	80	79	76.5	66	83	83	78	77.5	82.5	79.1
Ambulatory care visits (age-sex adjusted rate of visits per resident) 2011/12	4.5	3.92	3.9	3.04	4.55	4.6	3.98	3.82	3.08	4.45
Use of hospitals (age-sex adjusted % of residents with at least one inpatient hospital stay per year) 2011/12	5.8	5.3	6.5	6.7	4.6	5.0	7.3	5.3	5.8	6.3
In-patient hospitalization (age-sex adjusted rate per 1,000 residents) 2011/12	78	68	86	98	60	65	101	70	80	86.4
Hospitalization rates for ambulatory care sensitive (ACS) conditions (age-sex adjusted rate per 1,000 residents age 0-74) 2011/12	4.0	3.8	4.2	7.0	1.0	2.5	8.5	2.5	5.3	6.3

NOTE:

All values are approximate; data available in bar graph form only

SOURCE: Manitoba Centre for Health Policy 2013

19.4.1.10.3 Emergency Medical Response Services

Emergency medical response services (EMS) consist of both ground and air ambulance.

Ground ambulance services in Manitoba are delivered by the RHAs and by other service providers, such as municipalities and Aboriginal communities, through an agreement with the RHAs. In a 2012 review of Manitoba's EMS services, Manitoba's ground ambulance services were likened to that of a "patchwork quilt", with wide variations in organization, staffing models and response times (Toews 2013).

Currently in the Southern Health RHA, ground ambulance services are provided by full-time, part-time and casual paramedics with assistance from community first responders. There are 19 stations across Southern Health, although not all are staffed 24/7. Steinbach, however, is staffed with two ambulances every day. As of 2012, 32 fleet units were being operated out of eighteen stations in Winnipeg. Limited data were available on ground ambulance services for Interlake-Eastern RHA and Prairie Mountain Health.

There are four types of air ambulances services in Manitoba: Basic Air Ambulance, Lifeflight Air Ambulance, Shock Trauma Air Rescue (STARS) and Southern Air Ambulance Inter-Facility Transport (Toews 2013).

For the communities served by the Bethesda Regional Health Centre in Southern Health, the modality of emergency medical transport varies depending on the nature of the emergency, the patient's location, and the professional scope of the emergency responders available (KPI, pers. comm.). The Bethesda Regional Health Centre does have access to STARS, although the response time for STARS can be similar to the ground ambulance given the additional time required for STARS to fly to and from Winnipeg, then transfer to another hospital within Winnipeg by ground ambulance. Additionally, there are service gaps in areas around Vita, St. Pierre and Ste. Anne, where response times can exceed 30 minutes. Lastly, not all ground ambulance personnel are advanced care paramedics—some are first responders with a more limited scope of practice.

All ambulances in rural Manitoba are dispatched through one location in Brandon (outside the LAA). If a resident calls 911 or if Brandon Regional Health Centre requests an ambulance, it is dispatched through Brandon. The ambulance service uses geolocation, so that ambulances are always out on the road and moving around the region in an attempt to ensure a response time of less than 30 minutes. This is achieved about 92% of the time. In some rural places (such as around Vita, St. Pierre and Ste. Anne) where this is not always possible, STARS might be called in, although the need for STARS is determined by the dispatch service in Brandon.

19.4.1.10.4 Mental Health Services

Most mental health services in Manitoba are delivered by the RHAs, with some services administered or funded centrally by Manitoba Health. A wide range of community-based and inpatient mental health services are available.

Within the Bethesda Regional Health Centre, Mental Health Liaison Nurses work in the ER to address mental health challenges in an effort to prevent unnecessary admissions (KPI, pers. comm.). Steinbach has a short-stay crisis stabilization unit, and the Eden Mental Health Centre (in Winkler, outside the LAA) offers acute psychiatry services. Selkirk Health Centre (located in Selkirk, outside the LAA) is the provincial mental health service, providing specialized in-patient mental health services. There are also many community resources available through the Southern Health mental health program, including those for adolescents and intensive case management.

19.4.1.10.5 Health Resiliency and Vulnerability

Health resiliency refers to the degree to which people or populations are able to cope with, resist and recover from the effects of environmental, economic or social stressors (International Panel on Climate Change; WHO 2002). In the context of the community health assessment, it is important to try to understand health resiliency, because it affects how different populations may respond to potential effects of the Project.

Some populations or groups tend to be less resilient than others. For example, epidemiologic research links factors such as age, poverty, disability, people of Aboriginal descent, and low education with poorer health outcomes. While not all people who fit any of these conditions suffer from poor health, on the whole these populations tend to have lower resiliency and worse outcomes.

To identify the relative health resilience of the communities in the LAA, a health resiliency index was developed,¹ predicated on five domains that have been shown to have a strong association with poor health outcomes and for which information was available for all LAA communities (Socio-economic and Land Use TDR). These five domains and specific indicators used to calculate health resiliency were:

- age (percent of the population under age 19 or over 65)
- economic power (education less than high school; unemployment rate; percent of homes owned vs. leased/rented)
- community assets and infrastructure (fire and police housed within the community)
- health care access (primary care within the community; distance to 24-hour emergency care)
- Aboriginality (percent of the population who identify as Aboriginal)

The RMs of Headingley, Springfield, Macdonald and the town of Ste. Anne had the greatest health resiliency. The RMs of Tache, Ritchot, Ste. Anne, South Cypress, Rosser and Piney exhibited somewhat less resiliency. And finally, the RM of Stuartburn, the village of Glenboro and

¹ The health resiliency index was developed by Habitat Health Impact Consulting, co-author of this chapter.

the RM of La Broquerie had the least health resiliency. The City of Winnipeg was not included in the health resilience index because only a small proportion of the city is included in the LAA.

19.5 Assessment of Effects on Community Health and Well-being

The assessment of community health and well-being examines potential effects on health and well-being associated with socio-economic change and the mobile workforce, stress and annoyance, Aboriginal health, and health care service infrastructure. Potential effects on community health and well-being related to stress and annoyance (including perceived effects of EMF) were most often cited during public engagement.

19.5.1 Project Interactions with Community Health and Well-being

Table 19-19 identifies physical activities and components that might interact with community health and well-being.

Table 19-19 Potential Project-Social Interactions and Effects on Community Health and Well-being

Project Components and Physical Activities	Potential Social Effects				
	Health effects of socio-economic change	Health effects of mobile workforce	Stress and annoyance	Aboriginal health	Health care services and infrastructure
Pre-construction activities	–	–	✓	–	–
Transmission Line Construction Activities					
Mobilizing (staff and equipment)	✓	✓	✓	✓	✓
Access Route and Bypass Trail Development	✓	✓	✓	✓	✓
Right-of-way Clearing/Geotechnical Investigation	✓	✓	✓	✓	✓
Marshalling Yards, Borrow Sites, Temporary Camp Setup	✓	✓	✓	✓	✓
Transmission Tower Construction and Conductor Stringing	✓	✓	✓	✓	✓
Demobilization	✓	✓	✓	✓	✓

Project Components and Physical Activities	Potential Social Effects				
	Health effects of socio-economic change	Health effects of mobile workforce	Stress and annoyance	Aboriginal health	Health care services and infrastructure
Transmission Line Operation/Maintenance					
Transmission Line Operation/Presence	✓	–	✓	✓	–
Inspection Patrols	✓	–	✓	–	–
Vegetation Management (tree control)	✓	–	✓	✓	–
Station Construction					
Station Site Preparation	✓	✓	✓	–	✓
Electrical Equipment Installation	✓	✓	✓	–	✓
Station Operation/Maintenance					
Station Operation/Presence	–	✓	✓	✓	–
Vegetation Management (weed control)	–	–	–	✓	–

NOTES:
“✓” = Potential interactions that might cause an effect.
“–” = Interactions between the Project and the VC are not expected.

Prior to construction, the Project could cause stress and annoyance to persons who are concerned about how the Project may affect them and their households. Such concerns could be related to perceived risks associated with interference with current and planned land uses (Table 19-2).

During construction, the presence of the temporary workforce is the primary effect pathway for potential effects on community health and well-being. Because the use of the temporary workforce spans most construction activities, these activities have been identified as having a potential interaction with health care services/infrastructure, socio-economic change, and other effects of the mobile workforce. Potential effects related to stress and annoyance may also occur as a result of the uncertainty caused by anticipated Project-related changes (which can occur prior to construction) and construction activities. Project activities that may increase levels of stress and annoyance are related to the siting, construction and presence of the transmission line, which is linked to increased concerns related to changes in property values and outsiders being located near a community, and the perception that the transmission line will negatively affect landscape aesthetics (Chapter 17 – Visual Quality). Construction-related activities have the potential to increase noise levels and cause other perceived negative health effects that are tied to living nearby the transmission lines (e.g., EMF exposure) (Chapter 18 – Human Health Risk).

Aboriginal health effects related to change in food security are associated with land clearing, maintaining the right-of-way (ROW) with the use of pesticides or herbicides, resulting in a decrease in area available for traditional harvesting or a change in access. This effect will persist through construction and operation and maintenance.

During operation and maintenance, there will be relatively few people employed (three to five workers); therefore, workforce-related effects will be negligible. However, stress and annoyance due to the visible presence of Project infrastructure could persist. The assessment of Project effects during operation and maintenance will therefore be limited to stress, annoyance, and Aboriginal health effects

19.5.2 Assessment of Health and Well-Being Effects Associated with Socio-Economic Change

19.5.2.1 Pathways for Health Effects Associated with Socio-Economic Change

This section characterizes how Project-related employment and income, which are social determinants of health have potential to influence health outcomes. The social determinants of health related to access to and use of healthcare infrastructure and services, and food security are addressed in Section 19.5.6 and Section 19.5.5 respectively.

19.5.2.1.1 Construction

There are a number of social and economic changes that are expected to result from the Project, including the provision of jobs and income and the presence of the Project workforce. These social and economic factors can influence health outcomes, and for this reason are often termed social determinants of health. Most social and economic factors associated with the Project will occur during construction, due to the increase in temporary population (workforce) and enhanced economic activity. Such effects can be both adverse and beneficial.

The potential for individuals to gain employment and income are drivers of positive health outcomes from the Project. Income contributes to an individual's ability to secure adequate housing, a healthy diet, and a higher standard of living. Studies have shown that income affects a wide range of physical and mental health outcomes, including healthy child development, infectious and chronic diseases, injuries, mental well-being, and health care service utilisation (Yen and Syme 1999; McIntosh *et al.* 2009; Lightman *et al.* 2009; Mikkonen and Raphael 2010; Public Health Agency of Canada 2013). Conversely, low income and unemployment are associated with poor physical and mental health outcomes (Yen and Syme 1999). These effects extend not only to individuals, but also to their families and communities.

During construction, ROW clearing could include short-term contracts to clear the transmission line ROW. These opportunities could be available to businesses or individuals in local communities. The Project will generate an estimated 504 person-years (PYs) of direct, indirect,

and induced employment in Manitoba, and 447 PYs elsewhere in Canada. The Project is not expected to result in labour shortage issues (Hambley 2015, pers. comm.). It is anticipated that most of the labour force will be hired from outside the LAA.

19.5.2.2 Mitigation for Health Effects Associated with Socio-Economic Change

The following measures will be implemented to enhance positive health outcomes and avoid or reduce adverse health outcomes associated with socio-economic changes:

- Manitoba Hydro will work with the contractors through the procurements process to promote participation of local businesses in the Project.
- Continue to engage with and share Project information, such as workforce numbers and construction schedules, with local communities, and Aboriginal groups.

19.5.2.3 Characterization of Residual Social Effects for Health Effects Associated with Socio-economic Change

19.5.2.3.1 Construction

During construction, the Project has the potential to generate health benefits tied to the provision of jobs and income (Chapter 14 – Employment and Economy). The extent to which health benefits will occur is related to the degree to which the Project is successful in providing jobs to those who are currently under- or unemployed. However, because of the relatively small size of the construction workforce (approximately 175 at the peak month average in Q2 2018) and short construction period, the magnitude of such benefits will be modest. Given the relatively small amount of labour generated in the LAA, negligible adverse effects on health related to changes in in LAA communities are expected.

19.5.2.4 Summary

Both positive and adverse health effects are expected and will occur primarily during the construction phase, but may extend into the operation and maintenance phase. Although small, the Project will result in some positive effects for local residents who gain employment. .

19.5.3 Assessment of Health Effects Associated with the Mobile Workforce

19.5.3.1 Pathways for Health Effects Associated with the Mobile Workforce

19.5.3.1.1 Construction

For all components combined, the workforce is estimated to peak in Q4, 2017 at about 150 workers. The mobile construction camp is likely to be located between Piney and Zhoda. The potential community health effects associated with a mobile workforce fall into two categories:

- Effects from social and economic interactions with local communities, such as changes brought about by employment and income opportunities and changes in the social dynamics of communities (Section 19.5.2).
- Effects due to the inadvertent spread of infectious diseases among the mobile worker and local population.

SOCIAL AND ECONOMIC INTERACTIONS OF WORK-FORCE

The social dynamics of a community can be affected by the presence of mobile workers, particularly in smaller communities, because there are often opportunities for social and commercial interactions between temporary workforce personnel and established residents. Some of these interactions are positive; for example, spending on goods and services can stimulate some local businesses and positive interactions can occur in social or recreational settings. In other instances, negative effects can occur, including increases in alcohol and drug consumption, or feelings of hostility or outbreaks of violence. A variety of health effects can be linked to these changes, most notably changes in injury rates, emergency department use and mental well-being.

SEXUALLY TRANSMITTED INFECTIONS

Sexually transmitted infections are a serious and common concern in regions that experience influxes of temporary workers. Sexually transmitted infections can spike in communities during periods of construction activity, especially when there are large temporary workforces located near isolated communities. The increases can be traced to a number of factors, but in particular, the combination of mobile workers living and working in a camp or in a community, who often have high levels of disposable income, may become involved in illicit activities such as alcohol, drugs or sex.

In addition, STIs often go unreported or untreated in the mobile worker population. Mobile development workers often face substantial barriers to accessing STI prevention and testing services due to issues such as the limited hours of operation of clinics in nearby communities and geographic isolation of camps housing workers (Goldenberg *et al.* 2007, 2008a, 2008b, 2008c).

The cultural dynamics of some of the communities affected by the Project may be another factor to consider in the context of STI prevention, transmission and treatment. According to a KPI, in Southern Health there are strong religious and cultural beliefs, where harm reduction activities have been particularly challenging and the actual rates of STIs may be underreported due to the stigma associated with screening.

RESPIRATORY AND GASTROINTESTINAL INFECTIONS

Infectious respiratory and gastrointestinal illnesses, although quite different, share similar risk factors: both are exacerbated by working and living conditions that bring people close to one another. *Understanding the State of Industrial Camps in Northern BC: A Background Paper* (Thibault 2012) briefly discussed infectious diseases as a public health issue in the context of industrial camps in northeastern BC. The report concluded that camp conditions could pose a potential for infectious disease transmission. Infectious respiratory and GI disease transmission can also be a concern in settings where Project-related demand for housing causes an increase in crowding among some community members.

The transmission of vaccine-preventable diseases (e.g., measles, mumps, chicken pox, influenza) may be a particular problem in communities where immunization rates are low, as is the case in some regions of Southern Health (KPI, pers. comm.).

19.5.3.2 Mitigation for Health Effects Associated with the Mobile Workforce

Manitoba Hydro will implement the following mitigation measures to reduce the risk of increasing the spread of transmissible diseases between the temporary Project workforce and the local community:

- Camp contractors are required to maintain a clean camp that meets all applicable provincial regulations and public health standards.
- Work with the relevant regional health authorities to ensure adequate and appropriate strategies are put in place to reduce or eliminate the spread of infection at worksites, including the transport of severely contagious workers, and ensure sanitation standards meet public health guidelines.
- Continuous communication with communities to address complaints or concerns related to Project activities or workers.

19.5.3.3 Characterization of Residual Social Effect for Health Effects Associated with the Mobile Workforce

19.5.3.3.1 Construction

Due to the relatively small number of Project workers (a peak average of 175), and in combination with the above mitigation measures, there is likely to be little effect of the mobile workforce on infectious disease transmission during the construction phase. For STIs, any workforce-related increases in STIs that occur near Winnipeg will be negligible compared to baseline levels, while numbers of new cases of STIs in rural regions will be low and difficult to detect on a population basis. Infectious respiratory or GI disease increases would likely be noticeable at a population level only in the case of a camp- or worksite-based outbreak (anticipated to be less than 100 beds), which would require notification of and possibly intervention by the relevant health authority.

Because workers coming from outside the LAA will stay in either temporary accommodations (*i.e.*, hotels/motels) in local communities, or in mobile construction camp established for the Project potential negative social interactions are possible. However, given the relatively small workforce, and because the duration of construction activity at any one location will be limited, the potential for adverse social interactions is low. With the implementation of mitigation measures outlined above, the residual change in health outcomes is anticipated to be short-term, continuous and reversible.

With mitigation, the Project will result in a negligible magnitude of adverse health effects associated with the mobile workforce during the construction phase, because of the small size of the construction workforce, and likely limited to no health effects during the operation and maintenance phase. Any effects would be short-term, continuous, and reversible since they occur only during the construction phase.

19.5.4 Assessment of Stress and Annoyance

19.5.4.1 Pathways for Stress and Annoyance

Stress and annoyance is primarily a nuisance to those who experience them, but unmanaged stress and annoyance also have physical health consequences that include weakened immune systems, weakened functioning of the circulatory and metabolic systems, and increased incidence of cardiovascular disease and Type 2 diabetes (Brunner and Marmot 2006). Exposure to stress can also contribute to behaviours such as smoking, overconsumption of alcohol and less than healthy eating habits.

Feedback from Manitoba Hydro's engagement processes has identified the following factors as potentially contributing to stress and annoyance in the local population:

- The Project's lengthy environmental assessment and regulatory review process
- Unknowns about the Project
- Change in the landscape
- Perceived effects of EMF on human and animal health
- Effects on private property, including the Project's proximity to properties, property values, compensation, uncertainty about title, interference with future subdividing and building
- Additional costs to taxpayers
- Noise associated with the transmission line and construction activities
- Concerns with the nature of the engagement process
- Environmental and ecological effects

19.5.4.1.1 Construction, Operation and Maintenance

Concerns about the perceived health effects of EMF exposure during transmission line operations were expressed throughout the public engagement and First Nation and Metis engagement processes. Participants expressed a range of concerns, from worries about cancer and long-term health effects, to the proximity of transmission lines to vulnerable populations such as children. As described in Chapter 18 – Human Health Risk, several key studies conducted by the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) confirm there is no link between exposure to EMF fields and adverse human health outcomes. Despite this, there remains a perception that transmission lines pose health risks (Furby *et al.* 1988; Devine-Wright 2012; Cain and Nelson 2013; Keir *et al.* 2014). Concerns about the Project in regards to perceived health risks by some LAA residents has led to phone calls to the local health authorities (KPI, pers. comm.).

The difference between the perceived risk and the “real”, validated risk can be substantial. According to Cain and Nelson (2013), “in terms of public opposition, perceived risks are often more important than actual risks, and the difference between perceived and actual risk can be large.” Few studies have examined the relationship between the perceived risks associated with transmission lines and adverse health effects. The first prospective study of its kind, recently conducted in the Netherlands, found that health complaints increased for residents living within 300 m of a new transmission line, and that there were negative effects on health perceptions for nearby residents even before the line was in operation (Porsius *et al.* 2015). According to Porsius *et al.* (2014), “the relatively high perceived risks of power lines may adversely affect well-being and health of residents living near a power line through a psychosocial pathway linking exposure to a potential environmental hazard to symptom reporting”. Another study shows similar health effects associated with the perceived risk of other environmental exposures, such as industrial odours, noise and air pollution (Marques and Lima 2011).

19.5.4.2 Mitigation for Stress and Annoyance

To mitigate stress and annoyance caused by changes in real and perceived environmental effects, the route selection process considered a number of factors, including existing land uses, feedback provided during the Public engagement and First Nation and Metis engagement processes, and the presence of existing infrastructure (Chapter 5 – Transmission Line Routing; Chapter 18 – Human Health Risk). The following measures will also be implemented to mitigate the effects of stress and annoyance:

- Manitoba Hydro will enter into easement agreements with private landowners whose land is crossed by the transmission line. The information provided to landowners during this process is expected to alleviate concerns related to Project uncertainty. [Manitoba Hydro's Manitoba-Minnesota Transmission Project Landowner Compensation Information brochure]
- The final detailed Project design will take in to account standards for setbacks and overhead clearance, including CSA standards such as CAN/CSA-C22.3 No. 1-10 "Overhead Systems" and CAN/CSA 22.3 No. 60826-10 "Design Criteria for Overhead Transmission Lines".
- Manitoba Hydro will develop, organize, and participate in ongoing Public engagement and First Nation and Metis engagement processes activities in order to provide timeline and up-to-date information regarding Project activities and to receive feedback.
- Mitigation measures identified in Chapter 17 to reduce adverse effects on visual quality, and associated stress and annoyance related to changes in views.

The following mitigation measures identified in Chapter 16 – Land and Resource Use with respect to property and residential developments will reduce adverse effects on stress and annoyance related to noise generated by construction activities:

- Construction activities and equipment will be managed to avoid damage and disturbance to adjacent properties, structures and operations.
- Mud, dust and vehicle emissions will be managed in a manner that considers the safe and continuous public activities near construction sites where applicable.
- Noisy construction activities where noise and vibration may cause disturbance and stress in built-up areas will be limited to daylight hours.
- A communication protocol will be developed to notify affected parties of blasting operations and conductor splicing. Affected parties may include Manitoba Conservation and Water Stewardship, RCMP, municipalities, landowners and resource users.

The mitigation measures identified in Chapter 18 – Human Health Risk will also reduce adverse effects on stress and annoyance associated with noise and EMF, including:

- conducting construction activities as per applicable noise bylaws

- informing nearby residents of major noise-generating activities such as the use of implode sleeves for conductor splicing and potential helicopter use for tower installation
- continuing to address concerns related to EMF and providing factual, science-based information to concerned individuals and organizations

19.5.4.3 Characterization of Residual Environmental Effect for Stress and Annoyance

19.5.4.3.1 Pre-construction

Prior to construction, stress and annoyance will be associated with perceived effects by persons concerned about how the Project may affect them or their households. Such concerns were identified during engagement processes (Table 19-2); they included perceived effects due to proximity of the Project to residences, and possible effects on property values, tourism, recreation, quality of life and cultural identity. Information provided in this section, and elsewhere in the EIS, with respect to Project effects that could contribute to stress and annoyance, and mitigations of those effects are expected to reduce the stress and annoyance associated with Project pre-construction. This is because it is anticipated that some of the stress is related to limited understanding of potential effects and mitigations, and such information will be provided in the EIS. This effect will occur continuously throughout the pre-construction phase. It is anticipated that changes in stress and annoyance during pre-construction will be of low magnitude, and will be within the current capabilities of the health care infrastructure to manage.

19.5.4.3.2 Construction

Increased noise levels and changes in the visual landscape during construction are likely to be the primary source of stress and annoyance for local residents. Increased construction traffic, land clearing, diesel generators and large machinery are other potential contributors. Noises will be primarily limited to the construction area and will not extend throughout the LAA.

With mitigation, the Project will result in a low magnitude of stress and annoyance associated with noise during the construction phase. The effects associated with noise are multiple regular events, short-term, and reversible since they occur only during the construction phase.

19.5.4.3.3 Operation and Maintenance

During the operation and maintenance phase, potential sources of stress and annoyance include the perceived risks associated with exposure to EMF, perceived decreased property values, changes in the landscape, and audible noise caused by operation of the transmission line (Morgan and Granger 1985; Furby *et al.* 1987; MacGregor *et al.* 1994; Linder 1995; McMahan and Meyer 1995). Landowners and residents living nearer to the transmission line within the LAA are most likely to experience stress and annoyance from these sources for as long as the line is in operation.

With mitigation, residual effects on stress and annoyance will be of low to moderate magnitude for the following reasons:

- the Project is anticipated to have a low effect on property values (Chapter 16 – Land and Resource Use);
- the anticipated change in visual quality associated with operation and maintenance of the transmission towers are of moderate magnitude, and restricted to the LAA (Chapter 17 – Visual Quality);
- residual human health risk effects associated with changes in Project-related noise are adverse but negligible in magnitude, limited to the LAA, regular, long-term, and reversible (Chapter 18 – Human Health Risk); and
- actual health risks from EMF emissions are negligible, as current scientific evidence indicates that transmission lines do not pose a risk to human health (Exponent 2015; Chapter 18).

These effects are continuous, permanent and irreversible since some degree of stress and annoyance could potentially be experienced in relation to these factors for as long as the line is in operation.

19.5.5 Assessment of Change in Aboriginal Health

19.5.5.1 Pathways for Change in First Nation and Metis Health

The most common concerns associated with the construction and operation of electrical transmission lines in the context of Aboriginal health are the loss or change in vegetation and wildlife habitat and the resulting potential effect on the quality and quantity of subsistence foods and traditional medicines.

The Project may affect Aboriginal health by contributing to a decrease in the consumption of subsistence foods and traditional medicines, either by altering the landscape in such a way that subsistence foods and traditional medicines are less readily available through change in access or removal, or by the belief that foods are contaminated and should be avoided.

The following concerns were raised regarding Aboriginal health:

- According to the Aboriginal Traditional Knowledge Study Community Report submitted by Black River, Long Plain and Swan Lake First Nation (2015), there are concerns that the clearing of vegetation could result in the permanent loss of medicinal plants, berries and other traditional plant foods, such as wild rice and weke. The report also suggests there are concerns about the possibility that contamination from the construction of access roads will lower the consumption of medicinal plants and berries.

- The Roseau River Anishinabe First Nation (2015) is primarily concerned about the protection of the traditional areas identified during the Project mapping process.
- Peguis First Nation indicated in the Land Use and Occupancy Interview Project Report (2015) that community members are concerned that their gathering rights will be affected.

Another potential adverse effect is the potential for changes in the environment that alter the connection to the land and engagement in traditional activities, which are important determinants of Aboriginal health. As noted by Richmond and Ross (2009), for Aboriginal people “the health of the land and the health of the community are thought to be synonymous, nurtured through relationships to the physical environment and the cultural, spiritual, economic, political and social roots it provides.” When these cultural connections between land and identity are compromised, health can be affected directly—for example, through a shift away from traditional foods towards a less-healthy Western diet—and indirectly, through a lost way of life (Richmond and Ross 2009). Specific concerns raised in both TK reports include potential loss of cultural, heritage, historical and sacred sites.

19.5.5.2 Mitigation for Aboriginal Health

Manitoba Hydro will offer to hold Environmental Protection Plan meetings with First Nations and the MMF to review concerns raised during and subsequent to the FNMEP, including potential Aboriginal health effects caused by the changes in subsistence food and traditional medicine consumption, and engagement in traditional activities and to discuss site specific environmental protection measures that will be incorporated into the construction phase of the environmental protection plan.

- Contractor will be restricted to established roads and trails, and cleared construction areas in accordance with the AMP.
- In situations where the ROW does not have completely frozen or have dry ground conditions alternate mitigation such as construction mats may be used.
- Contractor specific Erosion Protection and Sediment Control Plans will be prepared by the Contractor, accepted by Manitoba Hydro prior to construction and updated annually.
- Clearing within environmentally sensitive areas will be conducted in a manner that limits disturbance to existing organic soil layer.
- For clearly identified plant harvesting areas, Manitoba Hydro may utilise a variety of measures, including flagging of area, selective clearing methods, construction matting, non-chemical vegetation management, specific measures are assigned on a site-by-site basis.
- Vehicles, equipment and machinery must arrive on-site in clean condition free of fluid leaks and weed seeds.
- Where access to agricultural land is necessary, the Agricultural Biosecurity Transmission Standard Operating Procedure must be followed.

- Weed control along access roads and trails, borrow pits, quarries, construction camps, marshalling yards will be in accordance with Rehabilitation and Weed Management Plan.
- Disturbed areas along transmission line ROWs will be rehabilitated in accordance with site Rehabilitation and Weed Management Plan.
- Locations of equipment cleaning sites (when not contained within station boundaries) will be recorded and monitored during the following growing season as part of weed control in accordance with Rehabilitation and Weed Management Plan.
- Where appropriate, regional native grass mixtures will be used to assist re-vegetation of disturbed areas to control erosion or prevent invasion of non-native species. The mixtures will not contain non-native or invasive species.
- There will be no herbicides used in the clearing phase of construction.
- Manitoba Hydro will consider non-chemical vegetation management in clearly identified sensitive sites that contain plants that are of importance to Aboriginal harvesters.
- Respecting Reduced Risk Timing Windows for Wildlife to avoid works during times of the year when wildlife species are sensitive to disruptive operations because of a sensitive lifecycle activity such as calving, nesting, and hibernation. These windows are based on federal and provincial regulatory requirements. Timing periods may be expanded or refined based on further data collection, transmission line final design and regulatory approvals to be issued for the Project.
- Installing bird diverters on skywires in areas of high collision risk potential.
- Applying applicable buffers and setbacks during clearing activities for bird nesting and breeding sites.
- Conducting pre-construction surveys for elements such as stick nests and mineral licks to identify areas for setbacks and buffers.
- Bypass trails, sensitive sites and buffer areas will be clearly marked prior to clearing.
- The Contractor will be responsible for developing, implementing and maintaining Erosion Protection and Sediment Control Plans and procedures to be put in place prior to commencement of construction activities.
- Through ongoing engagement processes notifications to interested First Nations and the MMF advising on when/where construction is occurring.

19.5.5.3 Characterization of Residual Social Effect for Aboriginal Health

19.5.5.3.1 Construction and Operation and Maintenance

The criteria for characterizing residual environmental effects on Aboriginal health are based on the assessment of environmental effects for plant harvesting, and the assessment of change in land and resource use used for hunting and trapping (Chapter 11 – Traditional Land and Resource Use) and Aboriginal traditional knowledge (ATK). The assessment of potential changes in the environment that may alter First Nations engagement in traditional activities was informed by ATK studies provided to Manitoba Hydro by the Roseau River Anishinabe First Nation, Black River, Long Plain and Swan Lake First Nations and Peguis First Nation.

The assessment of effects for plant harvesting (Chapter 11) was informed by the residual environmental effects identified in the following VC assessments: vegetation and wetlands (Chapter 10) and land and resource use (Chapter 16). The assessment of residual effects for plant harvesting will result in adverse effects on plant harvesting by decreasing the availability of traditional use plant species and reducing the land base available for traditional plant harvesting activities. However, several plant harvesting areas were identified during the FNMEP in the RAA that will not be affected by the Project; therefore, there will continue to be viable traditional use plant populations available for harvesting. The vegetation and wetlands assessment characterized the magnitude of effects as low, whereby the Project is unlikely to have a residual effect on the occurrence of traditional use plant species within the LAA, although temporary shifts in distribution might occur.

The assessment of change in land and resources used for hunting and trapping (Chapter 11) was informed by the residual environmental effects identified in the wildlife and wildlife habitat assessment (Chapter 9) and land and resource use assessment (Chapter 16). The wildlife and wildlife habitat assessment characterized residual environmental effects magnitude as low, whereby the Project is unlikely to have a measurable effect on wildlife abundance in the LAA, but temporary local shifts in wildlife distributions might occur. However, the effect on hunting and trapping is characterized as moderate in the assessment of change in land and resources used for hunting and trapping (Chapter 11).

The Project has the potential to change the physical environment in such a way that may alter First Nations and Metis ability to participate in traditional and cultural activities, and decrease the consumption of subsistence foods and traditional medicines.

According to the traditional knowledge reports provided by the Roseau River Anishinabe First Nation (2015) and the Black River, Long Plain and Swan Lake First Nations (2015), these First Nations reported a close connection with the land and active engagement in traditional and cultural activities, including hunting, trapping, fishing and the harvesting of subsistence foods and traditional medicines. However, the extent to which communities participate in these activities is described approximately or in general terms, and it is uncertain how many community members rely on subsistence foods from the LAA as a source of nutrition, or experience food insecurity.

The activities described in the TK reports and data from the FNFNES are not representative of all First Nations engaged with the Project. However, based on the available information, it is likely that the Project will to some degree alter, interfere with access to and participation in traditional and cultural activities, and may contribute to decreased consumption of subsistence foods and traditional medicines for some community members.

With mitigation, the Project will result in a low effects on Aboriginal health during the construction phase, and operation and maintenance phase within the LAA. This is attributed to the Project being located in an area that has been considerably disturbed by past and present physical activities and the ROW traverses 752 ha of Crown Lands, which is 0.5% of the Crown land within the RAA. Effects occur continuously and are permanent, as they will extend the lifetime of the Project, and are considered irreversible.

19.5.6 Assessment of Effects on Health Care Services and Infrastructure

19.5.6.1 Pathways for Health Care Services and Infrastructure

The Project could place additional demand on health care services and infrastructure during the construction phase through three potential pathways. The first is through an increase in demand for health care services caused by the use of a temporary mobile workforce, such as occupational injuries, traffic-related injuries, alcohol and drug-related health issues, or increased rates of infectious disease. An increase in these conditions may place additional demands on health care services and infrastructure and therefore affect the quality of care available to local residents (e.g., increased patient wait times, increased workload in understaffed areas). However, given the limited size and dispersion of the workforce, the demands placed on any specific healthcare services and infrastructure are not anticipated to be substantial (Chapter 13 – Infrastructure and Services).

The second potential pathway is through an increased demand for health care services by the local population, via increased rates of infectious disease, traffic-related injuries or health effects related to stress and annoyance. This, too, may strain capacity and affect the quality of care available to local residents.

The third way in which the Project could affect health care services and infrastructure is through affecting essential supporting infrastructure, such as travel restrictions due to construction, or presence of slow-moving vehicles on roadways, potentially impeding ambulances, or other factors affecting travel to or services at the hospitals. This is assessed in Chapter 13 – Infrastructure and Services, and is therefore not re-assessed here.

19.5.6.2 Mitigation for Health Care Services and Infrastructure

Manitoba Hydro will implement the following measures to mitigate potential effects on health care services and infrastructure:

- Share Project information, including workforce information and accommodation requirements, with local governments, service providers, and businesses, as appropriate, so they are aware of anticipated Project-related demands, allowing them to identify and address potential service gaps or issues.
- Project personnel will be made aware of the Emergency Response Plan and designated staff will receive Emergency Response Plan training. Among other elements, the plan will address handling and storage of materials, driving safety, animal encounters, emergency response communications, spill response, personnel injury response and vehicle accidents. The plan will describe response measures for major medical emergencies and include procedures for emergency response coordination with local emergency response personnel and local medical facilities.
- Provide first aid supplies and facilities, and trained first aid personnel to deal with minor injuries.
- Liaise with the Southern Health RHA about the possibility of coordinating primary care services with the mobile clinic around Stuartburn and Piney.
- Coordinate with local agencies (including RCMP, Emergency Preparedness, hospitals, and air ambulances) on emergency response plans.
- Group transportation (e.g., buses, crew vans) will be used to transport workers between camp(s) and the worksites, and between temporary accommodations in nearby communities and the worksites.
- Maintain firefighting trained workers and fire suppression systems at construction sites and camp.

19.5.6.3 Characterization of Residual Social Effect for Health Care Services and Infrastructure

The anticipated maximum workforce for the Project is relatively small (*i.e.*, a peak average monthly workforce of 150 people per month during the construction phase) and not expected to place a major strain on health care services as whole, although there may be slight regional differences in health care capacity. Any potential increase in demand would be limited to peak periods of construction because workforce-related effects will be negligible during operation and maintenance.

Project-related injuries are not anticipated to place undue pressure on health care services or infrastructure. The Project will generate 124 PYs of direct employment. Applying Work Safe Manitoba's 2013 heavy construction all injury rate of 9.7 per 100 PYs results in an estimate of 12 injuries over the 32 month construction period, for an average of 0.38 injuries per month. During the peak

of construction, there will be an estimated 175 persons employed, with predicted injuries of 1.40 during the peak month. Considering that the all injury rate overestimates the number of workers that will actually require medical attention, and because there are several hospitals in or near the LAA capable of treating such emergencies, with application of mitigation Project-related injuries will have a negligible effect on health care services and infrastructure.

The potential effect on health care services and infrastructure from other health conditions arising from the temporary mobile workforce, such as an increase in infectious disease or drug and alcohol-related problems, is expected to be small due to the small number of temporary workers dispersed across Project components. Similarly, Project workforce-related health conditions affecting the local population and subsequent health care utilization is expected to be minimal due to the small number of temporary workers dispersed across Project components during construction. While some local residents may seek out primary health care for Project-related stress and annoyance during the operation and maintenance phase, it is unlikely to result in a strain on health care services.

In terms of health care capacity, the hospitals servicing areas of the Project in and around Winnipeg are unlikely to be adversely affected during the construction phase, because there are currently no major concerns with capacity in Winnipeg hospitals (KPI, pers. comm.).

To the west of Winnipeg and around the Glenboro area, health service capacity is somewhat more constrained, with the Glenboro Health Centre unable to provide 24-hour emergency care due to personnel shortages (KPI, pers. comm.). However, such care is available to residents in and around Glenboro through shared on-call with the Carberry Health Centre, and if needed, additional services are available at the Brandon Regional Health Centre, whose occupancy is currently running at around 90% (KPI, pers. comm.). Given the small workforce required for this Project component (approximately 30 per month), a minimal effect on health infrastructure in this area is expected (KPI, pers. comm.).

In the southeast region of the province, 24-hour emergency services are wholly provided by the Bethesda Regional Health Centre in Steinbach. Currently the Centre is operating at close to 95% occupancy (although it aims for 82-92% occupancy) and it experiences staffing shortages (KPI, pers. comm.). Because this health centre services the area of the Project with the largest workforce component (approximately 100 workers), any additional usage from the temporary workforce or local population during construction could place additional burden on services. However, it is estimated that the Project will have a negligible effect on this hospital.

19.5.6.4 Summary

The residual effects on health care services are predicted to be adverse because the Project may increase the use of these services by Project workers or the general population, and areas of health care service delivery are already strained, including the Bethesda Regional Health Centre, the Glenboro Health Centre, and primary care services in Steinbach. However, residual effects during construction will be of negligible magnitude, and any increase is expected to be within the capabilities of the current system. Residual effects during operation and maintenance are

expected to be negligible due to the low workforce numbers and limited pathways for effects. Any effects are expected to be limited to the LAA, because patients will primarily use the hospitals near the Project. Effects are short-term, continuous, and reversible because they mainly occur during the construction phase.

19.5.7 Summary of Residual Social Effects on Community Health and Well-being

Table 19-20 summarizes residual effects on community health and well-being.

Table 19-20 Summary of Residual Social Effects on Community Health and Well-being

Project Phase	Residual Social Effects Characterization						Socio-economic Context
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	
Health Effects Associated with Socio-economic Change							
Construction	P-A	N	LAA	ST	C	R	MR
Health Effects Associated with the Mobile Workforce							
Construction	A	N	LAA	ST	C	R	MR
Stress and Annoyance							
Pre-Construction	A	L	LAA	ST	C	R	MR
Construction	A	L	LAA	ST	IR	R	MR
Operation and Maintenance	A	M	LAA	P	C	R	MR
Aboriginal Health							
Construction	A	L	LAA	P	C	I	LR
Operation and Maintenance	A	L	LAA	P	C	I	LR

Residual Social Effects Characterization							
Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-economic Context
Health Care Services and Infrastructure							
Construction	A	N	LAA	ST	C	R	MR
Operation and Maintenance	A	N	LAA	P	C	R	MR
<p>KEY</p> <p>See Table 19-8 for detailed definitions</p> <p>Direction: A: Adverse; N: Neutral; P: Positive</p> <p>Magnitude: N: Negligible; L: Low; M: Moderate; H: High</p> <p>Geographic Extent: PDA: ROW/Site; LAA: Local Assessment Areal; RAA: Regional Assessment Area</p> <p>Duration: ST: Short-term; MT: Medium-term; P: Permanent</p> <p>Frequency: S: Single event; IR: Irregular event; R: Multiple Regular event; C: Continuous</p> <p>Reversibility: R: Reversible; I: Irreversible</p> <p>Socio-Economic Context: U: Undisturbed, D: Disturbed; LR: Low resilience, MR: Moderate resilience, HR: High resilience</p> <p>N/A Not applicable</p>							

19.6 Assessment of Cumulative Social Effects on Community Health and Well-being

The Project residual effects described in Section 19.5 are likely to interact cumulatively with residual effects of other physical activities as identified in this section and the resulting cumulative effects are assessed. This is followed by an analysis of the Project contribution to residual cumulative effects.

19.6.1 Identification of Project Residual Effects Likely to Interact Cumulatively

Table 7-4 in Chapter 7 – Assessment Methods, presents the Project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual social effects from the Project act cumulatively with those from other projects and physical activities, a cumulative effects assessment is undertaken to determine their significance (Table 19-21).

Table 19-21 Potential Cumulative Social Effects on Community Health and Well-being

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Social Effects				
	Health Effects Associated with Socio-economic Change	Health Effects Associated with the Mobile Workforce	Stress and Annoyance	Aboriginal Health	Health Care Services and Infrastructure
Past and Present Physical Activities and Resource Use					
Agriculture (Conversion, Livestock Operations, Cropping and Land Drainage)	–	–	–	–	–
Residential Developments	–	–	–	–	–
Existing Linear Developments (Riel-Forbes 500 kV, Glenboro-Rugby-Harvey 230 kV, Riel Sectionalisation)	–	–	–	–	–
Other Resource Activities (Forestry, Mining, Hunting, Trapping, Fishing)	–	–	–	✓	–
Recreational Activities	–	–	–	–	–
Future Physical Activities					
Bipole III Transmission Project	–	–	✓	✓	–
St. Vital Transmission Complex	–	–	✓	✓	–
Dorsey-Portage South Transmission Project	–	–	✓	✓	–
Northwest Winnipeg Natural Gas Pipeline Project	–	–	✓	✓	–
Richer South Station to Spruce Station Transmission Project	–	–	✓	✓	–
Energy East Pipeline Project	–	–	✓	✓	–
Southend Water Pollution Control Centre Upgrade Project	–	–	–	–	–
St. Norbert Bypass	–	–	–	–	–
Headingley Bypass	–	–	–	–	–
Oakbank Corridor	–	–	–	–	–
Residential Development	–	–	–	–	–
Natural Gas Upgrade Projects	–	–	–	–	–

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Social Effects				
	Health Effects Associated with Socio-economic Change	Health Effects Associated with the Mobile Workforce	Stress and Annoyance	Aboriginal Health	Health Care Services and Infrastructure
MIT Capital Projects (Highway Renewal)	–	–	–	–	–
Piney-Pinecreek Border Airport Expansion	–	–	–	–	–

NOTES:

“✓” = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual social effects.

“–” = Interactions between the residual effects of other projects and those of the Project residual effects are not expected.

Effects identified in Table 19-21 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not assessed further.

Residual Project-related health effects associated with socio-economic change and the mobile workforce and effects on health care services and infrastructure have been assessed as negligible. This assessment is made because the Project effects will result in no measureable change from baseline conditions (as defined in Table 19-8). As such, “negligible” as used in this assessment means that an effect cannot be discerned and characterized by any means, and therefore no assessable effect exists. CEAA 2012 requires that each environmental assessment of a Project take into account any cumulative environmental effects that are likely to result from the Project in combination with the environmental effects of other physical activities that have been or will be carried out. Because these three residual effects of the Project will not result in any measureable change from baseline conditions, there is nothing to add to the effects of other projects. Therefore, further assessment of the effects is not warranted.

Past and present physical activities and resource uses are embodied in the existing conditions for stress and annoyance and Aboriginal health, and provide the basis for the assessment of Project residual effects. It is not anticipated that past and present activities or uses will result in any additional stress and annoyance or effects on Aboriginal health in the future that are not already present, and are therefore not considered further in the assessment of cumulative effects.

Reasonably foreseeable future projects that will be noisy or generate traffic have the potential to act cumulatively with the residual stress and annoyance from the Project during the construction phase. Reasonably foreseeable future projects that cause stress and annoyance through perceived risks of EMF exposure, change in property values, or perceived noise have the

potential to act cumulatively with the residual stress and annoyance from the Project during the operation and maintenance phase.

These potential cumulative effects are discussed in Section 19.6.2.

Reasonably foreseeable future projects that are built on or nearby previously undisturbed or minimally disturbed lands, or lands that are important to Aboriginal communities have the potential to cause cumulative effects on Aboriginal health through a cumulative loss of use or access of lands, or the perception of environmental contamination or overall landscape degradation. These potential cumulative effects are discussed in Section 19.6.3.

19.6.2 Cumulative Effects Assessment for Stress and Annoyance

19.6.2.1 Cumulative Effect Pathways for Stress and Annoyance

The following projects identified in Table 19-21 could contribute to cumulative levels of stress and annoyance for local residents through increased construction traffic and noise during construction:

- Bipole III Transmission Project
- St. Vital Transmission Complex
- Dorsey-Portage South Transmission Project
- Richer South Station to Spruce Station Transmission Project
- Energy East Pipeline Project

During operation and maintenance, these projects plus the Northwest Winnipeg Natural Gas Pipeline Project may contribute to stress and annoyance caused by perceived decrease in property values, changes in the landscape or the potential for pipeline spills or leaks.

The Bipole III, St. Vital, Dorsey-Portage South Transmission Project, and Richer South Station to Spruce Station transmission projects may also contribute to stress and annoyance related to perceived risks of EMF exposure and perceived noise caused by the operation of transmission lines.

19.6.2.2 Mitigation for Cumulative Effects for Stress and Annoyance

Potential mitigation measures that could be implemented by Manitoba Hydro and other proponents to reduce cumulative stress and annoyance effects include:

- Engage and share Project information with local residents and First Nation and Metis engagement processes so they are aware of future Manitoba Hydro projects.

- Communicate and share resources on human health findings with local residents to reduce perceived risks related to EMF exposure and other environmental exposures, such as industrial odours, noise and air pollution.
- Conduct construction activities as per applicable noise bylaws.

19.6.2.3 Residual Cumulative Effects for Stress and Annoyance

The four projects listed above are likely to contribute additional stress and annoyance through related noise and traffic disturbances associated with construction activities. These effects will be experienced primarily close to the construction areas, short term and continuous until the end of construction, and will occur in a moderately resilient context given feedback identified during Project-related engagement activities.

Landowners and residents living near both the Project and one or more of the other four projects identified in Table 19-21 are most likely to experience cumulative stress and annoyance from perceived risks associated with exposure to EMF, perceived decreased property values, changes in the landscape, and noise caused by operation of the transmission line, or pipeline spills or leaks. Studies have indicated that perceived health effects related to transmission line development lessen with distance from the line (Thomson and Evans 1996; Bond and Hopkins 2000; Porsius *et al.* 2014) suggesting that such stress would not be felt by residents throughout the RAA, but instead would be focussed in areas that are near the transmission line developments. Given the size of the RAA, and reasonable expectation that mitigation measures will be applied by Manitoba Hydro to address concerns related to noise and air quality, and that information will be provided in regards to EMF, the residual cumulative effects on stress and annoyance is considered low magnitude. However, effects will be continuous, long-term and reversible as some level of stress and annoyance could potentially be experienced as long as the Project is operational.

19.6.3 Cumulative Effects Assessment for Aboriginal Health

19.6.3.1 Cumulative Effect Pathways for Aboriginal Health

Reasonably foreseeable future projects may have both beneficial and adverse effects on Aboriginal health. Beneficial effects could be experienced because of employment opportunities. As discussed in Section 19.5.2, employment and income comprise some of the primary drivers of positive health outcomes. The Project, and other reasonably future projects identified in Table 19-21 will create employment and income, contributing to positive health outcomes associated with income and employment related social health determinants. In the case of Aboriginal individuals who are currently unemployed or under-employed, these benefits may be strongly experienced.

However, projects that involve land clearing or changes in land use may contribute to adverse cumulative effects on Aboriginal health, particularly those on Crown land, on previously undisturbed or minimally disturbed lands, or other lands that are important to First Nations and Metis. Crown land is important because First Nations' members have the right "to hunt, trap and fish for food at all seasons of the year on unoccupied Crown land and other land to which they have a right of access" (Government of Manitoba 2009). Traditional activities can still be pursued on Crown land over which Manitoba Hydro has built a ROW and acquired an easement, though there will be periods during the two and a half years of clearing and construction when such activities cannot be practiced on the land in question. Some Aboriginal persons may be less inclined to practice traditional activities in and immediately adjacent to the ROW as a result of the change in appearance of the land or changes in vegetation and wildlife behavioural patterns that could occur where the ROW is built in areas that are presently forested..

The following reasonably foreseeable future projects have therefore been identified as having the potential to contribute to cumulative effects:

- Bipole III Transmission Project
- St. Vital Transmission Complex
- Dorsey-Portage South Transmission Project
- Northwest Winnipeg Natural Gas Pipeline Project
- Richer South Station to Spruce Station Transmission Project
- Energy East Pipeline Project

The Project, in conjunction with these projects, may result in a cumulative loss or alteration, or perceived effects, on lands that support traditional foods harvesting due to clearing, invasive species introduction, or herbicides use.

19.6.3.2 Mitigation for Cumulative Effects for Aboriginal Health

The mitigation measures put forth to reduce or eliminate effects on vegetation and wildlife habitat and the resulting effect on the quality and quantity of subsistence foods and traditional medicines resources that First Nations and Metis rely on will help to reduce cumulative effects on Aboriginal Health. These include mitigations identified in Section 19.5.5.2 that address change in availability of edible and medicinal plants and change in game species availability. Detailed information about mitigation measures for the VCs that are related to Aboriginal health is provided in Chapter 9 – Wildlife and Wildlife Habitat, Chapter 10 – Vegetation and Wetlands, Chapter 11 – Traditional Land and Resource Use and Chapter 16 – Land and Resource Use. Manitoba Hydro where appropriate, will extend the mitigation measures developed for this Project to future transmission line projects proposed or under development in the RAA.

19.6.3.3 Residual Cumulative Effects for Aboriginal Health

The Project, in conjunction with other physical activities proposed for Crown lands, may cumulatively reduce the use by First Nation and Metis of Crown lands to the extent that some members of these communities may be less inclined to engage in traditional practices along the ROW built in previously forested or unmodified areas due to the change in appearance of the land and alterations to vegetation and the behavior of wildlife. Land clearing and the physical presence of the line are two of the key factors affecting access and use of traditional lands for First Nation and Metis (e.g., the availability of wildlife and potential disturbance of traditional foods). Approximately 64% of the RAA has already been modified by agriculture and development (e.g., town sites/residential sites, airstrips, linear infrastructure, transmission lines, roads, railroads, pipelines) and mining (e.g., gravel pits and landfills). The PDA includes only 752 ha of Crown lands, which represents 0.5% of the Crown lands within the RAA.

In Chapter 11, a moderate cumulative effect on traditional land and resource use is forecast for that VC. Cumulative effects are expected to be permanent, continuous, and irreversible. Cumulative effects on several of the VCs that influence traditional land and resource use, will also experience permanent effects.

The vegetation and wetlands assessment (Chapter 10) indicated that the Project has the potential to interact cumulatively with other projects and permanently affect traditional use plant species in the vegetation and wetlands RAA because of clearing of native vegetation, vegetation management and the creation of permanent structures.

The cumulative assessment of change in habitat availability (Chapter 9 – Wildlife and Wildlife Habitat) indicated that the contribution of future projects to wildlife mortality risk in the wildlife and wildlife habitat RAA will be permanent, and that birds (a source of food identified by the Peguis First Nation) will be the most vulnerable to cumulative effects.

In consideration of the cumulative effects assessment on wildlife and wildlife habitat (Chapter 9), vegetation and wetlands (Chapter 10) and traditional land and resource use (Chapter 11), cumulative effects on Aboriginal health during the construction phase and operation and maintenance phase within the RAA are expected to be low in magnitude. This is because changes in the availability of traditional foods within the RAA will not result in change in Aboriginal health that will affect the capabilities of health infrastructure and service management systems. Effects will occur on various parcels of Crown land throughout the RAA. Effects will be continuous and permanent since the residual effect will extend for the lifetime of the Project or more, and irreversible. First Nations and Metis have relatively low resilience, as community health is comparatively poor and highly vulnerable to social, economic and environmental stressors.

19.6.4 Summary of Cumulative Effects

Past and present physical activities and resource uses are embodied in the existing conditions for community health and well-being, and provide the basis for the assessment of Project residual effects. It is not anticipated that any of these activities or uses will result in any additional effects on community health and well-being in the future that are not already present, and are therefore not considered further in the assessment of cumulative effects.

The Northwest Winnipeg Natural Gas Pipeline Project's construction phase is scheduled for 2015-2016, and the operation and maintenance phase 2016+. Therefore, there is no temporal overlap between the construction phase of this project and with the construction phase of the Project, and will therefore not act cumulatively with the Project residual effects on health care infrastructure and services.

There are therefore six future projects proposed for southern Manitoba whose residual effects have the potential to overlap temporally and spatially with the Project residual effects, as outlined in Table 19-21. The potential cumulative social effects on community health and well-being associated with stress and annoyance and Aboriginal health are summarized in Table 19-22.

19.7 Determinations of Significance

With mitigation measures, the overall residual cumulative community health and well-being effects attributable to the existing and planned projects within the RAA are assessed as not significant, as explained below. The residual cumulative health and well-being effects of past, present or reasonably foreseeable future projects are not anticipated to result in significant cumulative effects on stress and annoyance or Aboriginal health.

19.7.1 Significance of Social Effects from the Project

With the application of mitigation measures, the residual effects of the Project on community health and well-being are predicted to be not significant.

Because of the relatively small size of the construction workforce relative to the population within the LAA, and with the application of mitigation measures, the Project will not adversely affect socio-economic determinants of health or physical and mental health outcomes in a manner that cannot be managed by existing healthcare services and infrastructure. Project-provided first aid services will be able to address the majority of workplace-related health issues, while medical facilities in large population centres, such as Winnipeg, Steinbach, and Brandon will be able to cope with any residual increase in service demand. While the Project is anticipated to increase stress and annoyance, this is not expected at a level that will cause acute or chronic physical or mental health outcomes, detectable at a population level. Therefore, Project effects on community health and well-being are assessed as not significant.

Table 19-22 Summary of Cumulative Social Effects on Community Health and Well-being

Residual Cumulative Social Effects Characterization							
Cumulative Effect	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-economic Context
Stress and Annoyance							
Cumulative social effect with the Project	A	L	RAA	P	C	R	MR
Contribution from the Project to the overall cumulative social effect	The Project is expected to contribute to adverse effects on stress and annoyance that are low magnitude, short term during construction and continuous and irreversible during operation and maintenance, will extend into the RAA, and which will occur in a moderately resilient context						
Aboriginal Health							
Cumulative social effect with the Project	A	L	RAA	P	C	I	LR
Contribution from the Project to the overall cumulative social effect	The Project is expected to contribute to adverse effects on Aboriginal health that are low in magnitude and continuous over construction, operation and maintenance, extending into the RAA, and which will occur in a low resilient context. Effects are reversible when Project activity ceases.						
KEY							
See Table 19-8 for detailed definitions							
Direction: A: Adverse; N: Neutral; P: Positive							
Magnitude: N: Negligible; L: Low; M: Moderate; H: High							
Geographic Extent: PDA: ROW/Site; LAA: Local Assessment Areal; RAA: Regional Assessment Area							
Duration: ST: Short-term; MT: Medium-term; P: Permanent							
Frequency: S: Single event; IR: Irregular event; R: Multiple Regular event; C: Continuous							
Reversibility: R: Reversible; I: Irreversible							
Socio-Economic Context: U:Undisturbed, D:Disturbed; LR: Low resilience, MR: Moderate resilience, HR: High resilience							
N/A Not applicable							

Project effects on Aboriginal health related to the availability of traditionally harvested foods will be not significant because changes in harvested foods availability will not result in a deterioration of food security that results in chronic or acute physical or mental health outcomes detectable at the population. This conclusion is based on the following:

- the extent of Crown land covered by the PDA that could be affected;
- predictions that the Project will not have a significant effect on wildlife and wildlife habitat (Chapter 9), or vegetation and wetlands (Chapter 10);
- Crown lands within the Project easement will be accessible to traditional land and resource uses after construction; and because
- most plant harvesting and hunting trapping sites located within the RAA, identified through the FNMEP and in Project-specific TLU studies, were located outside the LAA (Chapter 11).

Therefore, effects on traditionally harvested foods are not significant, so the Project will not have a significant effect on the food security of Aboriginal communities.

19.7.2 Significance of Cumulative Social Effects

With mitigation measures, the overall residual cumulative community health and well-being effects attributable to all projects within the RAA are assessed as not significant. For the projects identified in the cumulative effects case, construction-related effects, such as stress and annoyance related to noise, dust, and workforce presence, will be short term, and generally confined to the respective PDAs where construction occurs. Some cumulative effects on stress and annoyance related to the continual presence of visible infrastructure could be expected to persist throughout the life of the projects. However, given that the literature suggests that such effects will be localized, and some concerns (e.g., due to change in property values) tend to diminish with time, cumulative effects related to stress and annoyance are not expected to cause irreversible physical or mental health outcomes detectable at the population level, and are thus considered not significant. While it was determined that there will be a low cumulative effect on Aboriginal health related to the availability of traditional food sources, in consideration of other traditional food sources available, the cumulative effect is not anticipated to result in a highly distinguishable change in food security or a change in physical and mental health outcomes for First Nations and Metis that are detectable at a population level; therefore, the effect is considered not significant.

19.7.3 Project Contribution to Cumulative Social Effects

The contribution of the Project residual effects to overall cumulative effects on stress and annoyance and Aboriginal health is relatively small, as it will be only one of five projects contributing to cumulative effects on stress and annoyance and only one of six projects contributing to cumulative effects on Aboriginal health within the RAA.

19.7.4 Sensitivity of Prediction to Future Climate Change

Based on the climate change scenarios presented in the Hydroclimatic Study for the Project (Manitoba Hydro 2015b), some increase in temperatures and precipitation are projected for the future within the RAA. The maximum temperature could change by an annual average of +1.5°C in the 2020s, +2.8°C in the 2050s and +4.0°C in the 2080s. Predicted total precipitation amounts during this period are projected to increase by 2.5%, 1.5%, and 2.8% in the 2020s, 2050s and 2080s, respectively. However, precipitation amounts are projected to be lower than current levels for the summer months.

Climate change will have no bearing on construction-related effects on community health and well-being, because such effects will occur in the short-term, while climate change is a long-term phenomenon.

Climate change could have a long-term bearing on the quality of habitat needed to support Aboriginal traditional hunting and gathering practices. This may include:

- change in the access and use of wildlife for hunting and other traditional activities resulting from habitat loss and shifts in species range from extreme weather events, such as wildfires and drought
- reduced food availability (e.g., shifts in the seasonal timing of insect emergence, water deficits for vegetation and wetlands during the summer).

The predicted climate change scenarios would not change the significance determinations for Aboriginal health, as they are not anticipated to measurably increase the magnitude of effects of the Project on habitat availability or wildlife mortality; or measurably increase the magnitude of Project effects on landscape intactness, native vegetation cover classes, wetland cover classes, rare or traditional use plant species, or the spread of invasive species.

19.8 Prediction Confidence

Prediction confidence on Project effects on community health and well-being is moderate. While predictive analysis indicates that the Project will have only a low to moderate effect on community health infrastructure and services, effects on the other community health and well-being indicators could not be predicted quantitatively, nor is it possible to accurately attribute Project effects.

19.9 Follow-up and Monitoring

There are no requirements under CEAA 2012 to undertake follow-up and monitoring with respect to Project effects on community health and well-being.

19.10 Summary

Community health and well-being is a VC because of the potential for the Project to affect a number of social health aspects, including physical health, mental health, and health infrastructure. A number of key issues and concerns were identified during the Public engagement and First Nation and Metis engagement processes and carried forward into this assessment. These included the potential for stress and annoyance associated with environmental disturbance and change in land use, potential effects on Aboriginal health related to change in availability of traditional foods, and potential for increased demand on health care services and infrastructure.

Health effects related to socio-economic change, the presence of the temporary workforce, and demands on the health care infrastructure and services, can be mitigated. Because the workforce is small, and will be spread out, adverse effect on health outcomes of communities within the LAA will be negligible. As well, incremental demands on health care infrastructure will be minimal, and easily addressed through available capacity of regional hospitals.

The effect of the Project on stress and annoyance is tangible, though difficult to measure. The Project will be a source of perceived health risks associated with noise, changes in air quality, and EMF. The information provided in this chapter, and throughout the EIS, will help reduce stress caused by uncertainty or limited understanding of the Project by providing stakeholders with an in-depth understanding of the Project, its potential effects, and Manitoba Hydro's commitments to mitigate adverse effects. Manitoba Hydro will compensate landowners whose properties are directly affected by the Project in accordance with its compensation program, and will continue to engage with communities to identify, and address concerns.

Manitoba Hydro acknowledges concerns expressed through the First Nation and Metis engagement process in regards to potential reduction in the availability of traditional foods and medicines due to the clearing of unmodified Crown land for ROW development. The need for such clearing was considered in transmission line routing, which responded to concerns expressed through the First Nation and Metis engagement process regarding harvesting and cultural locations, and made use of existing transmission corridors as much as practical. Manitoba Hydro proposes several mitigation measures designed to address the reduction in the area available for traditional harvesting due to the Project, and will endeavor to work with First Nations and Metis to address concerns related to EMF and potential risks to traditional foods harvesting.

Project residual effects on community health and well-being are assessed as not significant. Because of the relatively small size of the construction workforce relative to the population within the LAA, and with the application of mitigation measures, the Project will not adversely affect socio-economic determinants of health or physical and mental outcomes such that they cannot be managed by existing healthcare services and infrastructure.

Project effects on Aboriginal health related to the availability of traditionally harvested food, and thus food security, will be not significant because changes in harvested foods availability within the RAA will not contribute to acute or chronic physical or mental health outcomes via adverse changes related to food security that are irreversible and detectable at a population level using existing population health indicators.

Cumulative effects on community health and well-being are assessed as not significant. While multiple projects will contribute to stress and annoyance, and potentially contribute to adverse physical and mental health outcomes, these effects are not predicted to be detectable at a population level using existing population health indicators. The Project's contribution to cumulative effects will vary throughout the RAA, but overall represents only a fraction of the overall cumulative effects. Climate change is not expected to change significance determinations for community health and well-being.

19.11 References

19.11.1 Literature Cited

- Assembly of Manitoba Chiefs. 2012. First Nations Regional Health Survey Phase 2 (2008-2010): Manitoba Regional Report, Assembly of Manitoba Chiefs, Winnipeg, MB. 158 pp.
Available from <http://www.scribd.com/doc/125182661/Rhs-Survey-Report-Final-Copy-for-Print> [accessed 12 March 2015].
- BC Centre for Disease Control. 2011. Antimicrobial Resistance Trends in the Province of British Columbia, Vancouver, BC. 88 pp
- Bhatia R, Farhang L, Heller J, Lee M, Orenstein M, Richardson M and Wernham, A. Minimum Elements and Practice Standards for Health Impact Assessment, Version 3, September, 2014
- Black River First Nation, Long Plain First Nation, Swan Lake First Nation. 2015. Aboriginal Traditional Knowledge Study Community Report submitted by Black River First Nation, Long Plain First Nation, Swan Lake First Nation. 72 pp.
- Bond, S., & Hopkins, J. .2000. The impact of transmission lines on residential property values: results of a case study in a suburb of Wellington, NZ. Pacific Rim property research journal, 6(2), 52-60. Available at:
<http://www.tandfonline.com/doi/abs/10.1080/14445921.2000.11104090#.Va620fVj4E>.
Accessed: July 2015.
- British Columbia Transmission Corporation (BCTC). 2010. Section 7.14 Human Health Environmental Effects Assessment. Available at:
http://a100.gov.bc.ca/appsdata/epic/documents/p299/d32054/1271430814179_70679abae257b77cb049dd0d5f020cc53ffd95d0f7999c6e6f7df1d4e533615c.pdf Accessed: June 2015

- Brunner, E., and Marmot, M.G. 2006. Social organization, stress, and health. In *Social Determinants of Health*. Edited by M. G. Marmot and R. G. Wilkinson. Oxford University Press, Oxford, England. 6–30 pp.
- Cain, N. L., and Nelson, H. T. 2013. What drives opposition to high-voltage transmission lines? *Land Use Policy* 33: 204-213 pp. doi:10.1016/j.landusepol.2013.01.003.
- Canadian Environmental Assessment Agency. 2012. Canadian Environmental Assessment Act. Available from <http://laws-lois.justice.gc.ca/eng/acts/C-15.21/page-1.html> [accessed 12 February 2015].
- Chan, L., Receveur, O., Sharp, D., Schwartz, H., Ing, A., Fediuk, K., Black, A., and Tikhonov, C. 2012. First Nations Food, Nutrition and Environment Study (FNFNES): Results from Manitoba (2010), University of Northern British Columbia, Prince George, BC. 178 pp. Available from http://www.fnfnes.ca/docs/MB%20Reports/FNFNES%20Report-MB_WEB_rev.pdf [accessed 12 March 2015].
- Chandler, M.J., and Lalonde C.E. 1998. Cultural continuity as a hedge against suicide in Canada's First Nations. *Transcultural Psychiatry* 35: 191-219 pp. doi: 10.1177/136346159803500202
- Colorado Department of Public Health and Environment. 2006. Gastrointestinal Illness in Children's Resident Camps: Outbreak Prevention and Control. 8 pp.
- Danuser, B. 2001. Candidate physiological measures of annoyance from airborne chemicals. *Chemical Senses* 26(3): 333-337 pp. doi:10.1093/chemse/26.3.333
- Davenport, J., and Davenport, J. (1980). *The Boom Town: Problems and Promises in the Energy Vortex*. Laramie, WY: University of Wyoming. Department of Social Work. Wyoming Human Services Project.
- Devine-Wright, P. 2013. Explaining “NIMBY” objections to a power line: The role of personal, place attachment and project-related factors. *Environment and Behavior* 45(6): 761-781 pp. doi:10.1177/0013916512440435.
- Exponent. 2015a. Research on Extremely Low Frequency Electric and Magnetic Fields from Alternating Current Transmission Lines – Summary of Evaluation and Evidence. Prepared for Manitoba Hydro. DRAFT
- Fleischer, A and Tsur, Y. 2000. Measuring the recreational value of agricultural landscape *Eur Rev Agric Econ* (2000) 27 (3): 385-398 doi:10.1093/erae/27.3.385
- Food Banks Canada. 2014. HungerCount 2014. Food Banks Canada, Toronto, ON. 38 pp. Available from http://www.foodbankscanada.ca/getmedia/7739cdf-72d5-4cee-85e9-54d456669564/HungerCount_2014_EN.pdf.aspx?ext=.pdf [accessed 12 March 2015].
- Fransoo, R., Martens, P., *The Need To Know Team*, Prior, H., Burchill, C., Koseva, I., Bailly, A., and Allegro, E. 2013. *The 2013 RHA Indicators Atlas*, Manitoba Centre for Health Policy, Winnipeg, MB. 453 pp. Available from http://mchp-appserv.cpe.umanitoba.ca/reference/RHA_2013_web_version.pdf [accessed 12 March 2015].

- Freudenburg, W.R. (1980). The Effects of Rapid Population Growth on the Social and Personal Well-Being of Boomtown Residents. College of Agriculture Research Center, Washington State University.
- Freudenburg, W.R., Bacigalupi, L.M., and Landoll-Young, C. (1982). Mental health consequences of rapid community growth: A report from the longitudinal study of boomtown mental health impacts. *Journal of Health and Human Resources Administration*. 4(3), 334-352.
- Furby, L., Slovic, P., Fischhoff, B., and Gregory, R. 1988. Public perceptions of electric power transmission lines. *Journal of Environmental Psychology* 8(1): 19-43 pp.
doi:10.1016/S0272-4944(88)80021-5.
- Goldenberg, S., Shoveller, J., Koehoorn, M., and Ostry, A. 2007. Sexual behaviour and sexually Transmitted Infection (STI) Prevention among Youth in Northeastern BC, Vancouver Foundation, 12 pp. Available from <http://youthsexualhealth.ubc.ca/files/2011/06/R-Goldenberg-SexualBehaviourAnd1.pdf> [accessed 12 March 2015].
- Goldenberg, S.M., Shoveller, J.A., Ostry, A.C., and Koehoorn, M. 2008a. Sexually transmitted infection (STI) testing among young oil and gas workers: the need for innovative, place-based approaches to STI control. *Canadian Journal of Public Health* 99(4): 350-4 pp.
- Goldenberg, S.M., Shoveller, J.A., Ostry, A.C., and Koehoorn, M. 2008b. Youth sexual behaviour in a boomtown: implications for the control of sexually transmitted infections. *Sexually Transmitted Infections* 84(3): 220-23 pp.
- Goldenberg, S., Shoveller, J., Koehoorn, M., and Ostry, A. 2008c. Barriers to STI testing among youth in a Canadian oil and gas community. *Health and Place* 14(4):7 18-29 pp.
doi:10.1016/j.healthplace.2007.11.005.
- Golder Associates. 2008. Appendix S: Public Health Risk Assessment Interior to Lower Mainland Transmission Project. 06-1422-034/6000/6002 Rev.2 (November 10, 2008)
- Government of Manitoba. 2009. Interim Provincial Policy for Crown Consultations with First Nations, Metis Communities and Other Aboriginal Communities. May 4, 2009. Available from
<http://www.gov.mb.ca/ana/resources/pubs/interim%20prov%20policy%20for%20crown%20consultation%20-%202009.pdf>
- Government of Manitoba, Manitoba Health, Healthy Living, and Seniors. 2013. Manitoba Annual Summary of Communicable Diseases, Government of Manitoba, Winnipeg, MB. 68 pp. Available from <http://www.gov.mb.ca/health/publichealth/surveillance/cds/docs/2013.pdf> [accessed 12 March 2015].
- Government of Manitoba, Manitoba Health, Healthy Living, and Seniors. 2013-14. Annual Influenza Report, 2013/14, Government of Manitoba, Winnipeg, MB. 26 pp. Available from
<http://www.gov.mb.ca/health/publichealth/surveillance/influenza/docs/1314season.pdf> [accessed 12 March 2015].

- Government of Manitoba, Health, Healthy Living and Seniors. n.d. Sexually transmitted and blood-borne infections [online]. Available from <http://www.gov.mb.ca/health/publichealth/cdc/sti/index.html?print> [accessed April 23, 2015].
- Government of Manitoba, Manitoba Health. 2012-13. Annual Health Statistics 2012-2013, Government of Manitoba, Winnipeg, MB. 103 pp. Available from <http://www.gov.mb.ca/health/annstats/as1213.pdf> [accessed 12 March 2015].
- Government of Manitoba. 2004. Injuries in Manitoba: A 10 year review, Government of Manitoba, Winnipeg, MB. 246 pp. Available from <http://www.gov.mb.ca/healthyliving/hlp/docs/injury/ten/injuriesmb.pdf> [accessed 12 March 2015].
- Government of Manitoba. 2012. Focused on What Matters Most: Manitoba's Plan to Protect Universal Health Care, Government of Manitoba. 10 pp. Available from <https://www.gov.mb.ca/health/documents/fwmm.pdf> [accessed 12 March 2015].
- Government of Manitoba. 2012. Manitoba 2012 Labour Force Trends [online]. Available from <http://www.gov.mb.ca/tce/lmi/trends/trends.html> [accessed 12 March 2015].
- Government of Manitoba. 2015. The Environment Act: C.C.S.M. c. E125. Available from <http://web2.gov.mb.ca/laws/statutes/ccsm/e125e.php> [accessed 12 February 2015].
- Government of Manitoba. n.d. All Aboard Action Plan: Food Security, Government of Manitoba, Winnipeg, MB. 8 pp. Available from http://www.gov.mb.ca/allaboard/pubs/all_around_food_security.pdf [accessed 12 March 2015].
- Habitat Health Impact Consulting (2013). Review of Community Health Issues in the Keeyask Generation Project Environmental Impact Statement. Report prepared for the Public Interest Law Centre of Manitoba and the Manitoba Clean Environment Commission. Available at: http://www.cecmanitoba.ca/resource/hearings/39/CAC-022%20Keeyask%20Hydro%20Community%20Health%20Review_Nov%204%202013.pdf
- Health Canada. 2012. The First Nations and Inuit Health Branch Strategic Plan: A Shared Path to Improved Health, Health Canada, Ottawa, ON. 24 pp. Available from http://www.hc-sc.gc.ca/fniah-spnia/alt_formats/pdf/pubs/strat-plan-2012/strat-plan-2012-eng.pdf [accessed 12 March 2015].
- Healthy Child Coalition. 2013. Resource for families Southeast Manitoba January 2013 [online]. Available from <http://healthychildcoalition.ca/wp-content/uploads/2013/07/Family-Services-Listing-2013-updated-July-30-2013.pdf> [accessed April 23, 2015].
- ICMM (International Council on Mining and Metals). 2010. Good Practice Guidance on Health Impact Assessment. London, UK.
- Idler, E.L., and Benyamini, Y. 1997. Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behaviour* 38(1): 21–37 pp. Interlake Tourism Association, n.d. Manitoba's Interlake – inland oceans, infinite possibilities. Available from: <http://www.interlaketourism.com/> [accessed February 1, 2015].

- IFC (International Finance Corporation). 2009. Introduction to Health Impact Assessment. Washington, D. US: International Finance Corporation
- IPIECA and OGP (International Petroleum Industry Environmental Conservation Association and International Association of Oil and Gas Producers. 2005. Managing Workplace Stress: A Guide for Oil Industry Managers and Supervisors, IPIECA and OGP, London and Brussels. 16 pp. Available from <http://www.ogp.org.uk/pubs/378.pdf> [accessed 12 March 2015].
- Keir, L., Watts, R., and Inwood, S. 2014. Environmental justice and citizen perceptions of a proposed electric transmission line. *Community Development: Journal of the Community Development Society* 45(2): 107-120 pp. doi:10.1080/15575330.2014.887130.
- Kuhnlein, H.V., and Receveur, O. 1996. Dietary change and traditional food systems of Indigenous peoples. *Annual Review of Nutrition*. 16, 417-442 pp. doi:10.1146/annurev.nu.16.070196.002221 2011.
- Lightman, E. S., Wilson, B., and Mitchell, A. 2009. Poverty is Making Us Sick: A Comprehensive Survey of Income and Health in Canada, Wellesley Institute, Toronto, ON. 38 pp. Available from <http://www.wellesleyinstitute.com/wp-content/uploads/2011/11/povertyismakingussick.pdf> [accessed 12 March 2015].
- Linder, S. H. 1995. Contending discourses in the electric and magnetic fields controversy: The social construction of EMF risk as a public problem. *Policy Sciences*, 28(2), 209-230.
- LNG Canada. 2014. Application for Environmental Assessment Certificate for the LNG Canada project. Section 7.5, Community Health and Well-being. Available from: http://a100.gov.bc.ca/appsdata/epic/documents/p398/d38157/1415047927217_KGyFJXmP1x2sG8wCmyvdfS27j60hvHtwhPJZxGRMqpgdrdszwXMw!-1038573416!1415046831474.pdf [accessed 8 August 2015]
- Loppie, R.C., and Wien, F. 2009. Health Inequalities and Social Determinants of Aboriginal Peoples' Health. National Collaborating Centre for Aboriginal Health, Prince George, BC. 42 pp. Available from http://www.nccah-ccnsa.ca/docs/social%20determinates/nccah-loppie-wien_report.pdf [accessed 12 March 2015].
- Lovell, S. and Sullivan, W. 2006. Environmental Benefits of conservation buffers in the United states: Evidence, promise, and open questions. *Agricultural Ecosystems and Environment*, 112: 249-260 pp.
- MacGregor, Donald G., Paul Slovic, and M. Granger Morgan. "Perception of risks from electromagnetic fields: a psychometric evaluation of a risk-communication approach." *Risk analysis* 14.5 (1994): 815-828.
- Manitoba Bureau of Statistics. 2008. 2006 Census Profile: Piney, RM, Government of Manitoba. 5 pp. Available from http://www.gov.mb.ca/asset_library/en/statistics/demographics/communities/piney_rm.pdf [accessed 12 March 2015].
- Manitoba Bureau of Statistics. 2008. 2006 Census Profile: South Cypress, RM, Government of Manitoba. 5 pp. Available from http://www.gov.mb.ca/asset_library/en/statistics/demographics/communities/south_cypress_rm.pdf [accessed 12 March 2015]

- Manitoba Bureau of Statistics. 2008. 2006 Census Profile: Ste. Anne, RM, Government of Manitoba. 5 pp. Available from http://www.gov.mb.ca/asset_library/en/statistics/demographics/communities/ste_anne_rm.pdf [accessed 12 March 2015]
- Manitoba Bureau of Statistics. 2008. 2006 Census Profile: Ste. Anne, T, Government of Manitoba. 5 pp. Available from http://www.gov.mb.ca/asset_library/en/statistics/demographics/communities/ste_anne_t.pdf [accessed 12 March 2015].
- Manitoba Bureau of Statistics. 2008. 2006 Census Profile: Stuartburn, RM, Government of Manitoba. 5 pp. Available from https://www.gov.mb.ca/asset_library/en/statistics/demographics/communities/stuartburn_rm.pdf [accessed 12 March 2015].
- Manitoba Clean Environment Commission. 2013. Report on Public Hearing: BIPOLE III Transmission Project. Government of Manitoba.
- Manitoba Environmental Approvals Branch. 2014. Information Bulletin: Environmental Act Proposal Guidelines. Available from http://www.gov.mb.ca/conservation/eal/pubs/info_eap.pdf [accessed 12 February 2015].
- Manitoba Hydro. 2015. Aboriginal Traditional Knowledge Study Community Report: submitted by Black River, Long Plain, and Swan Lake First Nations.
- Manitoba Hydro. 2015b. Manitoba-Minnesota Transmission Project – Historic and Future Climate Study. Prepared by Water Resources Engineering Department, Power Planning Division. Winnipeg, MB.
- Martens, P.J., Bartlett, J., Burland, E., Prior, H., Burchill, C., Huq, S., Romphf, L., Sanguins, J., Carter, S., and Bailly, A. 2010. Profile of Metis Health Status and Healthcare Utilization in Manitoba: A Population-Based Study, Manitoba Centre for Health Policy, Winnipeg, MB. 606 pp. Available from [accessed 12 March 2015].
- Marques, S., and Lima, M. L. 2011. Living in grey areas: Industrial activity and psychological health. *Journal of Environmental Psychology* 31(4): 314-322 pp.
doi:10.1016/j.jenvp.2010.12.002.
- McIntosh, C., Fines, P., Wilkins, R., and Wolfson, M. 2009. Income disparities in health-adjusted life expectancy for Canadian adults, 1991 to 2001. *Health Reports* 20(4): 5 p.
- McMahan, S., and Meyer, J., 1995. Symptoms Prevalence and Worry About High Voltage Transmission Lines. *Environmental Research*. V 70. Iss. 2. August 1995. Pg. 114-118. Available at: <http://www.sciencedirect.com/science/article/pii/S0013935185710559>. Accessed: July 2015.
- Mikkonen, J., and Raphael, D. 2010. Social Determinants of Health: The Canadian Facts. York University School of Health Policy and Management, Toronto, ON. 62 pp. Available from http://www.thecanadianfacts.org/The_Canadian_Facts.pdf [accessed 12 March 2015].
- Morgan, M. G., Slovic, P., Nair, I., Geisler, D., MacGregor, D., Fischhoff, B., ... & Florig, K. 1985. Powerline Frequency Electric and Magnetic Fields: A Pilaf; Study of Risk Perception

- National Energy Board. 2014. National Energy Board Act. Available from <http://www.canlii.org/en/ca/laws/stat/rsc-1985-c-n-7/latest/rsc-1985-c-n-7.html> [accessed 15 February 2015].
- National Energy Board. 2015. NEB Electricity Filing Manual. Available from <https://www.neb-one.gc.ca/bts/ctr/gnnb/flngmnl/flngmnl-eng.pdf> [accessed 17 June 2015].
- National Research Council Committee on Health Impact Assessment (2011). Improving Health in the United States: The Role of Health Impact Assessment. National Academies Press
- Office of the British Columbia Provincial Health Officer. 2012. The Health and Well-being of the Aboriginal Population - Interim Update October 4, 2012. Office of the Provincial Health Officer, Vancouver, BC. 17 pp. Available from <http://www.health.gov.bc.ca/pho/pdf/interim-update.pdf> [accessed 12 March 2015].
- Pacific Northwest LNG and Stantec. 2014. Environmental Impact Statement and Environmental Assessment Application for the Pacific Northwest LNG project. Section 18, Community Health and Well-being. Available from: http://a100.gov.bc.ca/appsdata/epic/documents/p396/d37423/1395765944858_4c3e62c6c9b21ab36431891ca349aaa232612bd636fdc3a890dfb7d030c90064.pdf [accessed 8 August 2015]
- Peguis First Nation. 2015. Report to Peguis First Nation and Manitoba Hydro - Peguis First Nation Draft Land Use and Occupancy Interview Project for the Manitoba-Minnesota Transmission Project. 32 pp.
- Porsius, J. T., Claassen, L., Smid, T., Woudenberg, F., and Timmermans, D. R. M. 2014. Health responses to a new high-voltage power line route: Design of a quasi-experimental prospective field study in the Netherlands. BMC Public Health 14(1): 237-237 pp. doi:10.1186/1471-2458-14-237.
- Porsius, J. T., Claassen, L., Smid, T., Woudenberg, F., Petrie, K. J., and Timmermans, D. R. M. 2015. Symptom reporting after the introduction of a new high-voltage power line: A prospective field study. Environmental Research 138: 112-117 pp. doi:10.1016/j.envres.2015.02.009.
- Province of Manitoba. 2015. Climate Change and Green Initiatives Branch: What Manitoba is doing [online]. Available from http://www.gov.mb.ca/conservation/climate/mb_doing.html [accessed April 2015]
- Public Health Agency of Canada. 2003. Gastroenteritis outbreak among Canadian forces members: Bosnia-Herzegovina, August 2003. Canadian Communicable Disease Reports 31(13): 141-148 pp.
- Public Health Agency of Canada. 2013. What Makes Canadians Healthy or Unhealthy [online]? Available from <http://www.phac-aspc.gc.ca/ph-sp/determinants/determinants-eng.php> [accessed 12 March 2015].

- Roseau River Anishinabe First Nation. 2015. Roseau River Anishinabe First Nation Aboriginal Traditional Knowledge Report. 8 pp. Ross, N., Wolfson, M., Kaplan, G., Dunn, J., Lynch, J., and Sanmartin, C. (2006). Income Inequality as a Determinant of Health. In *Healthier Societies: From Analysis to Action* (Heymann, J., Hertzman, C., Barer, M., and Evans, R., eds), Oxford Scholarship Online. DOI: 10.1093/acprof:oso/9780195179200.001.0001.
- Safe Work Manitoba. 2014. The Manitoba Workplace Injury Statistics Report 2000-2013, Safe Work Manitoba, 46 pp. Available from <http://safemanitoba.com/safe-work-manitoba-injury-statistics-2000-2013> [accessed 12 March 2015].
- Schneiderman, N., Ironson, G., and Siegel, S. D. 2005. Stress and health: psychological, behavioral, and biological determinants. *Annual Reviews of Clinical Psychology* 1: 607-628 pp. doi:10.1146/annurev.clinpsy.1.102803.144141.
- Sharpe-Staples, G. 2006. Gas Project Joint Review Panel. Geer General Hearing, Inuvik, NWT.
- Sheppard, S. 2004. Visual analysis of forest landscapes. *Elsevier Encyclopedia of Forest Sciences*, 440–450 pp.
- South East Helping Hands. n.d. About: What services do we provide and who received them? [online]. Available from <http://sehh.ca/about> [accessed April 23, 2015].
- Stantec .2013. North Montney Project Environmental and Socio-economic Assessment. Chapter 15 Social and Cultural Wellbeing. November 2013.
- Statistics Canada. 2011. Aboriginal peoples in Canada: First Nations people, Metis and Inuit [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-011-x/99-011-x2011001-eng.cfm> [accessed 12 March 2015].
- Statistics Canada. 2011. Number and distribution of the population reporting an Aboriginal identity and percentage of Aboriginal people in the population, Canada, provinces and territories, 2011 [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-011-x/2011001/tbl/tbl02-eng.cfm> [accessed 12 March 2015].
- Statistics Canada. 2012. 6020100.02, Manitoba (Code 6020100.02) and Winnipeg, Manitoba (Code 602) (table), Census Profile, 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed March 5, 2015].
- Statistics Canada. 2012. 6020110.07, Manitoba (Code 6020110.07) and Winnipeg, Manitoba (Code 602) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWe [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Headingley, Manitoba (Code 4611042) and Division No. 11, Manitoba (Code 4611) (table), Census Profile.2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].

- Statistics Canada. 2012. La Broquerie, Manitoba (Code 460087) and Manitoba (Code 46) (table), Census Profile. 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Macdonald, Manitoba (Code 4610035) and Manitoba (Code 46) (table), Census Profile. 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Piney, Manitoba (Code 4601039) and Manitoba (Code 46) (table), Census Profile. 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Ritchot, Manitoba (Code 4602075) and Manitoba (Code 46) (table), Census Profile. 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Rosser, Manitoba (Code 4614015) and Manitoba (Code 46) (table), Census Profile, 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Springfield, Manitoba (Code 4612047) and Manitoba (Code 46) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Ste. Anne, Manitoba (Code 4602057) and Manitoba (Code 46) (table), Census Profile. 2011 Census, Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Stuartburn, Manitoba (Code 4601035) and Manitoba (Code 46) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. Tache, Manitoba (Code 4602069) and Manitoba (Code 46) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2012. South Cypress, Manitoba (Code 4607038) and Manitoba (Code 46) (table). Census Profile, 2011 Census. Statistics Canada Catalogue no. 98-316-XWE [online]. Available from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March, 2015]

- Statistics Canada. 2013. 0100.02, Manitoba (Code 3671) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2013. 0110.07, Manitoba (Code 2505) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2013. Headingley, RM, Manitoba (Code 4611042) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2013. Health profile – definitions, sources and symbols [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/help-aide/DQ-QD04.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. Health profile, December 2013. Interlake-Eastern Regional Health Authority [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/details/page.cfm?Lang=E&Tab=1&Geo1=HR&Code1=4603&Geo2=PR&Code2=46&Data=Rate&SearchText=Interlake-Eastern%20Regional%20Health%20Authority&SearchType=Contains&SearchPR=01&B1=All&Custom=&B2=All&B3=All> [accessed 12 March 2015].
- Statistics Canada. 2013. Health profile, December 2013. Prairie Mountain Health [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/details/page.cfm?Lang=E&Tab=1&Geo1=HR&Code1=4602&Geo2=PR&Code2=46&Data=Rate&SearchText=Prairie%20Mountain%20Health&SearchType=Contains&SearchPR=01&B1=All&Custom=&B2=All&B3=All> [accessed 12 March 2015].
- Statistics Canada. 2013. Health profile, December 2013. Southern Health [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/details/page.cfm?Lang=E&Tab=1&Geo1=HR&Code1=4605&Geo2=PR&Code2=46&Data=Rate&SearchText=Southern%20Health&SearchType=Contains&SearchPR=01&B1=All&Custom=&B2=All&B3=All> [accessed 12 March 2015].
- Statistics Canada. 2013. Health profile, December 2013. Winnipeg Regional Health Authority [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/details/page.cfm?Lang=E&Tab=1&Geo1=HR&Code1=4601&Geo2=PR&Code2=46&Data=Rate&SearchText=Winnipeg%20Regional%20Health%20Authority&SearchType=Contains&SearchPR=01&B1=All&Custom=&B2=All&B3=All> [accessed 12 March 2015].
- Statistics Canada. 2013. Interlake-Eastern Regional Health Authority (2013 Health Region), Manitoba and Manitoba (table). *Health Profile*. 2011 Census. Statistics Canada Catalogue no. 82-228-XWE [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/index.cfm?Lang=E> [accessed 5 March 2015].

- Statistics Canada. 2013. La Broquerie, RM, Manitoba (Code 4602053) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. Macdonald, RM, Manitoba (Code 4610035) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004- XWE [online] Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2013. Manitoba (Code 46) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 27 February 27 2015].
- Statistics Canada. 2013. Prairie Mountain Health (2013 Health Region), Manitoba and Manitoba (table). *Health Profile*. 2011 Census. Statistics Canada Catalogue no. 82-228-XWE [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/index.cfm?Lang=E> [accessed 5 March 2015].
- Statistics Canada. 2013. Ritchot, RM, Manitoba (Code 4602075) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. Rosser, RM, Manitoba (Code 4614015) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. South Cypress, RM, Manitoba (Code 4607038) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004- XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. Southern Health (2013 Health Region), Manitoba and Manitoba (table). Health Profile. 2011 Census. Statistics Canada Catalogue no. 82-228-XWE [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/index.cfm?Lang=E> [accessed March 5, 2015].
- Statistics Canada. 2013. Springfield, RM, Manitoba (Code 4612047) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004- XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2013. Ste. Anne, T, Manitoba (Code 4602061) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].

- Statistics Canada. 2013. Tache, RM, Manitoba (Code 4602069) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE [online]. Available from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E> [accessed 12 March 2015].
- Statistics Canada. 2014. Footnotes.1: Perceived health, very good or excellent [online]. Available from <http://www12.statcan.gc.ca/health-sante/82-228/details/page.cfm?Lang=E&Tab=1&Geo1=HR&Code1=4605&Geo2=PR&Code2=46&Data=Rate&SearchText=Southern%20Health&SearchType=Contains&SearchPR=01&B1=All&Custom=&B2=All&B3=All> [accessed January 29, 2015].
- Statistics Canada. 2015. Black River First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=260&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Brokenhead Ojibway Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=260&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Buffalo Point First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=260&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Dakota Plains First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=288&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Dakota Tipi First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=295&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Long Plain First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=287&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Peguis First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=269&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Roseau River Anishinabe First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=273&lang=eng [accessed 12 March 2015].

- Statistics Canada. 2015. Sandy Bay First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=283&lang=eng [accessed 12 March 2015].
- Statistics Canada. 2015. Swan Lake First Nation Population Characteristics [online]. Available from http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/Search/FNPopulation.aspx?BAND_NUMBER=293&lang=eng [accessed 12 March 2015].
- Thibault, G. 2012. Understanding the State of Industrial Camps in Northern BC: A Background Paper, Northern Health, Prince George, BC. 39 pp. Available from http://www.northernhealth.ca/Portals/0/About/NH_Reports/documents/2012%2010%2017_Ind_Camps_Backgrounder_P1V1Comb.pdf [accessed 12 March 2015].
- Thomas, P., and Evans, G. W., 1996. Resident perceptions of a Nearby electric Transmission Line. *Journal of Environmental Psychology*. V 16, Iss. 1. 1996, pg 65-74. Available at: <http://www.sciencedirect.com/science/article/pii/S0272494496900067>. Accessed: July 2015.
- Toews, R. 2013. Manitoba EMS System Review, Government of Manitoba, Minister of Health, Winnipeg, MB. 70 pp. Available from <https://www.gov.mb.ca/health/documents/ems.pdf> [accessed 12 March 2015].
- Weber, B.A., and Howell, R.E. (1982). *Coping with Rapid Growth in Rural Communities*. Boulder, CO: Westview Press.
- Workers Compensation Board of Manitoba (WCB). 2013. Safe Work Manitoba. The Manitoba Workplace Injury Statistics Report 2000-2013. Accessed June 9, 2015 from http://www.wcb.mb.ca/sites/default/files/resources/annualInjurystats2000_2013%20v3.1.pdf.
- Yen, I., and L. Syme. 1999. The social environment and health: A discussion of the epidemiologic literature. *Annual Review of Public Health* 20: 287-308 pp.
doi:10.1146/annurev.publhealth.20.1.287.

19.11.2 Personal Communications

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2015. Director of Acute Care. Prairie Mountain Health, Shoal Lake Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, March 9, 2015
2015. Director, Medical Services Administration. Prairie Mountain Health. Shoal Lake Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, April 7, 2015
2015. Disaster Management Specialist. Office of Disaster Management, Government of Manitoba, Winnipeg Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, February 20, 2015
2015. Medical Officer of Health, Sexually Transmitted and Blood-borne Infections. Manitoba Health, Healthy Living and Seniors, Winnipeg Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, March 10, 2015
2015. Medical Officer of Health. Winnipeg Regional Health Authority, Winnipeg Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, February 18, 2015
2015. Medical Officer of Health, Environmental Health. Manitoba Health, Healthy Living and Seniors, Winnipeg Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, February 18, 2015
2015. Medical Officer of Health. Interlake-Eastern Regional Health Authority, Stonewall Manitoba. Email and telephone correspondence with Ardeth Evans, Habitat Health Impact Consulting, Calgary, AB, March 9, 2015.

Manitoba-Minnesota Transmission Project

Project Infrastructure

- ◆ Converter Station (Existing)
- Final Preferred Route (FPR)

Infrastructure

- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

Regional Health Authority

- Prairie Mountain Regional Health Authority
- Interlake-Eastern Regional Health Authority
- Southern Regional Health Authority
- Winnipeg Regional Health Authority

Assessment Area

- Community Health and Well-being Regional Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park
- Rural Municipality

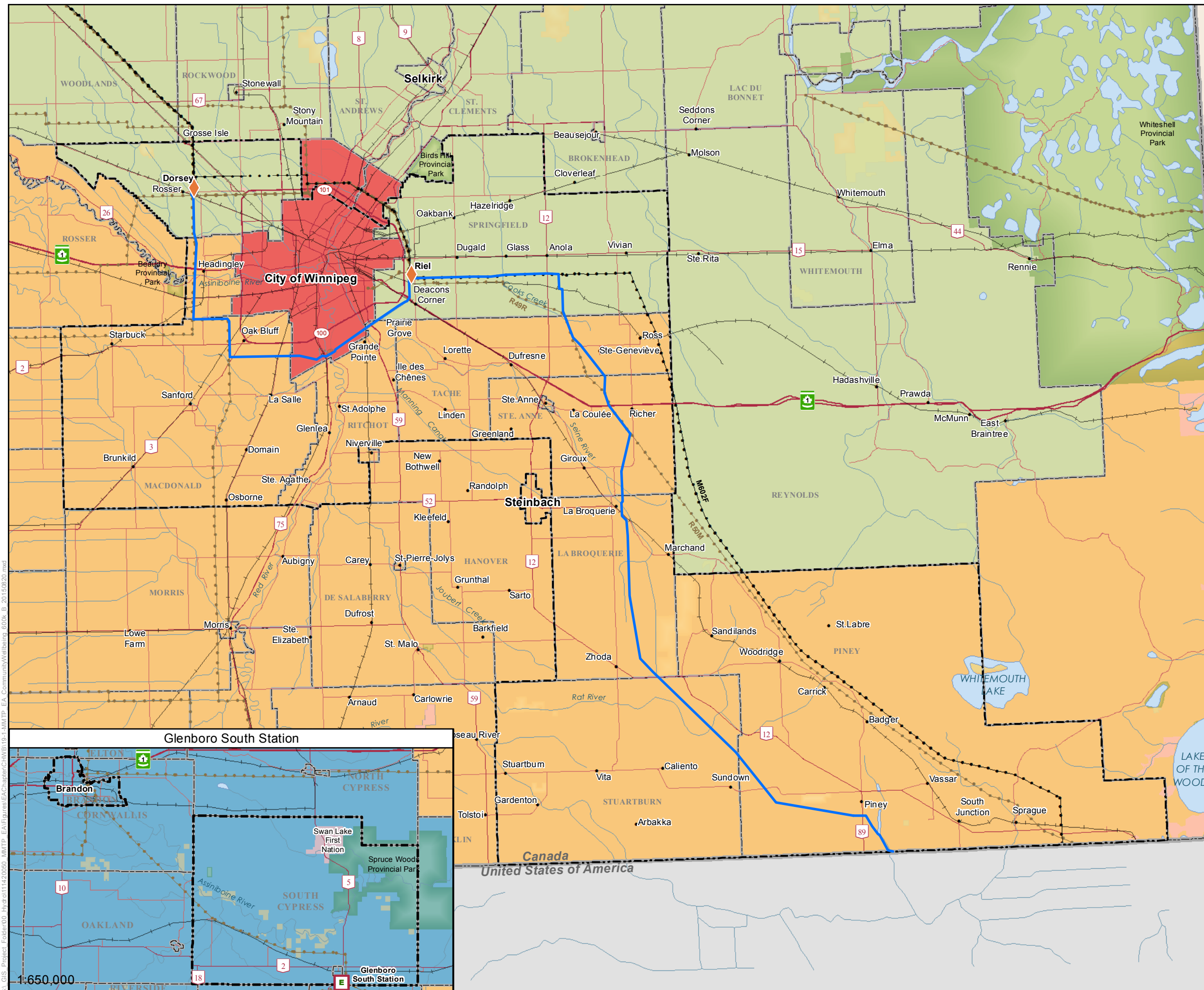
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 20, 2015



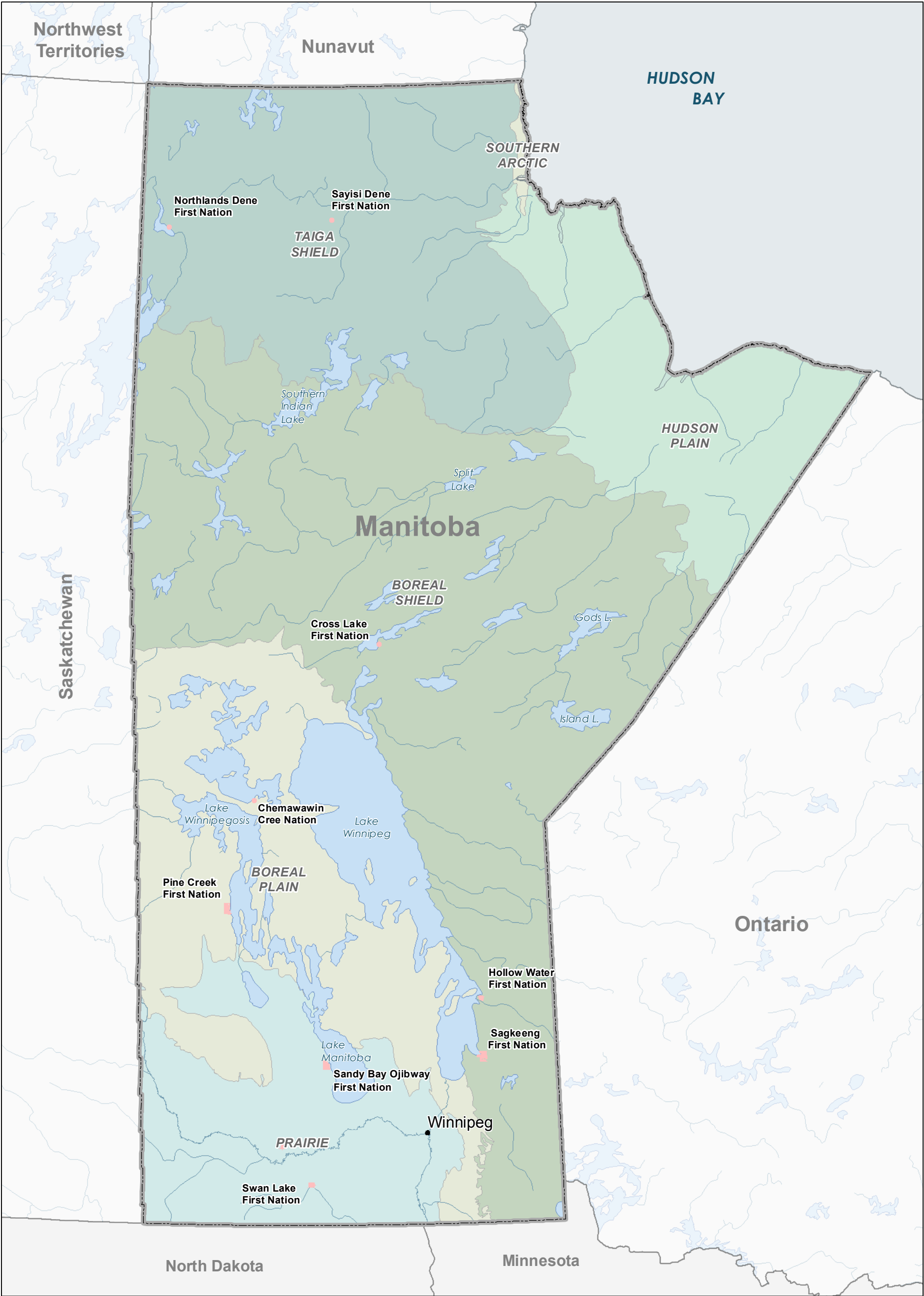
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Regional Assessment Area Community Health and Well-being



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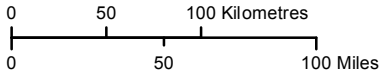
**Manitoba-Minnesota
Transmission Project**

Communities and Ecozones

- Participating First Nations Communities ¹
- Ecozones ²
- Boreal Plain
- Boreal Shield
- Hudson Plain
- Prairie
- Southern Arctic
- Taiga Shield

Source:
1. First Nations Food, Nutrition and Environment Study (FNFNES): Results from Manitoba (2010). Prince George: University of Northern British Columbia, 2012. Print. Reproduced with permission from William David, Assembly of First Nation.
2. Ecozones of Canada, 2006. Manitoba Land Initiative

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 23, 2015



**FNFNES Participating First Nations
Communities and Ecozones**