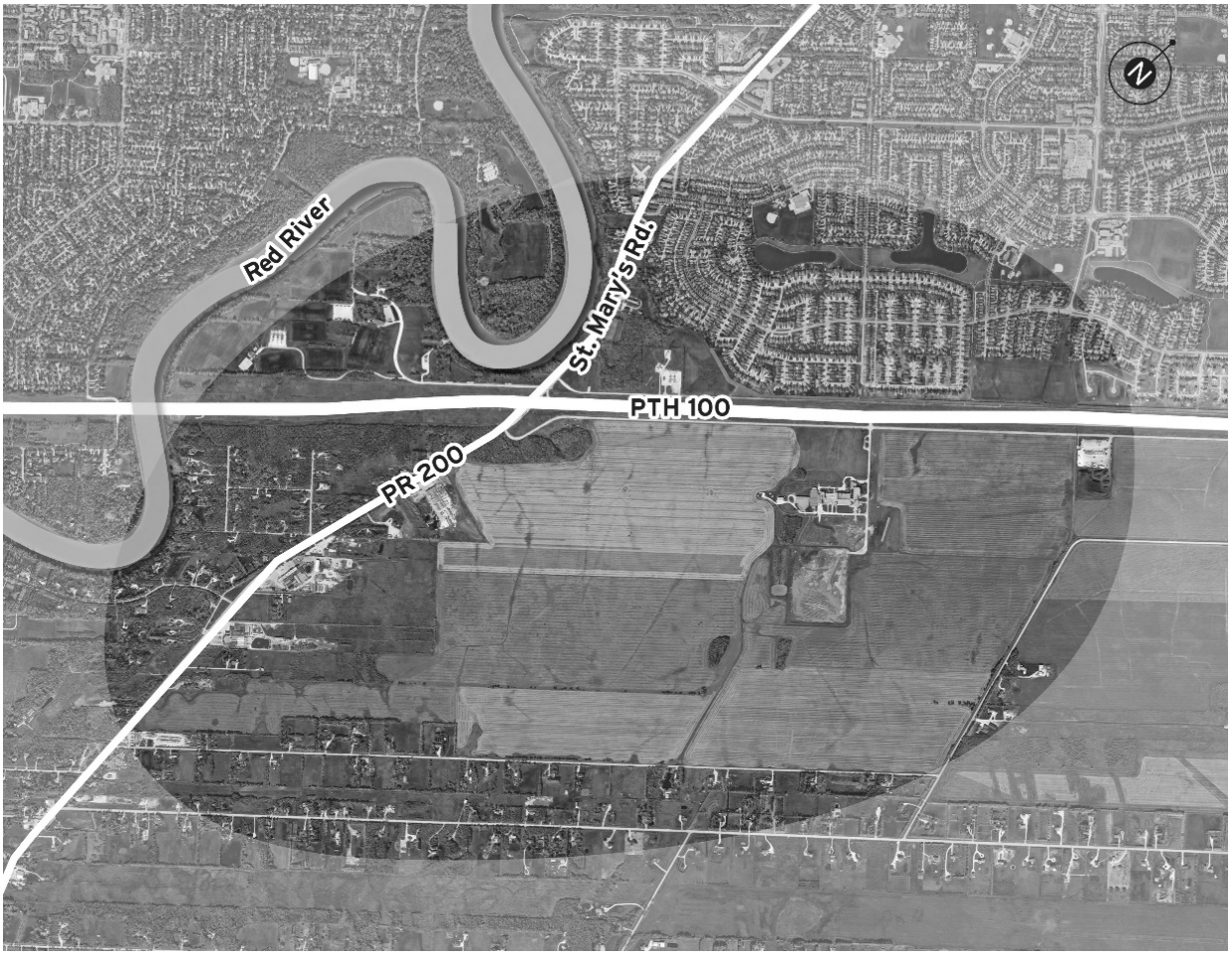
MANITOBA INFRASTRUCTURE
PO NUMBER: 4501203835

DESIGN AND CONSTRUCTION OF INTERCHANGE AT PROVINCIAL TRUNK HIGHWAY (PTH) 100 AND PROVINCIAL ROAD (PR) 200 (ST. MARY'S ROAD)

ENVIRONMENT ACT PROPOSAL

MARCH 2021 FINAL



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ENVIRONMENT ACT PROPOSAL

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CLIENT REF:4501203835
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EXECUTIVE SUMMARY

INTRODUCTION

In 2017, Manitoba Infrastructure commissioned a project to prepare the South Perimeter Highway Design Study which identified requirements to reconstruct Provincial Trunk Highway (PTH) 100 and Provincial Road (PR) 200 (St. Mary's Road) to a freeway standard. The study included the review of several intersections, water course crossings and rail crossings. The PTH 100 and PR 200 (St. Mary's Road) intersection was part of this review. A Diverging Diamond Interchange was selected as the preferred alternative, and a functional roadway design was prepared and presented to the public. In the summer of 2020, MI considered a staged approach and completed a functional design of an Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) (herein referred to as the "Project") which is the subject of this application.

The scope of the Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) will include detailed design and construction of:

- An interchange on PTH 100 at PR 200;
- PTH 100 to align with the ultimate stage recommended alignment from the South Perimeter Highway Design Study;
- Active Transportation pathways that tie into the surrounding network, included a crossing of PTH 100 on the proposed 2-lane PR 200 (St. Mary's Road) bridge structure;
- Intersections at Redview Drive, and Frobisher Road;
- Realignment of St. Mary's Roads; and
- Miscellaneous service road realignments and connections.

Under the *Classes of Development Regulation* of *The Environment Act* of Manitoba, the Project is considered a Class 2 Development and as such requires an Environment Act License. This Environment Act Proposal report provides a summary of the design and construction details, and environmental effects of the proposed Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) in support of obtaining an Environment Act Licence for the Project.

PROJECT SUMMARY

LOCATION

The design-build location of the Project is at the south end of the City of Winnipeg (City), Manitoba at the signalized intersection of PTH 100 and PR 200 (St. Mary's Road). The geographic limits of the Project are:

- West on PTH 100 to the east abutment of the PTH 100 Bridge Structure over the Red River;
- East on PTH 100 to the east functional limit of the PTH 100 and PR 200 Interchange Ramp Tapers;
- North on St Mary's Road to Redview Drive; and

— South on PR 200 for a distance of approximately 3.1 kilometres.

For the purposes of this report, the Project Study Area is defined by the geographic limits and as outlined in **Map 1, Appendix A**. The project footprint is defined as the lands owned and operated by MI for the purposes of construction and operation of the PTH 100 and PR 200 (St. Mary's Road) interchange.

OBJECTIVES OF THE PROJECT

The fundamental objective of the Project is to design and build the Interim Interchange that will address operational and traffic safety needs, will have the greatest cost effectiveness and has high quality levels that result in low operational and maintenance costs, along with high durability.

A secondary goal for this Project is to act as economic stimulus to help offset the financial impact of COVID-19 to the Provincial economy. This goal is directly connected with the completion date for delivery and interim milestones, which together, represent a limited window to deliver the Project.

SCOPE OF THE ASSESSMENT

In support of the Project, a desktop review of available biophysical and socio-economic information was completed in May to June of 2018 as part of the South Perimeter Highway Design Study with a review and update to the information specific to the current Project Study Area completed in January and February 2021.

During the South Perimeter Highway Design Study, ecological field studies were completed to supplement information collected during the desktop review. Where applicable to this Project, information collected from the field surveys has been included in this Environment Act Proposal report. A supplemental site visit was conducted in February 2021 at 2433 St. Mary's Road to identify any potential evidence of bird nesting or bat roosting within the on-site buildings and the natural areas to the north and south.

EXISTING LAND USE

The Project is located wholly within the City boundaries. Land use designations associated with the Project Study Area consist primarily of ***Recent Communities*** including the River Park South residential area and commercial business to the north of PTH 100 and along St. Mary's Road, and ***Rural and Agricultural*** land use to the south of PTH 100. In addition, the Red River is located to the west of St. Mary's Road within approximately 60 metres of the existing roadway. There are also natural wooded areas located both south and north of PTH 100 adjacent to PR 200 (St. Mary's Road). The majority of the Project will be constructed within existing Manitoba Infrastructure right-of-way; however, some land acquisition will be required to support the Project. In total, there are five private landowner properties as well as eight City properties with a total land area of 44.53 hectares that will be impacted by the Project

DESCRIPTION OF PROPOSED DEVELOPMENT

The current PR 200 / PTH 100 intersection location has significant constraints that preclude the construction of an interchange at the existing location, including the significant skew angle between St. Mary's Road and PTH 100, the close proximity of St. Mary's Road to the Red River on the inside of PTH 100, and the required access to Maple Grove Rugby Park located immediately north of the existing intersection on the west side make up these constraints. As a result, it will be necessary to realign St. Mary's Road to the east.

PR 200 is a paved two-lane undivided highway classified as a Collector "A" with a speed limit of 80 kilometres per hour south of PTH 100 and a speed limit of 60 kilometres per hour north of PTH 100. PR 200 is under the City's jurisdiction within the Project Study Area. The existing intersection of PTH 100 and PR 200 (St. Mary's Road) is a four-legged signalized intersection on an approximately 50-degree skew. No overpass structures are currently present at this intersection. The posted speed limit is 100 kilometres per hour along PTH 100, reducing to 80 kilometres per hour near the existing intersection. The existing signalized intersection accommodates about 40,000 vehicles per day. Frobisher Road is a gravel two-lane undivided roadway north of PTH 100 that intersects St. Mary's Road 100 metres north of PTH 100 and is the only access to Maple Grove Park. The skew of Frobisher Road makes certain sight lines difficult, which has resulted in safety and congestion concerns for traffic accessing the Park. Seniuk Road is a gravel two-lane undivided roadway south of PTH 100 that provides access to commercial and agriculture properties and the City of Winnipeg's South End Water Pollution Control Centre. The Red River riverbank to the north of the intersection and downstream of Frobisher Road has previously been stabilized by the City as there was an outfall discharge at this location. Upstream of those works, the riverbank is unstable.

The proposed Project and focus of this report is the Interim Interchange Phase that will be configured as a traditional Diverging Diamond Interchange with roundabouts at the two intersections where the ramps connect to St. Mary's Road. The interchange is designed for a four-lane PR 200, along with a 4.0 metre active transportation pathway on the west (northbound) structure. Substructure units are located such that an Interim Stage, four-lane PTH 100 configuration below the structure can be expanded to an Ultimate six-lane configuration with adequate clear zones in the future without structural modifications. The detailed design that is being completed as part of this current project will further refine the Diverging Diamond Interchange preliminary design that was completed as part of the South Perimeter Highway Design Study.

EXISTING ENVIRONMENT

BIOPHYSICAL ENVIRONMENT

SOILS AND TERRAIN

The soils within the Project Study Area consist primarily of St. Norbert Clay and Red River Clay, both of which are blackearth soils that are developed on lacustrine fine clays of the Red River Association. Dryland agricultural capability for the Project Study Area is classified as Class 2 - soils typically have a moderate to high productivity for a wide range of crops. There are no major landforms (e.g., valleys, coulees, hills, eskers, etc.) within the Project Study Area or associated with the project footprint. Topography of the Project Study Area is level to gently sloping towards the Red River. Minor landforms found within the Project Study Area include drainage ditches and wetland depressions.

SURFICIAL AND BEDROCK GEOLOGY

Surficial geology of the Project Study Area consists primarily of offshore glaciolacustrine surficial deposits. These deposits consist of clays, silts and minor sand and are often between one and 20 metres thick. It can be anticipated that the clay thicknesses will vary from 12 m± to 15 m±, with the underlying glacial till being from 6 m± to 9 m± thick overlying limestone bedrock at depths ranging from 15 m± to 20 m±.

GROUNDWATER AND HYDROLOGY

The Winnipeg area is underlain by an extensive, confined carbonate rock aquifer known as the Upper Carbonate aquifer that is located within the top 15 to 30 metres of the Paleozoic limestones and dolomites. This aquifer is continuous over its extent and is formed by thick and extensive carbonate rock beds with minor shale beds. Transmissibility of this aquifer ranges from 24.8 and 2,480 cubic metres per metre per day.

Two groundwater wells were reported at 2433 St. Mary's Road and 2969 St. Mary's Road, with one at each property.

TERRESTRIAL ENVIRONMENT

There are nine natural areas located within the Project Study Area that have been identified by the City of Winnipeg Naturalist Services Branch. Natural area #395 will be entirely removed during the construction phase of the Project to allow for re-alignment of PR 200 and the construction of the ramps. Natural area #544 will have the easternmost sections of aspen and oak forest removed, again, to allow for the re-alignment of PR 200. The other natural areas identified within the PSA are not anticipated to be affected by the Project. Vegetated ditches within the existing PTH 100 right-of-way were found to be dominated by various grasses with wetter areas containing cattail and other common wetland indicator species. Commonly observed native plants included Indian hemp, American vetch and prickly rose. Weed species were prevalent throughout the right-of-way and natural areas. Within natural area #395, there were two sections identified as wetland areas with a total area of 0.40 hectares in size that were observed to be dominated by wetland grasses and contained snags and stumps with some areas of shrubs. It is anticipated that these two wetland sites would be classified as Class I or Class II wetlands.

Common mammalian species that may be found in the Project Study Area include white-tailed deer, red fox, striped skunk, raccoon, eastern cottontail, coyote, grey and red squirrels, white-tailed jackrabbit and various small mammals. Data from Manitoba Public Insurance indicates that a large number of deer are crossing PTH 100 and PR 200. The Manitoba Breeding Bird Atlas, Square 14PA31 in Region 3: Red River Valley encompasses the Project Study Area. A review of the summary for square 14PA31 identified 96 bird species reported with the most commonly reported species consisting of Canada goose, merlin, killdeer, ring-billed gull, American crow, barn swallow, yellow warbler, chipping sparrow, common yellowthroat and house sparrow. Amphibian species that likely occur within the wetland areas and wet ditches/drains in the are include boreal chorus frog and wood frog. Based on the proximity of the Project Study Area to the Red River, transient snapping and painted turtles may be observed within the Project Study Area.

AQUATIC ENVIRONMENT

The Red River is located at the western end of the Project area and is located adjacent (within 60 metres) to the existing St Mary's Road in the northern end of the Project area. No other large surface waterbodies are present within the Project Study Area. The Red River is known to contain approximately 66 freshwater fish species. It is expected that ditches, artificial dugouts and swales will convey water through the Project Study Area during spring and in wet conditions. Three unclassified stream order drains are present in the Project Study Area. The first flows east to west underneath PR 200, north of the dairy farm located at 2433 St. Mary's Road and into the Red River. The second unclassified stream flows south to north, again into the Red River, crossing beneath PTH 100 to the west of PR 200. The third is a swale running south to north, from the floodway to the South End Sewage Treatment Plant and is anticipated to connect to the larger rural drainage ditch network.

The first two drains are classified by Milani (2013) as having Class C habitat while the third drain is classified as having Class E habitat. Class C habitat is defined as providing direct fish habitat, complex habitat but with no indicator fish species present. Class E habitat is defined as providing indirect fish habitat. No fish sampling efforts were conducted at these three drain locations. It is not anticipated that these drains would provide direct fish habitat unless the Red River was in a flood stage; however, no fish or fish habitat studies were undertaken for this Project.

SPECIES OF CONSERVATION CONCERN

Review of the Manitoba Conservation Data Centre database, the Manitoba Breeding Bird Atlas, the Department of Oceans and Fisheries species at risk map and the Manitoba Conservation and Climate's Fisheries Science and Fish Culture Section revealed historic observations/potential presence of seven plant, six bird and five aquatic species of conservation concern for the Project Study Area. Based on habitat suitability, five plant species, two bird species and one herpetofauna species are identified as having the potential to be impacted by the Project

SOCIO-ECONOMIC ENVIRONMENT

PUBLIC SAFETY AND HEALTH RISKS

The greatest risk to public safety and health within the Project Study Area is likely associated with vehicle collisions and vehicle-wildlife collisions based on the primarily agricultural and residential land uses in the surrounding area. Manitoba Public Insurance reports that between 2010-2019, 84 white-tailed deer-vehicle collisions took place at / near the PR 200 (St. Mary's Road) and PTH 100 intersection. The Manitoba Public Insurance map of Top Deer-Vehicle Crash Areas 2014-2018 indicates that the Project Study Area is located within an area of "High" deer-vehicle collisions.

PARKS, OPEN SPACES AND TRAILS

Maple Grove Park is located along the east side of the Red River adjacent to St. Mary's Road; this part of the park consists of river bottom forest. However, it does not appear that the proposed design will directly impact any existing recreational facilities / playgrounds, parks or open spaces. The existing entrance to Maple Grove Park will be reconfigured and will allow for safer access to the park. No existing trails will be directly affected by the Project. Effects on parks and open spaces are therefore anticipated to be minimal during project construction activities with effects relating primarily to potential temporary access closure/changes during construction phase of the Project.

HERITAGE RESOURCES

Two heritage sites were identified as having high potential to be impacted by the Project. These heritage sites are located within the realignment area of PR 200 and PTH 100 and include a historic dairy farm property and a destroyed/abandoned farmstead. A pre-construction Heritage Resource Impact Assessment will be conducted for the summer of 2021 in support of the Project with oversight provided by the Historic Resource Branch.

INDIGENOUS AND METIS COMMUNITIES

The Project is located on Treaty 1 territory and the homeland of the Metis people. The nearest area of Community Interest was associated with Peguis First Nation within the Rural Municipalities of Rosser and Springfield. According to a review of the Manitoba Mines Branch - Integrated Mining and Quarry System website (Manitoba Mines Branch, n.d.), quarry maps viewer accessed in 2021 there are currently no Treaty Land Entitlement claims within the Project Study Area. There are no Metis communities in the project footprint or within the Project Study Area. There is no hunting or trapping within the City of Winnipeg boundaries. Additional Indigenous resource use such as fishing or gathering of traditional use plants and cultural or traditional activities were not identified for the project footprint. Historical Indigenous resources and artifacts may be present within the area. A search of the Indigenous Business Directory (Province of Manitoba, 2019) did not identify any Indigenous owned business addresses within the Project footprint.

POTENTIAL ENVIRONMENTAL EFFECTS

The environmental effects assessment for the Project involved evaluating the potential interactions between the Project components and the biophysical and socioeconomic resources to determine key effects. The biophysical resources assessed included: climate, air quality and greenhouse gases, soils and terrain, groundwater, surface waters, vegetation, wildlife and habitat, aquatic environment, and species of conservation concern. The socio-economic resources that were assessed included: land and resource use, parks, open spaces and trails, heritage resources, Indigenous and Metis communities and public safety and health. Where adverse Project effects were noted, mitigation measures based on Manitoba Infrastructure's General Environmental Requirements and additional Project-specific mitigation measures were proposed to avoid, minimize or remedy adverse environmental effects. Any residual effects anticipated to remain after the successful implementation of mitigation measures were defined and characterized with respect to significance.

FOLLOW-UP, MONITORING AND REPORTING

HISTORIC RESOURCES IMPACT ASSESSMENT

A pre-construction Historic Resources Impact Assessment will be conducted for the two heritage resource sites identified as having the potential to be impacted by the Project during the spring/summer of 2021. The Manitoba Historic Resources Branch will provide regulatory oversight and direction on the course of action to be taken should any artifacts be uncovered as per requirements under the ***Heritage Resources Act*** of Manitoba. The objectives of the assessment are to: establish the presence or absence of heritage resources within the project area; establish the content, structure, and significance of those resources, if present; establish suitable avoidance measures for any heritage resources found within the project footprint; and to either recommend approval to develop without further assessment or to recommend the need for and scope of any further study (including archaeological salvage excavation or other conservation action).

SPECIES OF CONSERVATION CONCERN

Due to the limited records available for natural areas #395, 544 and 1093, and reports of previous plant species of conservation concern within the Project Study Area, surveys for plant species of conservation concern will be conducted in the spring/summer of 2021 to confirm the presence or absence of plant species of conservation concern within the project footprint.

There is the potential for bird and bat species of conservation concern to be present within the project footprint, primarily associated with the historic dairy farm buildings at 2433 St. Mary's Road. Directed surveys for evidence of barn swallow nesting and for the presence of bat use for roosting and chimney swift roosting will be completed at the historic dairy farm site in the spring/summer of 2021.

If required, based on the findings of these additional surveys for species of conservation concern, additional mitigation measures as applicable will be developed in support of the design-build for the Project.

CONCLUSIONS

Based on the review of the existing environment's biophysical and socio-economic components for the Project Study Area, as well as assessment of anticipated effects and application of identified mitigation measures, residual effects associated with the proposed Project are anticipated to be low for the majority of the project components with a subsequent significance of low. Exceptions include residual effects on species of conservation concern that was rated as low to moderate as there is the potential for permanent loss of habitat for plant, bat and bird species of conservation concern. Additional field surveys to be completed in spring/summer of 2021 will aid in further identifying locations of species of conservation concern and in refining mitigation measures. In addition, residual effects for Public Safety and Health primarily from vehicle-wildlife collisions was also rated as low to moderate. White-tailed deer-vehicle collisions are associated with most of the main thoroughfares in Winnipeg, especially in south Winnipeg which has a large area of relatively undisturbed natural habitat and agricultural land that provide habitat for deer. The PTH 100 and PR 200 (St. Mary's) interchange has been identified as having the second highest annual deer-vehicle collision numbers along PTH 100. In order to mitigate against white-tailed deer – vehicle collisions, signage relating to wildlife crossings will be installed in accordance with Manitoba Infrastructure's traffic policies. Although the mitigation strategy proposed in this report may aid in reducing deer-vehicle collisions in the new interchange / roadway / realignment areas, it is unlikely that the proposed strategy will completely eliminate this impact.

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TABLES

FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

A-weighted decibels ..... dBA
active transportation ..... AT
Air Quality Index ..... AQI
Average Annual Daily Traffic ..... AADT
Best Management Practices ..... BMPs
carbon dioxide ..... CO
carbon dioxide equivalent ..... CO_{2eq}
carbon monoxide ..... CO
City of Winnipeg ..... City
Committee on the Status of Endangered Wildlife in Canada ..... COSEWIC
Conservation Data Centre ..... CDC
cubic metre ..... m^3
degrees Celsius ..... °C
Department of Oceans and Fisheries ..... DFO
Design-Build ..... DB
Diverging Diamond Interchange ..... DDI
Elevation ..... Elev.
Endangered Species and Ecosystems Act ..... ESEA
Environment Act License ..... EAL
Environment Act Proposal ..... EAP
Environment and Climate Change Canada ..... ECCC
Environmental Approvals Branch ..... EAB
Environmental Management System ..... EMS
foot ..... ft
gallon ..... gal
gallons per foot per day ..... gal/ft/day
gallons per minute ..... gpm
General Environmental Requirements (MI) ..... GER
Global Warming Potential ..... GWP
greenhouse gases ..... GHGs
hectare (10,000 m^2) ..... ha
Heritage Resource Impact Assessment ..... HRIA
Historic Resources Branch ..... HRB
hour ..... hr
Industrial Technology Centre ..... ITC
kilogram ..... kg
kilometre ..... km
kilometres per hour ..... km/hr
Litres per second ..... L/s
Manitoba Infrastructure ..... MI
Manitoba Land Inventory ..... MLI
Manitoba Conservation and Climate ..... MCC
Manitoba Conservation Data Centre ..... MB CDC
mechanical stabilized earth ..... MSE
metre ..... m
metres cubed per metre per day ..... $m^3/m/day$
methane ..... CH_4
microns ..... µm
millilitre ..... mL
millimetre ..... mm
Ministry of Environment ..... MOE
minute (time) ..... min
National Air Pollution Surveillance ..... NAPS
Naturalist Services Branch ..... NSB
nitrogen oxides ..... NO_x
nitrous oxide ..... N_2O
no date ..... n.d.
Operations and Maintenance ..... O&M
ozone ..... O_3
pascal ..... Pa
parts per million ..... ppm
parts per billion ..... ppb
percent ..... %
pound(s) ..... lb
Project Study Area ..... PSA
Provincial Road ..... PR
Provincial Trunk Highway ..... PTH
Public & Stakeholder Engagement Program ..... PEP
right-of-way ..... RoW
Rural Municipality ..... RM
South Perimeter Highway Design Study ..... SPHDS
Species at Risk ..... SAR
Species at Risk Act ..... SARA
Species of Conservation Concern ..... SOCC
square centimetre ..... cm^2
square kilometre ..... km^2
square metre ..... m^2
square metre per day ..... m^2/day
sulfur dioxide ..... SO_2
Transportation Association of Canada ..... TAC
Treaty Land Entitlement ..... TLE
var. ..... variation
World Meteorological Organization ..... WMO
WSP Canada Inc. ..... WSP

LIST OF SUPPORTING DOCUMENTS

The following documents can be accessed from the Manitoba Infrastructure, Highway Planning and Design website at: https://www.gov.mb.ca/mit/hpd/pth100/index.html in support of this Environment Act Proposal.

- South Perimeter Design Study – Final Report. June 2020. Completed by WSP Canada Group.
- Design Drawings for the South Perimeter Design Study Ultimate Stage Design Drawings, St. Mary's Interchange Interim Solution Functional Design.
- ITC South Perimeter Noise Study.
- South Perimeter Highway Safety Plan.

1 INTRODUCTION AND BACKGROUND

1.1 PROJECT OVERVIEW

In 2017, Manitoba Infrastructure (MI) commissioned the South Perimeter Highway Design Study (SPHDS), which identified requirements to reconstruct Provincial Trunk Highway (PTH) 100 and Provincial Road (PR) 200 (St. Mary's Road) to a freeway standard. The study included the review of several intersections, water course crossings and rail crossings. The PTH 100 and PR 200 (St. Mary's Road) intersection was part of this review. A Diverging Diamond Interchange (DDI) was selected as the preferred alternative and a functional roadway design was prepared and presented to the public as shown in **Figure 1**.

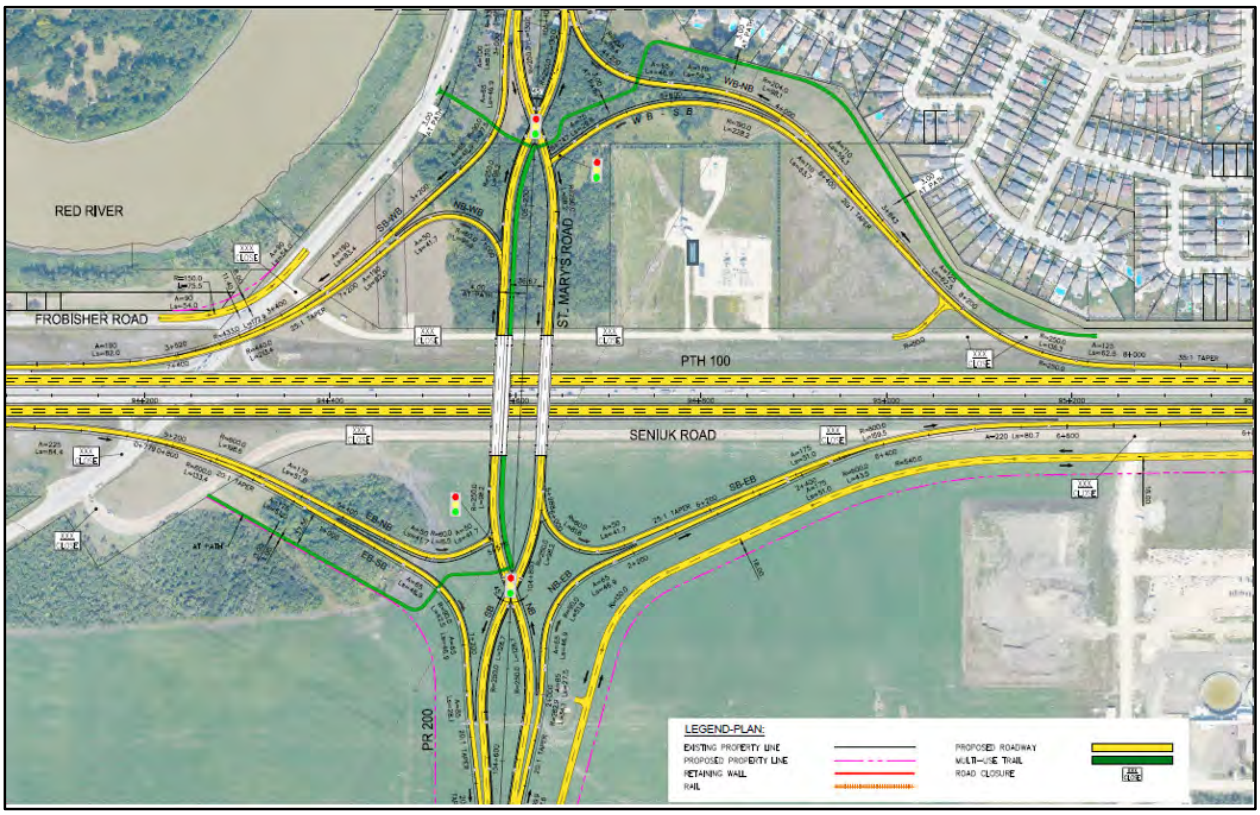


Figure 1. Diverging Diamond Interchange – Ultimate Stage

In the summer of 2020, MI considered a staged approach and completed a functional design of an Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) (herein referred to as the "Project"), which is the subject of this application (refer to **Section 3** for additional details).

The scope of the Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) will include detailed design and construction of:

- An interchange on PTH 100 at PR 200 (St. Mary's Road);
- PTH 100 to align with the Ultimate Stage recommended alignment from the SPHDS (refer to List of Supporting Documents);

- Active Transportation (AT) pathways that tie into the surrounding AT network, included a crossing of PTH 100 on the proposed 2-lane PR 200 (St. Mary's Road) bridge structure;
- Intersections at Redview Drive and Frobisher Road;
- Realignment of St. Mary's Road; and,
- Miscellaneous service road realignments and connections.

Under the *Classes of Development Regulation* of *The Environment Act* of Manitoba, the Project is considered a Class 2 Development and as such requires an Environment Act License (EAL). This Environment Act Proposal (EAP) report provides a summary of the design and construction details, and environmental effects of the proposed Interim Interchange at PTH 100 and PR 200 (St. Mary's Road) in support of obtaining an EAL for the Project.

NOTE: PR 200 and St. Mary's Road are used synonymously within this report when discussing the roadway at the future interchange location.

1.2 PROJECT BACKGROUND

PTH 100 is part of the ring road originally constructed in the 1950s and 1960s as a bypass route around the City of Winnipeg (City), and together with PTH 101, is known as the Perimeter Highway. Prior to the construction of the Perimeter Highway, traffic not destined for Winnipeg was required to use the City street system and often was delayed by urban traffic congestion. The Perimeter Highway was constructed to allow through traffic to bypass the City street system. PTH 100 extends from Portage Avenue at the west to Fermor Avenue at the east on the south side of the City and is accessed via stop-controlled and signalized at-grade intersections and interchanges. The residential growth combined with commercial development on either side of PTH 100 has also led to a significant increase in cross street movements and growing safety/operational issues.

A Preliminary Design Study of the South Perimeter Highway from PTH 3 to PTH 59 was undertaken in 1988 and recommended that PTH 100 become a freeway with access limited to interchanges only. That Study has been used since that time as a decision-making guide when reviewing development proposals and as a means to protect future right-of-way (RoW) requirements. However, since the 1988 Study, traffic volumes on PTH 100 have increased by 100%. As a result, safety, operational, and capacity deficiencies have also significantly increased. The general condition of the roadway and structures on PTH 100 has also decreased since 1988.

Therefore, prior to programming improvements to PTH 100, MI commissioned the SPHDS in 2017 that involved the completion of a Functional Design Study to upgrade PTH 100 from the PTH 1W (Portage Avenue to PTH 1E (Fermor Avenue) to a freeway standard with a six-lane cross-section and the elimination of all at-grade intersections and rail crossings. The SPHDS also involved the completion of preliminary designs for two bridges as shown in **Figure 1**.

Prior to completing the SPHDS, MI undertook a Functional Roadway Design and Preliminary Structure Design for an Interim Interchange at PTH 100 and PR 200. Three conceptual design alternatives were investigated for PTH 100 and PR 200 – a Diamond Interchange, a Parclo Interchange, and a DDI. The DDI was selected as the preferred alternative and a functional roadway design was prepared and presented to the public. Subsequent to the preferred ultimate stage DDI being selected, MI investigated whether a staged approach could be employed for the recommended DDI for PTH 100 and PR 200. This resulted in the completion of a functional roadway design for an Interim Interchange. In the summer of 2020, Manitoba announced that the PTH 100 and PR 200 (St. Mary's Road) Interim Interchange was its first priority in implementing the recommendations of the SPHDS with construction commencing in the Fall 2021.

1.3 PROJECT NEED, PURPOSE AND ALTERNATIVES

Of the various future interchanges recommended in the SPHDS, PTH 100 at PR 200 (St. Mary's Road) was identified as a high priority project due to the current traffic volumes and resultant level of service, angle of intersection, presence of the intersection to Maple Grove Park located in very close proximity to the intersection at PTH 100 and forecasted traffic levels. PR 200 (St. Mary's Road) is an important link connecting the Community of St. Adolphe to the City and to the surrounding towns in Southern Manitoba. North of PTH 100, PR 200 becomes St. Mary's Road and is a major north / south arterial route into the City.

The Ultimate configuration for the subject grade separation, as identified in the SPHDS, was a DDI. That configuration provided the necessary capacity to accommodate traffic levels 30 years out, which was the design horizon for the SPHDS. However, it was recognized that a lesser Interim Phase, that was compatible with a future DDI with minimal throwaway costs, could serve traffic needs for as much as 20 years. This Interim Phase would have significantly lower initial capital costs; subsequently functional plans for such a phase were developed as an add-on to the SPHDS.

The proposed Project and focus of this report is the Interim Phase Interchange that will be configured as a traditional DDI with roundabouts at the two intersections where the ramps connect to St. Mary's Road (see **Figure 6**). This phase will involve construction of an undivided two-lane bridge structure over PTH 100 including a 4.0 metre (m) AT pathway. The St. Mary's Road alignment for its crossing of PTH 100 will be changed from a significant skew to perpendicular by moving the road away from the Red River and its bank stability issues, which will also allow for a safer access location for Maple Grove Park. PR 200 would be realigned on the south side and would tie to the existing PR 200 north of Paul Boulevard. The alignment allows for the City's plans to build a new facility for the City's Insect Control Branch and helicopter pad.

1.4 OBJECTIVES OF PROJECT

The fundamental objective of the Project is to design and build the Interim Interchange that will address operational and traffic safety needs, will have the greatest cost effectiveness and has high quality levels that result in low operational and maintenance costs, along with high durability.

A secondary goal for this Project is to act as economic stimulus to help offset the financial impact of COVID-19 to the Provincial economy. This goal is directly connected with the completion date for delivery and interim milestones, which together, represent a limited window to deliver the Project.

1.5 PROJECT LOCATION AND STUDY AREA

The Design-Build (DB) location of the Project is at the south end of the City of Winnipeg, Manitoba at the intersection of PTH 100 and PR 200 (St. Mary's Road). The existing signalized intersection of PR 200 and PTH 100 is indicated in **Figure 2**.

The geographic limits of the Project are:

- West on PTH 100 to the east abutment of the PTH 100 Bridge Structure over the Red River;
- East on PTH 100 to the east functional limit of the PTH 100 and PR 200 Interchange Ramp Tapers;
- North on St Mary's Road to Redview Drive;

— South on PR 200 for a distance of approximately 3.1 km.

For the purposes of this report, the "Project Study Area" (PSA) is defined by the geographic limits and as outlined in **Map 1, Appendix A**. The "project footprint" is defined as the lands owned and operated by MI for the purposes of construction and operation of the PTH 100 and PR 200 interchange.

2 DESCRIPTION OF EXISTING CONDITIONS

2.1 OVERVIEW

The existing intersection at PTH 100 and PR 200 is a four-legged signalized intersection that consists of the following geometry:

- The northbound approach on PR 200 consists of a left-turn lane, a through lane and a right-turn lane.
- The southbound approach on St. Mary's Road consists of a left-turn lane, a through lane and a right turn cut-off lane.
- The westbound approach on PTH 100 consists of a left-turn lane, two through lanes and a right-turn cut-off lane.
- The eastbound approach on PTH 100 consists of a left-turn lane, two through lanes and a right-turn cut-off lane.

The existing intersection configuration is as shown in **Figure 2.**

Figure 2. Existing Intersection Configuration

The current PR 200 / PTH 100 intersection location has significant constraints that preclude the construction of an interchange at the existing location. The significant skew angle between St. Mary's Road and PTH 100, the close proximity of St. Mary's Road to the Red River on the inside of PTH 100, and the required access to Maple Grove Rugby Park located immediately north of the existing intersection on the west side make up these constraints. As a result, it will be necessary to realign St. Mary's Road to the east.

2.2 EXISTING LAND USE

2.2.1 EXISTING LAND USE AND DEVELOPMENT PLANS

The Project is located wholly within the City's boundaries. The City's Development Plan, titled *OurWinnipeg*, presents a high-level framework for land use planning in the City. *OurWinnipeg* is supported by the Complete Communities Direction Strategy, which provides policy direction for growth and development in the City. Based on *OurWinnipeg*, land use designations associated with the PSA consist primarily of *Recent Communities* including the River Park South residential area and commercial business to the north of PTH 100 and along St. Mary's Road, and *Rural and Agricultural* land use to the south of PTH 100. In addition, the Red River is located to the west of St. Mary's Road within approximately 60 m of the existing roadway. There are also natural wooded areas located both south and north of PTH 100 adjacent to PR 200 (St. Mary's Road). **Map 2, Appendix A** provides an overview of the Land Use Policy Areas and **Map 6, Appendix A** provides an overview of existing land use.

ST. VITAL PERIMETER SOUTH SECONDARY PLAN

The City has adopted a secondary plan for an area south of PTH 100 between the Red River and Lagimodiere Boulevard, to south of the floodway (By-law 1735/77), as identified in **Figure 3**.

Land east of the Red River is identified for Medium Density Rural Residential – 2 Acre, land east of that is designated Agricultural – 40 Acre and Work Area Reserve. Land to the south of the Agricultural and Work Area Reserve designations is defined as Low Density Rural Residential – 5 Acre. Lands on either side of the Seine River and abutting PTH 100 are identified as Commercial, Public Reserve and Medium Density – 2 Acre.

Direction for the Medium Density Rural Residential area is:

- To establish a medium density rural residential area and to adopt a zoning by-law establishing a minimum site area of two acres and a minimum site width of 180 feet for a single-family dwelling site subject to approved variations.

Direction for the Low Density Rural Residential area is:

- To establish a low density rural residential area and to adopt a zoning by-law establishing a minimum site area of five acres and a minimum site width of 300 feet for a single-family dwelling site subject to approved variations.

Direction for the Agricultural area is:

- To encourage the conservation of land for general agricultural activities, and where it is in the public's interest, ensure the timing and transition of agricultural lands to limited urban uses proceeds in an orderly manner; and,
- To encourage the use of land for agricultural activities on large holdings, and to protect continuous blocks of agricultural land from premature development by adopting for the Agricultural area a zoning by-law establishing a minimum site area of 40 acres and a minimum site width of 300 feet subject to approved variations.

To facilitate the development of a future working area, certain areas were identified as Work Area Reserve as shown in **Figure 3**. Direction for this area is as follows:

- To designate the area around the sewage treatment plant as a working area reserve to be developed when City sewer and water facilities become available and as the need arises. Until services become available and demand for industrial land becomes apparent, this area shall be zoned an agricultural area.

Commercial policies permit the establishment of a limited amount of highway commercial development immediately adjacent to the Perimeter Highway on the east side of St. Anne's Road.

The transportation section of the plan discourages private access driveways along PTH 100 by encouraging the consolidation of traffic at major points of entry and to make adequate provisions for access to parcels of land, which might otherwise be land locked.

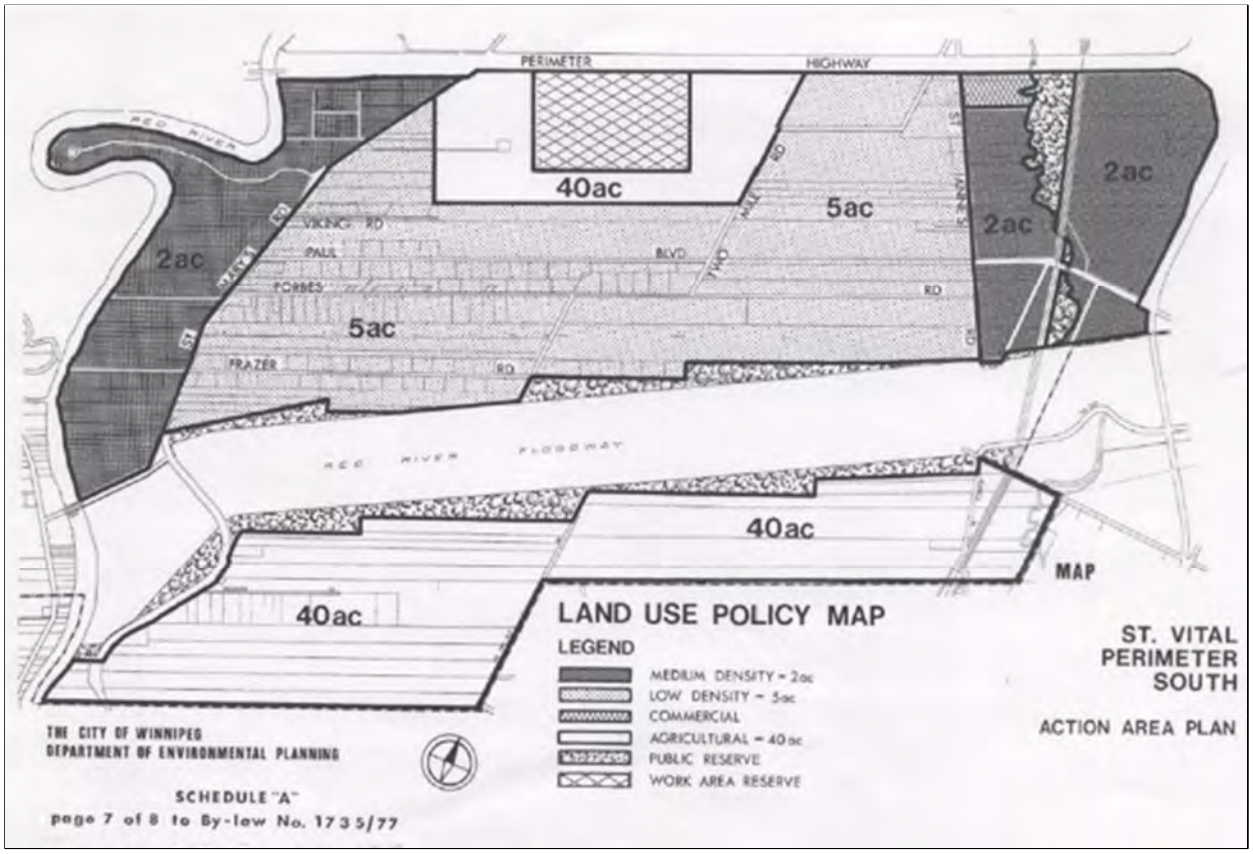


Figure 3. St. Vital Perimeter South Action Area Plan Land Use Policy Map

2.2.2 CITY OF WINNIPEG LAND USE

East of the Red River and west of St. Mary's Road on the north side of PTH 100 is Maple Grove Park. On the south side of PTH 100 within this section is large-lot residential development. There are no accesses to PTH 100 within this area.

At St. Mary's Road, the Red River is very close to the intersection and was a major consideration when re-designing this intersection, as was continued access to Maple Grove Park. On the east side of St. Mary's Road, south of PTH 100, land use is generally agricultural with Seniuk Road providing access to a service road that extends to St. Anne's Road along the south side and provides access to the City's South End Water Pollution Control Centre. Land use on the northeast corner of St. Mary's Road and PTH 100 includes a hydro sub-station, cell tower and an existing farmstead. Access to the cell tower and hydro sub-station are via a service road (Frobisher Road) that connects to St. Mary's Road just north of PTH 100.

Beyond the intersection of St. Mary's Road, extending to St. Anne's Road, land use on the south side of PTH 100 is largely agricultural except for the South End Water Pollution Control Centre and Gauthier Soils business. There is an outlet for the South End Water Pollution Control Centre, directly west of the facility on the south side of PTH 100. On the north side of PTH 100, land uses are residential.

2.2.3 PROPERTY OWNERSHIP

The majority of the Project will be constructed within existing MI RoW; however, some land acquisition will be required to support the Project. **Table 2-1** provides a list of private and City owned lands that MI will need to / is in the process of acquiring for the Project. In total, there are five private landowner properties as well as eight City properties with a total land area of 44.53 hectares (ha) that will be impacted by the Project as indicated on **Drawing Sheets 1 through 5, Appendix C**. Copies of the applicable land titles are also provided in **Appendix C**.

Table 2-1. List of Lands for Acquisition

Current Owner	Land Title Certificate #	Legal Land Locations	Area	Drawing Sheet #
Arbo Gardens Ltd	1088660/1	SP Lot 6, Plan 20294	0.103 ha	1
City of Winnipeg	2403053/1	Lot 28, Plan 20411	0.044 ha	1
	2397599/1	Lot 27, Plan 20411	0.012 ha	1
	2365576/1	Lot 26, Plan 20411	0.0076 ha	1
	1109468/1	Lot A, Plan 23942	0.15 ha	1
	1341235/1	Lot E, Plan 14846	2.38 ha	1
	1341235/1	Lot C, Plan 14846	3.68 ha	1
	1604659/1	Lot B, Plan 10523	0.051 ha	2 & 4
	1604659/1	Lot Pt A, Plan 10523	28.45 ha	2 & 3
Waterside Development	2923662/1	Lot 1, Plan 11187	1.347 ha	4
Preferred Dairies	2293262/1 2293323/1	RL 161 and 162 Parish of St Norbert, Plan 3941 RL 161 Parish of St Norbert, Plan 3941	8.12 ha	5
Cornelius Reimer	2921127/1	Lots 34 & 35, Plan 20513 WLTO	0.13 ha	5
Tina Hildebrand	1203118/1	Lot 36, Plan 20513 WLTO	0.06 ha	5
Total # of Hectares/Parcels			**44.53 ha/13 parcels**	

2.3 GEOTECHNICAL CONDITIONS

2.3.1 INVESTIGATION PROGRAM

A drilling and sampling program was completed from May 6 to 8, 2019, under the direct supervision of KGS Group, with drilling services provided by Maple Leaf Drilling Ltd., of Winnipeg, Manitoba. Drilling was performed using a Mobile Drill B37X track mounted geotechnical drill rig equipped with 125 mm diameter solid stem auger and an automatic drop hammer. Drilling included three deep test holes (TH19-01 to TH19 03) advanced to refusal in the underlying till, with two test holes (TH19-01 and TH19-03) extended 6.0 m to 6.3 m below auger refusal with triple tube HQ coring into the underlying limestone. Test hole locations are shown on **Figure 4**Error! Reference source not found. with UTM coordinates and ground elevations provided in **Table 2-2.**

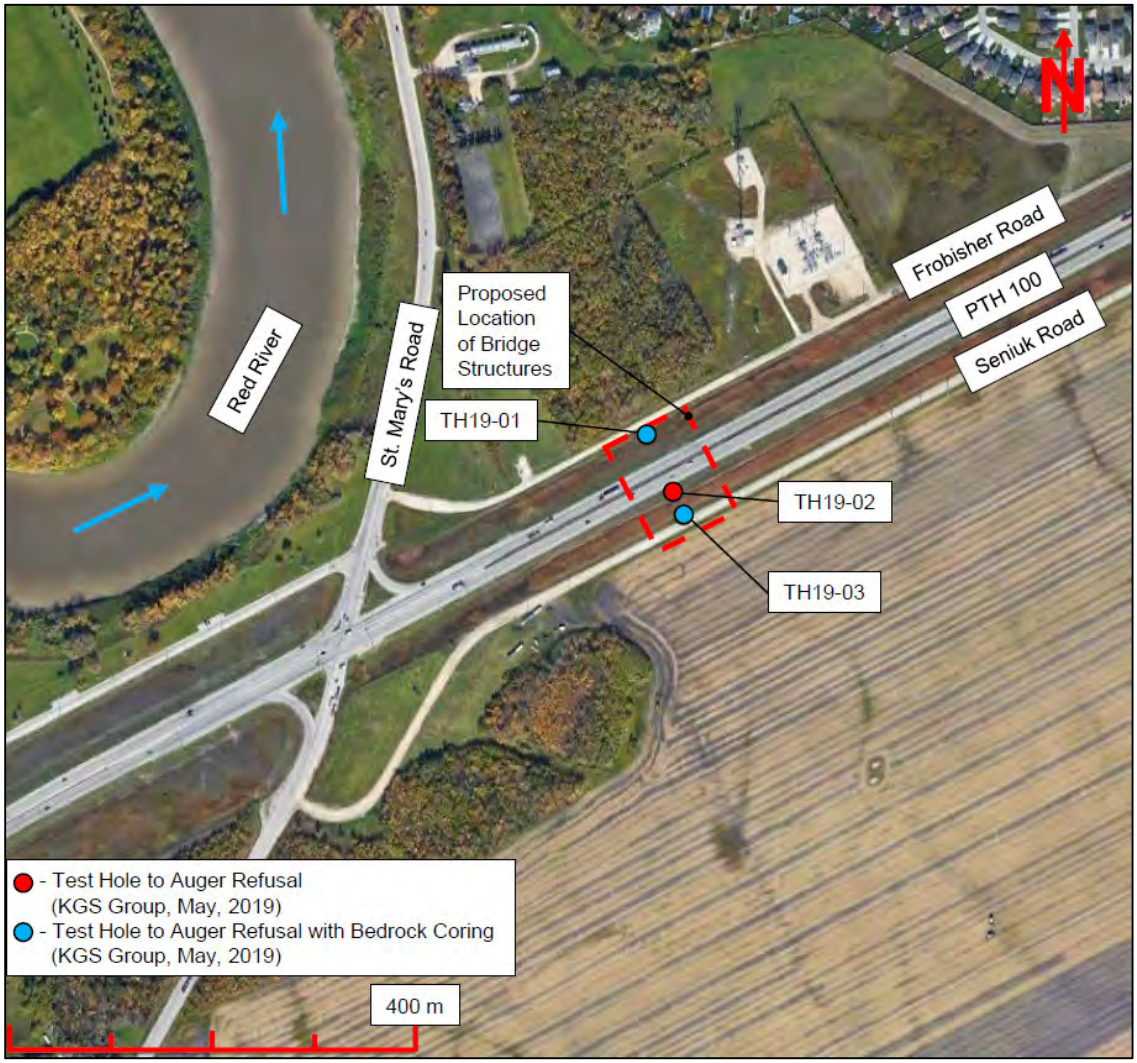


Figure 4. Geotechnical Investigation - Site Plan

The test holes drilled as part of the preliminary geotechnical investigation were completed in the PTH 100 RoW and were drilled in close proximity to the proposed interchange bridge structures.

Representative disturbed soil samples were obtained in each test hole at 1.5 m intervals, or at any change in soil strata. Samples were collected directly off the auger flights and visually classified in the field in accordance with the modified Unified Soil Classification System. Cohesive samples were tested using a field Torvane to evaluate consistency and to estimate undrained shear strength. Standard Penetration Tests were performed to evaluate relative in-situ density of the till. Relatively undisturbed soil samples were also obtained in each test hole using Shelby tubes at select depths. Upon completion of the drilling, each test hole was examined for indications of squeezing, sloughing and seepage. The test holes were backfilled with sand, bentonite chips and auger cuttings to ground surface.

Table 2-2. Geotechnical Test Hole Coordinates and Elevations

Test hole ID	UTM Northing (m)	UTM Easting (m)	Approximate Ground Elev. (m)	Approximate Top of Till Elev. (m)	Approximate Power Auger Refusal Elev. (m)	Approximate Top of Bedrock Elev. (m)
TH19-01	5,517,432	635,921	231.04	217.3	212.2	211.7
TH19-02	5,517,377	635,948	231.65	218.5	213.7	N/A
TH19-03	5,517,354	635,959	231.28	218.2	212.2	211.9

Settlement of embankment fills both in the short and long-term will be a key issue that needs to be addressed to have a successful completion and performance of the structures. Typically, MI requires that earth embankments constructed on soft foundation soils achieve 90% of primary consolidation / settlement prior to granular placement and 95% of consolidation prior to paving. The length of time it takes to reach this value is determined by several considerations, including type of material used to construct the embankment and dissipation of excess pore pressures developed in the foundation soils when conventional earth fill is used. Methods to speed up or shorten conventional consolidation times have typically included a closely spaced array of wick drains. Pre-loading with wick drains in the foundations results in settlements being achieved before the main structures are constructed and reduces or eliminates the need to consider downdrag loading on the piles. The result of pre-loading would give the construction Contractor more freedom in scheduling because the critical construction path generally follows the actual consolidation time which then governs the final paving schedule.

The achievement of 95% of primary consolidation on recent projects nevertheless still results in some future settlement “bump” forming at the approach slabs. This occurrence is likely due to the remaining primary consolidation as well as secondary and tertiary consolidation which is not addressed by the current approach. Repaving the approaches to the bridge after approximately five years has been a cost-effective solution to this technical issue.

Lightweight fill has been recently used successfully to construct high embankment fills (Centre-Port Canada Way, Waverley Bishop Grandin Overpass, Southwest Rapid Transit, MI Letellier Bridge) in Manitoba. The first MI project utilizing lightweight fill was the Letellier Bridge west approach embankment designed successfully by KGS Group to remediate settlement and abutment stability issues. The method effectively reduces the loading imparted to the foundation soils and therefore reduces the construction induced pore pressures as well as the predicted and observed amount of the settlement that will occur below the embankment. Global stability of the foundation soils is also addressed, and the footprint is typically much narrower. At the same time, downdrag is reduced or eliminated. This approach also reduces the requirement for carefully staged construction, allowing the contractor to compress the schedule if necessary.

The use of mechanically stabilized earth (MSE) walls for retaining the conventional embankment fills and abutments can be considered. For the PTH 59N / PTH 101 interchange this approach was used at several pinch points in the footprint of the project. Careful attention and quality control during construction is required. Ensuring that proper compactive effort is used during the placement of the fill behind the wall is important as the reinforcing strips tied to the MSE wall facing require properly compacted fill to perform suitably and aesthetically.

Regardless of the approach, detailed instrumentation and monitoring has proven to be very important. Monitoring of piezometers, settlement plates, Shape Accel Array cables, slope inclinometers and tiltmeters to allow for the construction to progress in a manner such that embankment loads do not exceed values that would cause failure of either the foundation soils or embankment fill. The use of either conventional fill or lightweight fill will allow for future widening of the main embankments and/or retaining walls.

A final geotechnical investigation will be completed at the location of each abutment and pier during detailed design as part of the DB for the Project.

2.3.2 STRATIGRAPHY AND GROUNDWATER CONDITIONS

In general, the stratigraphy at the interchange site was interpreted by KGS Group to consist of fat clay overlying clay till and dolomitic limestone. A detailed description of each stratigraphic layer is provided below:

FAT CLAY (CH)

Fat clay was encountered either from ground surface or below a thin 0.1 m thick layer of topsoil extending to the top of the clay till at 13.1 to 13.7 m± (Elev. 217.3 to 218.2 m±). The clay was generally brown in colour, moist, stiff in consistency and of high plasticity. With depth, the clay became grey in colour and firm to soft in consistency. The undrained shear strength of the clay, estimated by the field Torvane, decreased with depth and ranged from 55 kilopascal (kPa) near surface to 20 kPa in the lower clay nearing contact with the clay till.

CLAY TILL

Clay till was encountered below the fat clay at 13.1 to 13.7 m± (Elev. 217.3 to 218.2 m±) extending to 18.9 to 19.5 m± in TH19-03 and TH19-05 (Elev. 211.7 to 211.9 m±). The clay till was generally grey in colour, moist, soft to firm, of low plasticity, and contained trace fine to coarse grained sand and trace fine grained gravel. With depth, the clay till became very stiff to hard in consistency. The upper clay till generally had uncorrected N-values (SPT) of 2 to 42 above 16 m and 10 to greater than 50 below 16 m to auger refusal. Power auger refusal occurred at 18.9 to 19.5 m± below existing ground surface (Elev. 212.2 m±).

DOLOMITIC LIMESTONE

Dolomitic limestone was encountered below the clay till at 18.9 to 19.5 m± depth below ground surface (Elev. 211.7 to 211.9 m±) in TH19-01 and TH19-03. The top of bedrock was not confirmed in TH19-02 as no coring was completed beyond power auger refusal. The dolomitic limestone was light brown, very fine grained with trace to few vugs. The rock exhibited minimal vugs, alteration or other evidence of water bearing strata and was considered generally good quality rock within the white chalky limestone below Elev. 207.5 m (TH19-01) and Elev. 208.9 m (TH19-03).

2.3.3 GROUNDWATER CONDITIONS

Some seepage, sloughing and squeezing was observed during drilling, mainly in the lower fat clay and the clay till. At the completion of drilling the TH19-02 remained open and the water level was at 7.3 m.

Four vibrating wire piezometers and two 3 m long slotted standpipe piezometer were installed to monitor the groundwater levels in the clay, till and bedrock. Groundwater was measured at a depth of 2.3 to 6.0 m± in the clay (Elev. 225.0 to 228.7 m±), 3.5 to 6.2 m± in the till (Elev. 224.8 to 227.5 m±) and 5.7 to 6.3 m± in the bedrock (Elev. 225.0 to 225.6 m±). The limited groundwater monitoring data suggests that there is a slight downward hydraulic gradient in the upper clay and a slight upward gradient from the clay till into the lower clay.

Groundwater levels will fluctuate seasonally and following precipitation events; therefore, the actual water level at the time of construction could differ from the conditions reported in the 2019 geotechnical report. Groundwater inflows and subsequent sloughing / squeezing are likely to occur when advancing excavations into the till. Where encountered, groundwater inflows and potential sloughing that may occur will need to be dealt with during excavation. Such methods as deemed necessary for controlling water inflows will be determined by the foundation installation contractor.

2.3.4 FROST PENETRATION

The estimated maximum depth of frost penetration is 2.5 m assuming bare ground and no insulation cover. Heaving of soil due to frost action will be considered in the detailed design. Good site drainage will also be maintained after development over the life of the structure.

2.4 ROADWORKS

2.4.1 EXISTING ROAD GEOMETRY

PR 200 is a paved two-lane undivided highway classified as a Collector "A" with a speed limit of 80 kilometres per hour (km/hr) south of PTH 100 and a speed limit of 60 km/hr north of PTH 100. PR 200 is under the City's jurisdiction within the PSA. The existing intersection of PTH 100 and PR 200 (St. Mary's Road) is a four-legged signalized intersection on an approximately 50-degree skew. No overpass structures are currently present at this intersection. The posted speed limit is 100 km/hr along PTH 100, reducing to 80 km/hr near the existing intersection. The existing signalized intersection accommodates about 40,000 vehicles per day. Frobisher Road is a gravel two-lane undivided roadway north of PTH 100 that intersects St. Mary's Road 100 m north of PTH 100 and is the only access to Maple Grove Park. The skew of Frobisher Road makes certain sight lines difficult, which has resulted in safety and congestion concerns for traffic accessing the Park. Seniuk Road is a gravel two-lane undivided roadway south of PTH 100 that provides access to commercial and agriculture properties and the City's South End Water Pollution Control Centre. The Red River riverbank to the north of the intersection and downstream of Frobisher Road has previously been stabilized by the City as there was an outfall discharge at this location. Upstream of those works, the riverbank is unstable.

For the SPHDS traffic volumes and forecasting methodology for the existing (2018), 10-year (2028), 20-year (2038) and 30-year (2048) design horizons were completed. A collision analysis was also conducted as part of the SPHDS that indicated that between the years 2007-2015 a total of 101 collisions occurred at the PTH 100 and PR 200 intersection including 38 collisions resulting in injury and 63 collisions resulting in property damage; no fatalities were recorded for that time period.

2.4.2 ACTIVE TRANSPORTATION

MI recently developed an *Active Transportation Policy and Guide for Highway Operations* (June 2018) that provides a consistent, transparent and strategic framework for considering AT in MI's practices in locations with the highest AT demands. Roadways with the highest AT demands, also known as "hot spots" were identified during the SPHDS with PR 200 identified as a "hot spot". The level of activity, in terms of the number of cyclists and pedestrians, for the area, however, is not available. During the public engagement program completed for the SPHDS, the public and stakeholders commented on where they would like to see AT connections and a connection between Maple Grove Park and Cloutier Drive was identified as one of the desired connections. MI does not plan or design pathways within roadway RoWs; rather they allow adjacent municipalities to do so, in consultation with MI.

One of the Key Strategic Goals of the City's *Transportation Master Plan* is "a transportation system that supports active, accessible and healthy lifestyle options". To achieve this goal, there is a need to improve the walking and cycling environment by providing new and upgraded pedestrian and cycling facilities. The initial step in this process was the development of the *Pedestrian and Cycling Strategies* document approved by Council in 2015. This Strategies document established directions for walking and cycling policies, infrastructure, and programs over a 20-year plus period to ensure the accessibility, comfort and safety of walking and cycling in Winnipeg.

Pedestrian and cycling facilities identified in the Pedestrian and Cycling Strategies specific to the PSA are:

— Existing Pedestrian and Cycling Facilities include Cloutier Drive Off-Street Pathway.

— Proposed Pedestrian and Cycling Facilities include PR 200 Off-Street Pathway.

2.4.3 OTHER TRANSPORTATION SERVICES

TRANSIT

Transit service within the PSA is provided by the Winnipeg Transit service and is limited to the residential area associated with the Saint Vital area of the City as indicated in **Figure 5**. There is no transit service at this time on PR 200 south of PTH 100.

RAIL

There are no railway crossings or lines within the PSA.

Figure 5. Transit Routes within PSA

2.4.4 UTILITIES

At the at-grade intersection of PR 200 and PTH 100, there are some significant utilities. There is an 1800-millimetre (mm) wastewater sewer outfall, which extends southwest out of the South End Water Pollution Control Centre and continues through the existing intersection at PR 200 at a 45-degree angle to the Red River. A 1950-mm forcemain and a 600-mm feedermain cross perpendicular to PTH 100 to service the South End Water Pollution Control Centre. Along the north side of PTH 100 there is a Hydro station and several underground Hydro lines. There is a 100-mm high pressure gas main approximately 1450 m east of the PR 200 intersection.

2.4.5 DRAINAGE

Drainage characteristics associated with the PSA including general catchment boundaries and outlets are as follows:

- **Red River Outlet Location 3** – This outlet location to the Red River is located at Frobisher Road, approximately 450 m west of St. Mary's Road. The west limit of the drainage boundary for this catchment is approximately 700 m east of the Red River and the east limit is St. Mary's Road. An existing culvert crossing underneath PTH

100, approximately 450 m west of St. Mary's Road, conveys the runoff from the south side ditch to the north side ditch, then directly to Outlet 3.

- **Red River Outlet Location 4** – This outlet to the Red River is located at St. Mary's Road approximately 290 m north of PTH 100. The drainage boundary extends from St. Mary's Road to an east limit approximately 2.2 km east of St. Mary's Road. This section drains west towards St. Mary's Road first and then north at a location approximately 220 m east of St. Mary's Road. An existing culvert crossing underneath PTH 100 conveys runoff from the south side ditch to the north side ditch, then towards Outlet 4.

These outlets are discussed in the aquatic environment section (Section 7.1.8) regarding how they relate to fish and fish habitat within the PSA.

3 DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 OVERVIEW

Three conceptual design alternatives were investigated for PTH 100 and PR 200 – a Diamond Interchange, a Parclo Interchange, and a DDI. The DDI was selected as the preferred alternative and a functional roadway design was prepared and presented to the public. Subsequent to the preferred ultimate stage DDI being selected, MI investigated whether a staged approach could be employed for the recommended DDI for PTH 100 and PR 200. This resulted in the completion of a functional roadway design for an Interim Interchange as shown in **Figure 6** below.

The proposed Project and focus of this report, is the Interim Interchange Phase that will be configured as a traditional DDI with roundabouts at the two intersections where the ramps connect to St. Mary's Road (see **Figure 6** below). The preliminary Drawing Plans for the interchange design is provided in **Appendix B**.

The interchange is designed for a four-lane PR 200, along with a 4.0 m AT pathway on the west (northbound) structure. Substructure units are located such that an Interim Stage, four-lane PTH 100 configuration below the structure can be expanded to an Ultimate six-lane configuration with adequate clear zones in the future without structural modifications.

The detailed design that is being completed as part of the DB for the Project, will further refine the DDI preliminary design that was completed as part of the SPHDS. The Project schedule is outlined in **Section 3.3.7**.

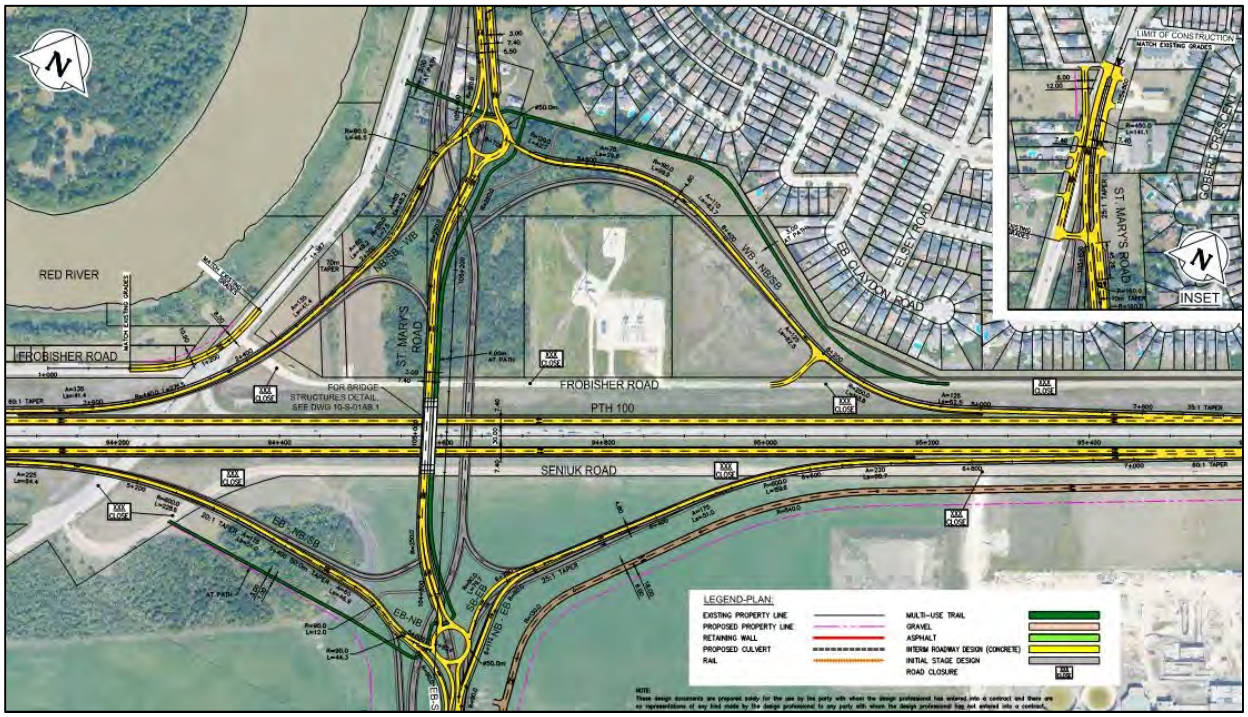


Figure 6. Proposed Interchange Configuration

3.2 ROADWORKS

3.2.1 ROAD DESIGN GUIDELINES AND CRITERIA

The new structures and approach geometry have been designed to meet Transportation Association of Canada (TAC) guidelines for road design, MI design standards, the preliminary Geometric Design Criteria (GDC) and the preliminary structure width requirements provided by MI.

The horizontal geometry for the St. Mary's Road interchange is based on St. Mary's Road being shifted approximately 400 m to the east of its existing location due to the proximity of the Red River. PTH 100 remains on its current alignment with westbound lanes remaining at their current location and the eastbound lanes shifted south to provide a 30-m median between them at the Interim, four-lane stage. At the Ultimate Stage, one additional lane would be added in the median in each direction to create a six-lane divided highway. The bridge structure should be designed such that the future addition of the two lanes on PTH 100 below is not affected.

The shifting and realignment of St. Mary's Road will result in a skewed crossing of 3 degrees for the interchange. St. Mary's Road will be constructed to a four-lane divided arterial roadway standard at the Interim Stage and will remain unchanged at the Ultimate Stage. The proposed interchange is a DDI style, although the structures themselves are effectively no different from other interchange types with separate structures for each travel direction.

3.2.2 HORIZONTAL ALIGNMENT

Horizontal alignment alternatives were established and evaluated in order to determine feasible overpass structure details for the preferred alignment. Details of the alignment alternatives are outlined in the SPHDS report. Slight modifications to the PTH 100 alignment to the south (to provide increased median separation) and re alignment of PR 200 near the structure / interchange location was recommended as the preferred alternative.

Horizontal geometry (curvature, curve length, super-elevation, etc.) were designed in accordance with the approved roadway design criteria for PTH 100 and for cross-roads. The proposed interchange site is located in tangent sections of the realigned highway. The proposed horizontal geometry for the recommended DDI option is based on meeting the desirable geometric design criteria.

The proposed structures have a minimum clear roadway width of 11.9 m in the northbound and southbound directions, as well as a 4.0 m AT path on the inside edge of the northbound structure. The minimum clear roadway width on the structure (as provided by MI Highway Planning and Design) is controlled by the lane geometry of PR 200. The crossing and roadway geometry were designed in accordance with the "Preliminary Geometric Design Criteria Recommendations" presented in the SPHDS report.

3.2.3 VERTICAL ALIGNMENT

PTH 100 will be at-grade with PR 200 passing over top of it. PTH 100's final grade will be approximately 1.0 m to 1.5 m above natural ground level in the area with the overall terrain being generally flat. As PR 200 must pass over PTH 100, it will be rising over it through constructing an earthen embankment at the desired vertical grade. The bridge structure will cross the highway and will provide the desired vertical clearance at the through lanes of PTH 100.

The vertical alignment (profile) for the preferred horizontal alignment alternative was developed and is presented in the SPHDS report. Vertical geometry (gradient, stopping sight distance, K-value, etc.) are in conformance with the approved roadway design criteria for PTH 100 and for cross-roads.

3.2.4 CROSS-SECTION

The cross-sectional details and elements associated with the new interchange are provided in **Appendix B**.

3.2.5 ROADSIDE SAFETY

A Road Safety Audit of the preferred functional design alignment was undertaken by an independent third-party engineering consultant - Flood Murray International. The Road Safety Audit report included general comments, a summary of design exceptions and specific comments related to the proposed design. The results of the audit were incorporated into the interchange design as deemed appropriate. Findings of the Road Safety Audit are summarized in the SPHDS report.

The Road Safety Audit did not include comments relating to wildlife collisions (Section 7.2.1.1).

3.2.6 CLEARANCES

The substructure units for the proposed structure are located outside of the clear zone such that crash protection and / or barrier measures are not required.

According to MI's approved *Bridge Design Criteria*, a minimum vertical clearance of 5.4 m will be maintained above all points of the roadway for overpass structures.

3.2.7 ACCESS MANAGEMENT

Access management was addressed in MI's *Safety Study* for PTH 100 and in access management recommendations in the SPHDS. Access management will also be applied along the new portions of PR 200 (St. Mary's Road). The Project will recognize existing and planned development and accommodate access needs. Examples include improved connections to the South Winnipeg Pollution Control Centre and Maple Grove Park, plus future access for the planned Insect Control Branch development. Confirmation of any changes to land use, development and access will be confirmed prior to Project construction. This will be further addressed as part of the stakeholder engagement process being completed for the Project. Requirements will be part of the DB team inputs to the final detailed design.

3.2.8 MAINTENANCE OF TRAFFIC

The proposed PR 200 re-alignment and bridge structure will be constructed offline from the existing PR 200 alignment as this facilitates construction staging. Traffic can remain on the existing roadway while the new alignment and structure is constructed until they are complete. An offline alignment also provides additional time for a surcharge load to be applied to the native prairie land to preload the ground for embankment fills prior to any construction.

Traffic staging and temporary lane closures will likely be required during construction of the median pier and for girder erection for spans over the existing PTH 100, and for the construction of the re-aligned PTH 100 (refer to the SPHDS for details).

3.2.9 UTILITY RELOCATIONS

The exact realignment of non-City utilities will be addressed at a future stage in the DB process. The affected utilities in the area have been contacted and a request has been made of the utilities for a review of any infrastructure that requires upgrades and / or relocation to accommodate the Project. The detailed design phase will include a full-scale utility locate and survey to ensure all utility locations are confirmed, with hydrovac and elevation surveys to confirm depth, as required.

3.2.9.1 WATERMAIN WORKS

There are no watermains in the area of the proposed interchange.

3.2.9.2 WASTEWATER SEWER WORKS

From the South End Water Pollution Control Centre, there is an 1800-mm sewer outflow. This sewer outflow travels below the existing St. Mary's Road intersection at PTH 100. It will require a pipe loading analysis and evaluation of special requirements for any construction work nearby.

3.2.9.3 GAS AND POWER

Relocations or adjustments of existing gas mains, hydro and cable lines will be required. The Manitoba Hydro station east of St. Mary's Road will require special consideration. There are approximately ten buried hydro cables in this region, with some of them encroaching into the future RoW. These must be relocated from underneath the proposed roadway, as required. In the area, there are numerous overhead and underground hydro lines that will be impacted. These will require adjustments or relocation, as required.

3.2.9.4 TELECOMMUNICATIONS

Relocations or adjustments of existing telecommunications lines will be required. There are buried BellMTS cables throughout the area near PR 200. This will be completed as part of the DB program.

3.2.10 SURVEY

A survey of the proposed bridge site location was not completed as the proposed structure is partially located over green field and existing highway. Light Detection and Ranging (LiDAR) elevation data was used for the geometric design and tie-in of the proposed structure and new roadway works.

3.2.11 LAND DRAINAGE

The runoff from the PTH 100 and PR 200 interchange and upstream contributing areas outlets to the Red River at two locations (Location 3 and Location 4) as shown in **Figure 7**.

Location 3 is located at Frobisher Road, approximately 450 m west of St. Mary's Road. The catchment area of this outlet is Catchment O. The west limit of the drainage boundary for Catchment O is approximately 700 m east of the Red River, and the east limit is approximately 2.2 km east of St. Mary's Road. A 1350-mm diameter culvert (Culvert C104) crossing underneath PTH 100, approximately 450 m west of St. Mary's Road, conveys the runoff from the south side ditch to the north side ditch, then directly to this outlet.

Location 4 is located at St. Mary's Road approximately 290 m north of PTH 100. The catchment area of this outlet is Catchment P. The drainage boundary of Catchment P extends from St. Mary's Road to the east limit approximately

2.2 km east of St. Mary's Road. Runoff from this catchment discharges the Red River through an existing 1200-mm culvert (culvert C110) underneath the current St Mary's Road.

The hydraulic analysis and runoff simulation for this area was conducted by using Personal Computer Storm Water Management Model 2017 hydraulic modeling software. A City of Winnipeg 50-year design storm with a 6-hour duration was used for modeling analysis. Modeling results are summarized in the SPHDS report.

LiDAR data was used to determine the drainage boundaries and flow directions within the PSA. A drainage study report provided by the City was used to determine boundaries of the contributing drainage from adjacent City lands.

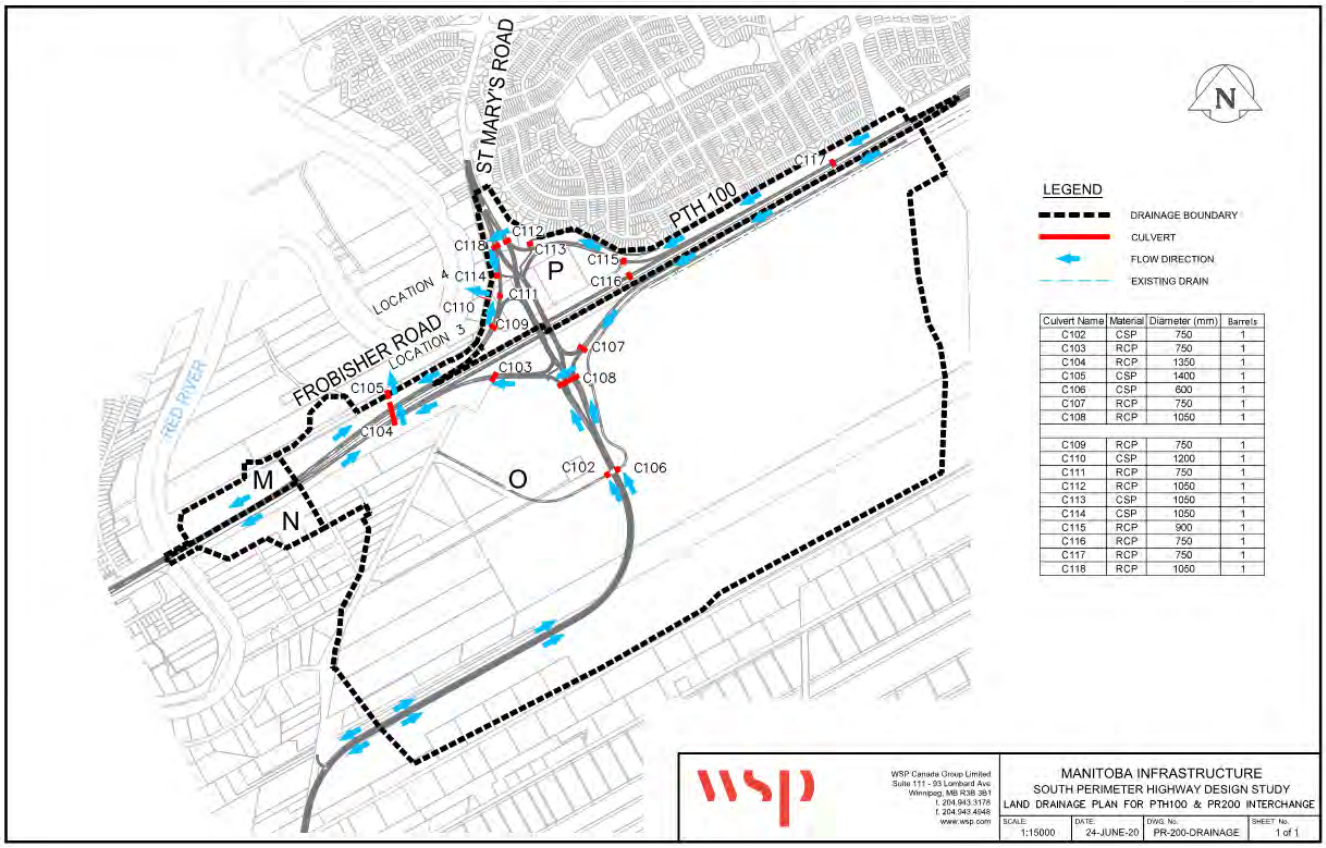


Figure 7. Drawing PR 200 Drainage Sheet 1

Figure 7 shows the direction of runoff movement within each catchment along with proposed locations and related sizes for culvert installations. All existing culverts will require replacement in addition to installing the new ones at the locations indicated.

3.2.12 ACTIVE TRANSPORTATION

AT through the interchange can be accommodated via a 4.0 m wide pathway running through the middle of St. Mary's Road across PTH 100. Pedestrians and cyclists will cross St. Mary's Road at the two signalized intersections within the interchange to access facilities on either side of PTH 100, including Maple Grove Park and residential neighbourhoods north of PTH 100. The proposed pathway along St. Mary's Road through the DDI is illustrated in **Figure 8**. The DB team will coordinate with the City of Winnipeg on potential City AT connections to the interchange structure, and all AT connections will be reviewed to ensure they do not conflict with the Ultimate DDI plan.

Figure 8. Proposed Active Transportation Facilities at PR 200

3.2.13 NOISE

As part of the SPHDS, an assessment of highway traffic related noise within the study area was conducted and where appropriate, proposed mitigations to bring noise levels to more acceptable levels were provided. Industrial Technology Centre (ITC) was retained to undertake the noise analysis and provide recommendations on where mitigation measures may be considered based on the transportation noise guidelines and criteria provided by MI.

The following noise guidelines criteria was used for the ITC noise study:

- The City of Winnipeg Motor Vehicle Noise Policies and Guidelines, October 11, 1984;
- Noise attenuation was considered in areas of urban residential development adjacent to PTH 100 when changes to PTH 100 and projected traffic increases on PTH 100 resulted in the projected noise levels in 2048 increased to above 65 dB;
- The point of reception for calculating noise levels on a residential property was the outdoor recreational area adjacent to PTH 100; and

— Noise attenuation measures must be technically and economically feasible to implement at the location being assessed.

Noise was evaluated on the north side of PTH 100 between St. Mary's Road and St. Anne's Road as part of the SPHDS for the projection year of 2048 for the future Ultimate 6-lane design of PTH 100. Until the Ultimate design is constructed, noise levels are predicted to be at or less than the current applied guideline of 65 dB; however, based on concerns raised during the public engagement program for the SPHDS regarding noise, a sound attenuation barrier will be constructed to the northeast of the interchange to mitigate noise for the residential neighbourhood north of PTH 100 and east of PR 200 (refer to Section 8.4.1).

3.2.14 LIGHTING

Future lighting for the interchange will be installed and maintained by Manitoba Hydro as per requirements for appropriate road lighting for highway interchanges. The DB team will work with Manitoba Hydro to develop the details of lighting requirements during the detailed design for the Project.

3.3 STRUCTURE TYPE SELECTION

During the SPHDS various structure options for the Project were evaluated based on five criteria including first cost / life-cycle cost, construction schedule / risk, constructability, inspection and maintenance and repairs / rehabilitation. Two-span structures with closed abutments and MSE walls, as well as four-span structures with open abutments, were considered at this site. The use of prestressed concrete girders and steel I-girders for the superstructure were investigated and considered MI standard solid concrete shaft sections for the pier substructure elements. To minimize maintenance costs, each alternative consisted of a continuous structure with jointless deck system, asphalt wearing surface, and semi-integral abutments, with MMFX/ChromX reinforcing steel used for superstructure concrete. All structure options were based on a minimum 75-year design life.

The span lengths for each replacement structure alternative considered in the preliminary design were determined based on the proposed geometry of the DDI, as well as the Ultimate Stage lane geometry of PTH 100. Appropriate horizontal clear zones of 10.5 m to the substructure units were provided on PTH 100 at the Ultimate Stage, along with 3H:1V abutment headslopes for four-span structure alternatives with open abutments. Headslopes included concrete slope paving with approximately 1 m of vertical clearance between the top of slope to the underside of the girder at abutment locations. Minimum vertical clearance requirements are maintained from the underside of lowest girder to highest point on the roadway section beneath it.

Based on the evaluation criteria, the recommended structure option for the PTH 100 and PR 200 interchange is dual two-span 69.46 m PPCBG structures with perched semi integral abutments behind MSE walls and a concrete column pier. The Interim Stage structure consists of 14-1300 mm deep girders per span for the northbound structure, and 10-1300 mm deep girders per span for the southbound structure. The structure is supported on driven steel H-piles with earth retaining elements for both abutments. Refer to **Appendix B** for Drawing Plans.

3.3.1 DESIGN CRITERIA

The SPHDS preliminary design of the new interchange bridges was completed in accordance with the design requirements of the latest edition of the AASHTO LRFD Bridge Design Specifications and AASHTO LRFD vehicle load requirements, including a design loading of Modified HSS 30, MS-30 lane loading, and the HL-93 loading.

3.3.2 SITE DESCRIPTION

PR 200 will approach PTH 100 at the proposed interchange location at a slight skew from normal to the longitudinal axis of the structure. Thus, only minor skewing (3 degrees) of the bridge substructures is required.

3.3.3 CROSS-SECTION / LENGTH

Dual two-lane structures spanning north-south along PR 2 00 over PTH 100 are proposed. The proposed 17.8.m wide northbound structure and 13.0 m wide southbound structure on PR 200 over PTH 100 will carry a 1.5 m exterior shoulder, two 3.7 m through lanes, a 3.0 m interior shoulder, and two TL-4 F-shape barriers. The northbound structure will also carry a 4.0 m wide AT path and curb with handrailing. PR 200 will overpass PTH 100, which consists of one 3.0 m shoulder, two 3.7 m through lanes (three at the Ultimate Stage) and one 1.5 m median shoulder – for each of the eastbound and westbound directions. The two-span structures with closed abutments and MSE walls will have lengths of 69.46 m (spans: 34.73 m – 34.73 m) (refer to **Appendix B**).

3.3.4 DESIGN

With available information from site visits, survey and geotechnical assessments, WSP developed structure options for this interchange based on several considerations that included:

- **Open and Closed Abutments:** Closed abutments normally contain vertical walls located closer to the travel lane. Open abutments offer the safety advantage of being more aesthetically pleasing to drivers (i.e., no "tunnel" effect) and more readily allow for maintenance work for the bearings. Closed abutments are most advantageous in urban settings where limited space is available. They also tend to be more cost-effective to construct. Open abutments (containing headslopes with exposed breastwalls) are widely used throughout the province and are specified in MI's standard design requirements. However, the province also has several structures with closed abutments in its inventory, such as at the PTH 59 / 101 Interchange. Closed abutments are deemed to be more advantageous and suitable at this site.
- **Slope Stability:** Stability of headslopes and side slopes have proven to be problematic throughout the province due to poor bearing capacity of the native clayey soils. Many overpass structures in the province's inventory have also experienced cracking and deterioration of headslope concrete as a result of settlements. As such, bridge headslopes are avoided by use of closed abutments. 4.5H:1V embankment side slopes were found to be stable for the proposed 8 m high embankments, with suitable settlement mitigation and / or drainage measures provided to meet the end of construction stability criteria.
- **Retaining Walls:** Retaining walls are required for the proposed alternatives with closed abutments. Vertical retaining walls will run parallel to PTH 100 and be located just inside of the abutments, decreasing in height to match the retained embankment side slopes. Retaining walls for embankment side slopes are not required; they are often only required in situations where right-of-way restrictions prevent embankment fill approaching on adjacent roadways and properties. Retaining walls may be constructed of either cast-in-place reinforced concrete on piles, or MSE structures. MSE walls are typically more economical than traditional concrete retaining walls in areas of fill greater than 4 m. MSE walls, used as part of the closed abutments, will not be permitted to carry load from the superstructure due to inspection difficulties and concerns regarding long-term settlement.

- **Roadway Clearance Envelope:** The minimum vertical clearance for overpass structures is 5.4 m. The PTH 100 roadway envelope width used in the preliminary structural design consists of three 3.7 m lanes (to accommodate the Ultimate Stage), one 3.0 m exterior shoulder and one 1.5 m median shoulder. A 10.5 m horizontal clear zone is provided from edge of travelled way to substructure concrete (piers and retaining walls).
- **Span Layout:** Based on the layout of the DDI and Ultimate Stage configuration of PTH 100 below, main span lengths of not less than 34.73 m are required to span over PTH 100 with a central pier being used.
- **Girders:** Potential girder types were selected based on MI's preference and design standards for major structures, and included precast prestressed box girder (PPCBG), precast prestressed concrete NU girders and structural steel plate I-girders. Proposed girder depths are based on preliminary design calculations considering the span arrangement and the governing HSS-30 design truck load. Preliminary engineering has found the following girder types to be suitable for a 34.73 m span length, governed by the HSS-30 loading at the ULS and Service Stress Limits:
  1. **PPCBG:** 1300 mm deep (based on MI standard details given the span length), with 27-16 mm prestressing strands;
  2. **NU Girders:** 1600 mm deep, with 38-16 mm prestressing strands, based on 2700 mm maximum girder spacing; and
  3. **Steel I-Girders:** Minimum 1500 mm deep with 500 mm wide flanges, with 25 mm and 16 mm thick typical flange and web plates, respectively, based on 2700 mm maximum girder spacing.

  Girder cross-section geometry should be confirmed and further refined during detailed design.

  Based on the span length of 34.73 m, box girder options are expected to be the most economical means to support the superstructure. Steel I-girders and NU girders are generally preferred for longer span lengths.
- **Abutments:** Abutments are designed using steel reinforced cast-in-place concrete. The standard MI shelf-type abutment is proposed. Abutments are supported on piles to mitigate problems associated with long-term settlement of embankments. The use of semi-integral abutments is recommended to remove the requirement for expansion joints, which can lead to costly future maintenance.
- **Piers:** Pier bents are designed using steel reinforced cast-in-place concrete for pier caps, pier columns and pile caps. A pier bent with multiple 3000 mm wide rectangular columns with circular ends are used. A 1900 mm deep hammer head pier cap is also proposed.
- **Foundations:** Based on the results of the geotechnical investigation and assessment, driven piles are well suited for the soil and groundwater conditions at this site. Suitable pile types are driven steel H-piles, steel pipe piles, or precast concrete hexagonal piles. Driven steel HP 310 x 10 piles are recommended for the abutment and pier foundations as they are an economical option and are widely used by MI in the region. Piles shall be driven to competent till below existing ground in accordance with the geotechnical recommendations presented previously.
- **Deck:** The concrete deck thickness was assumed to be a minimum of 225 mm for slab on girder options (i.e., NU girders and steel I-girders) given the girder spacing of 2700 mm and a minimum of 200 mm for PPCBGs. A continuous superstructure with composite deck is also proposed to minimize deck joints and reduce the capital costs, as well as maintenance costs associated with them. Deck reinforcing steel should be ChromX/MMFX. A 90 mm thick asphalt wearing surface with waterproofing membrane is also provided.
- **Bearings:** The structure is designed with expansion bearings at abutments and the pier with fixed bearings. Steel reinforced elastomeric bearing pads are recommended. These bearings are preferred due to lower capital cost, strong history of performance and ease of replacement.
- **Approach Slabs:** Approach slabs are recommended to span the void that may develop below the bridge approach, and to provide a ramp for differential settlement between the abutment and the embankment. They will also

provide a better seal against water percolation and erosion of the backfill material. A transition slab is also provided behind the approach slabs, with an asphaltic plug joint for the semi-integral abutment bridge. Approach slabs are approximately 7 m in length with thickness of 300 mm.

- **Guardrail and Barriers:** TL-4 F-shape concrete barriers are provided on the structure along each outside edge of the roadway. Approach guardrail will be connected to the structure bridge barriers using a transition section of thrie-beam rail, which will then transition to W-beam guardrail with appropriate flare. The W-beam will terminate with an approved category of end treatment. An aluminum pedestrian / bicycle combination railing with concrete curb is provided on the edge of deck on the side of the bridge with the AT path.
- **Drainage:** The deck cross slope is designed for drainage to occur along the shoulders and outside of travelled ways. Runoff will flow along bridge barriers down the bridge profile towards the approaches. Using the Federal Highway Administration Design of Bridge Deck Drainage, Hydraulic Engineering Circular No. 21 (HEC_21) as a guideline for the deck drainage design, it was determined that a minimum of two deck drains per span on the low side of the deck crossfall was required. This ensures water does not encroach into travel lanes during a 1 in 20-year rain event per MI's Structures Design Manual. With the crest curve located on the bridge, the deck was conservatively considered as a flat bridge in the deck drainage calculations with a portion of the bridge profile less than the minimum 0.035% slope desired by MI. Approach drainage details should be developed at the detailed design stage in accordance with MI's Structures Design Manual.

3.3.5 CONSTRUCTABILITY / TEMPORARY WORKS

Constructability should not be an issue for the proposed structure. It will be constructed off the existing PR 200 alignment, partially in green field away from traffic and other infrastructure. Traffic staging and lane closures will likely be required for the re-aligned PTH 100, median pier construction and girder erection.

The characteristics of the structure are consistent with those of other overpass structures, which have been successfully built in Manitoba, and construction should be achievable by typical means.

Only shallow excavations are anticipated to be required for MSE wall foundations and pile caps. Excavation side slopes may be susceptible to sloughing from wetting and mechanical disturbance. The recommendations for excavations presented in the Geotechnical Report should be adhered to.

3.3.6 AESTHETICS

The design of the new structure will be a visually clean and simple concrete bridge over piled pier bent. The design will have minimal visual impact on the surrounding environment. The MSE walls will extend beyond the structure on PTH 100 and have a pattern that is visually appealing, so as not to create a visual tunneling effect.

It is anticipated that landscape and / or bridge architectural components will be incorporated into the design of the structural components. The architectural elements for the structure will be developed during the detailed design phase.

3.3.7 SCHEDULING AND FUNDING

The schedule assumes a conventional design-bid-build procurement process with detailed design to begin in Year 2021, construction commencing in September 2021 and traffic availability anticipated for December of 2023.

The planning and design tasks/phases for the Project are summarized in **Table 3-1** below.

Table 3-1. Project Timeline

Timeline	Task/Phase
March 2021	Completion of EAP report in support of an EAL for the Project. EAP submission to Manitoba Conservation and Climate anticipated for early March 2021
January – March 2021	Stage 1 public and stakeholder engagement
January – April 2021	Project team will establish the DB contractor engagement process and associated documentation
January – March 2021	Review and refine functional roadway design and preliminary structures design
April 2021 – February 2022	Stage 2 public and stakeholder engagement
April – May 2021	Completion of the Heritage Resource Impact Assessment and submission to the Historic Resources Branch for review and approval (refer to **Section 7.2.3** for additional details)
June – August 2021	Completion of supplemental ecological surveys
Jan 2021 – September 2021	Phase 2 – Procurement of DB contractor
September 2021 – March 2024	Design and construction of the Project
September 2023	Anticipated traffic availability to interchange

3.3.7.1 CONSTRUCTION AND COMMISSIONING PHASES

The new interchange structure will be constructed offline from the existing St. Mary's Road and PTH 100 at-grade intersection; therefore, it is a major benefit that the new roadway embankments and bridge structure can be constructed without interfering with existing high-volume traffic routes. Raised embankments may result in potential future settlement and down drag on the substructure foundations due to the embankment surcharge on native ground. With the new interchange construction away from existing traffic and infrastructure, surcharge from raising of the embankments may be minimized by preloading the native ground and using wick drains to hasten initial settlement prior to embankment construction. Alternatively, using lightweight fill also alleviates lateral earth pressure behind the abutment backwalls, reduces lateral forces and down drag on the piles, and reduces slope instability.

With new semi-integral perched abutments behind MSE walls, the deck longitudinal loads will be carried by the new fixed pier. The new centre pier will be constructed in the median between the westbound and eastbound PTH 100 lanes with sufficient clear zone distance to eliminate the need for pier protection. MSE walls create a closed abutment structure, reducing the number of bridge spans and piers that will require future maintenance and inspections. The superstructure will meet the required minimum 5.4 m vertical clearance. Precast concrete box girders provide sufficient span length while providing a robust superstructure against potential vehicular collisions to the deck soffit. Continuous spans reduce the number of expansion joints required on the deck structure and enhance the user rideability. Asphaltic plug joints constructed at the ends of the approach slabs will provide relief from thermal expansion and contraction of the deck. Asphaltic plug joints are more cost effective and require less future maintenance than traditional strip seal expansion joints.

The new replacement bridge structure will be designed to meet the MI 75-year service life requirement, with minimal maintenance required. Typical maintenance needs involve regularly scheduled inspection of the structure, resurfacing of and / or resealing the wearing surface, and resetting / replacement of the bearings, if required.

3.3.7.2 DECOMMISSIONING PHASE

There is no set decommission phase for the interchange at this time. Future traffic studies for the PSA will determine when the upgrade from the Interim Phase DDI to the Ultimate Phase DDI should be completed.

3.3.7.3 FUNDING

The funding for the Project will be provided by the Province of Manitoba under the Restart Manitoba program.

4 PERMITTING AND REGULATORY REQUIREMENTS

Environmental approvals / permits applicable to the project are summarized in **Table 4-1.** In addition, **Appendix D** provides details of environmental regulatory requirements that may be required for the Project.

Table 4-1. Summary of Applicable Environmental Approvals / Permits Required for Project

Statute	Regulatory Agency	Summary of Regulation	Area of Applicability	Approval / Permit Requirements
Federal Legislation				
Species at Risk Act	Environment and Climate Change Canada (ECCC)	Protects species and their residences making it an offense to kill, harm, harass, capture, collect, possess, buy, etc., an individual of a listed endangered, threatened or extirpated species, or damage or destroy its residence for species listed on Schedule 1 of the Act. The Act automatically applies on provincial / territorial lands and waters for species covered under the *Migratory Bird Convention Act* and the *Fisheries Act*. Generally, provinces and territories work in-conjunction with the federal government and the Act to protect species and critical habitat on non-federal lands.	Historical sightings of species of conservation concern have been recorded for the PSA (refer to **Section 7.1.10**).	Permits from ECCC may be required should any the handling / capture of SAR as part of future mitigation measures for the Project. This will depend on future investigations of SAR during the 2021 field investigations.
Provincial Legislation				
The Environment Act	Manitoba Conservation and Climate (MCC)	Developments that are likely to have significant effects on the environment require an Environment Act Licence (EAL) issued by the Environmental Approvals Branch of the Manitoba Ministry of Sustainable Development. Three levels or “classes” of development are defined by the Act under the *Classes of Development Regulation* that lists the type of development projects that require an EAL.	The Project is considered a Class 2 Development under the Act.	An Environment Act Licence will be required for the Project.
***The Manitoba Contaminated Sites Remediation Act* (CSRA)**	Environmental Approvals Branch, MCC	The intent of the CSRA is to protect human health and the environmental (air, land and water) resources of Manitoba. Where an unlicensed or unpermitted release of material has occurred, the CSRA requires the affected area be remediated to mitigate the risk to human health and/or the environment. Section 3.1 of the CSRA states	The Province will be purchasing private and City of Winnipeg lands and will conduct a Phase I Environmental Site Assessment (ESA) and Phase II ESA (where applicable) program to ensure due diligence.	A Phase I and II ESA program will be conducted on those properties that will be required for the Project (Refer to Section 2.2.3).

Statute	Regulatory Agency	Summary of Regulation	Area of Applicability	Approval / Permit Requirements
		that the owner or occupier of a site must notify MCC in writing when they become aware of information that indicates that the site has been contaminated at a level that exceeds a standard established or adopted by regulation; and provide MCC with all reports and any other documentation in their possession respecting the contamination at the site.		
The Heritage Resources Act, 1986	Historic Resources Branch (HRB), Sport, Culture and Heritage	Any activity that may result in the damage, alteration or destruction of a heritage property may be subject to an archaeological investigation.	The HRB has indicated that there is a high potential to impact heritage resources within the PSA (refer to **Section 7.2.4**).	Heritage Permit will be required to complete the Heritage Resources Impact Assessment for areas of the PSA identified by the HRB as potentially containing heritage resources.
The Wildlife Act	Agriculture and Resource Development, Fish and Wildlife Branch	In Manitoba, protection of wildlife and their habitat is covered under the Act, the scope of which includes the management of wildlife, wildlife research and the protection of property and persons. This is achieved through the regulating / permitting of activities.	Several species of wildlife utilize the PSA (refer to **Section 7.1.7.2**).	Authorization may be required under the Act to capture, handle or harasses wildlife as part of future mitigation measures for the Project. This will depend on future investigations of SAR during the 2021 field investigations.
Municipal - (City of Winnipeg)				
Waterway By-law (No. 5888/92)	City of Winnipeg	The Waterway By-law (No. 5888/92) identifies regulated waterway areas with the City and under the By-law it is prohibited to conduct work in regulated areas without first obtaining a Waterway Permit. The regulated area is defined as the riverbed and lands extending 350 ft. on each side from the summer water level of the Red, Assiniboine, Seine and LaSalle rivers.	This bylaw is applicable as construction is occurring within the vicinity of the Red River regulatory area.	A Waterway Permit may be required for the Project. Permit holders may also require other approvals, such as zoning variances, building permits or local district approvals prior to proceeding with the work.

5 PUBLIC AND STAKEHOLDER ENGAGEMENT PROGRAM

5.1 OVERVIEW

For the SPHDS, a comprehensive public and stakeholder engagement program (PEP) was undertaken to both inform the public and stakeholders about the design study and to obtain feedback on design options and the Ultimate functional design. After the final phase of public engagement was completed for the SPHDS, the Province of Manitoba decided to pursue a staged development of the DDI. The delivery of the staged DDI includes an interim design, which has not yet been subject to public or stakeholder review and input. Although stakeholders and members of the public have not yet seen the interim design, there remains much commonality between the Ultimate and Interim Interchange concepts and the likely concerns and impacts they would create for the public and stakeholders. To address outstanding public and stakeholder concerns, further engagement will be undertaken for the current Project. A summary of the findings of the SPHDS PEP program are provided in **Section 5.2,** and an outline of future PEP for the PTH 100 and PR 200 interchange project are provided in **Section 5.3.**

5.2 SUMMARY OF PEP ACTIVITIES AND FINDINGS FROM SPHDS

The development of the PEP was based on the International Association of Public Participation's (IAP2) public participation spectrum. The PEP also provided an outline of the public engagement objectives and the methodology for engaging with landowners, stakeholders, and members of the general public. To introduce the study and collect feedback early in the process, landowners, stakeholders, and the public were engaged in-person and online.

The goal of the SPHDS PEP was to provide study information to the public, allow the public to provide input / voice their concerns and collect feedback throughout the study to:

- Help identify landowner, stakeholder and public concerns related to the project;
- Aid in selection of roadway and structures alignment options;
- Ensure the PTH 100 Projects compliments development in surrounding communities/RMs; and
- Identify property requirements.

The following summarizes the feedback received on the Ultimate Design for the SPHDS, and it is anticipated that the great majority remains relevant to the Interim Interchange now progressing to construction.

- In general, many of the public and stakeholders who participated in the engagement process were supportive of the interchange design and expressed satisfaction that the Government of Manitoba identified improvements to PTH 100 and PR 200 as a priority.
- The concerns raised were primarily related to noise, the land acquisition process, access to property, the impact the recommended design will have on the operation of existing businesses / organizations in the area, impacted property values, and how the proposed (future) designs will limit / constrain the use / investment of property over an uncertain future time period.

The following bullet points are some of the general comments and follow-up responses from the final phase of public engagement for the SPHDS:

- Expected more information regarding construction phasing and timing of future improvements / priorities. The project team responded by explaining that the detailed design and estimated costing needed to be determined first before the Government assessed timing or priorities.
- Many members of the public and directly impacted landowners expressed concern with the additional noise PTH 100 will generate once it is built out, particularly the noise impacts on their adjacent homes. The project team explained that a noise study was completed, and that the team is now considering where mitigation efforts will be directed to address noise issues on existing urban neighbourhoods.
- It was noted that many members of the public and stakeholders would like to see more AT connections and crossings implemented into the study's overall design. It was communicated to the public that the Province will provide for crossings of PTH 100 at a variety of locations. However, AT trails are a municipal responsibility and it will be up to individual municipalities to develop trails to make use of available crossings or routes that run parallel to PTH 100.
- A number of stakeholders expressed interest in the evaluation criteria and noted that they would like to see in more detail how each design option was weighted and evaluated based on the criteria than what was presented at the stakeholder meetings and Open House events. It was communicated that the evaluation criteria will be explained in more detail once the study's final report is public, which will be available for the public to view through MI.

Additional information regarding the results of the PEP can be found in the SPHDS report.

5.3 PLANNED PEP FOR PTH 100 & PR 200 INTERCHANGE

The PEP being undertaken for the PTH 100 and PR 200 interchange project will involve the techniques, events and communication channels outlined in **Table 5-1**. The goal of the PTH 100 and PR 200 interchange project PEP is to:

- Convey clear information on the Project, its scope, and timing;
- Inform the public on the design elements of the project (roadway, AT infrastructure, noise mitigation strategies) and the phasing and timing of construction; and
- Consult with stakeholders to identify any potential issues and concerns and provide solutions or feedback for the project team's consideration.

The Phases outlined in Table 5-1 relate to the Phase numbers for the overall Project. There is no PEP planned for Phase 2 of the overall Project.

Table 5-1. Public Engagement Program

PHASE 1: PROJECT PREPARATION (REFINING THE FUNCTIONAL ROADWAY DESIGN AND PRELIMINARY		
Engagement Activities	**Events / Meetings**	**Communication**
Phase 1: Stage 1		
Stakeholder Meetings – Anticipated three stakeholder meetings to be held with: 1. City of Winnipeg departments (including Local Area Councillor); 2. Emergency services, utilities, and transportation; and 3. Active transportation/trails, commerce, and environmental interest groups. – The purpose of these meetings is to communicate: 1. Project scope and timing; 2. The Interim interchange design; and 3. How stakeholder feedback from the SPHDS was incorporated. – Each meeting will ask stakeholders for general feedback as well as for specific feedback regarding aspects of the project related to their interests/knowledge which may influence the design.	– Three group stakeholder meetings to be held virtually	– Direct emails to Stakeholder representations – Follow up phone calls as required
Engagement Activities	**Events / Meetings**	**Communication**
Phase 1: Stage 2		
Stakeholder Meetings – Review outcome of Stage 1 Stakeholder Meetings and determine whether stakeholder meetings are required. – Stakeholder groups who raised significant concerns which the refined design could not address will be invited to attend a meeting – The purpose of the meetings are to communicate: 1. The refined design; 2. Any accommodations/revisions to the design to help reduce their concerns (if applicable); and, 3. Rationale for why accommodations/revisions to the design could not be made to address existing concerns. (if applicable)	– Stakeholder meetings to be held virtually	– Direct emails to Stakeholder representations – Follow up phone calls as required

Engagement Activities	Events / Meetings	Communication
MI to Host Landowner Engagement		– MI to communicate directly with landowners
Online Engagement – The project webpage will be updated with project updates and upcoming milestones. This will include: 1. Content for the "News Feed" tab 2. MI approved drawings/designs 3. MI approved reports – The project timeline and FAQ's will be reviewed, and updates provided as required. – Social media posts on the Manitoba Government Facebook page and Twitter account (@MBGov) will provide high-level project updates and direct people to the project webpage for more information.		– Direct email to SPHDS email list: 1. Share major milestones and project updates – Project webpage updates as major milestones occur – Social media posts directing the public to the project webpage – A public questionnaire will be posted on the project webpage providing an opportunity for members of the public to comment on the interim design
PHASE 3: DESIGN AND CONSTRUCTION OF PROJECT Goal: Assist MI with stakeholder engagement		
Stakeholder Liaison – MI to address any on-going stakeholder concerns.	– Stakeholder meetings to be held virtually as required	– MI to communicate directly with stakeholders

5.4 INDIGENOUS CONSULTATION

In summer 2020, MI contracted an independent party to establish whether Indigenous rights are impacted by the Project. The report prepared by the independent party identified that there were no concerns or conflicts with treaty or Indigenous rights. The report states that consultation with Indigenous groups is not required however, recommends that written notification is submitted to the Manitoba Metis Federation (MMF) advising of the Project.

6 ENVIRONMENTAL IMPACT ASSESSMENT SCOPE AND METHODS

6.1 METHODOLOGY

In support of the Project, a desktop review of available biophysical and socio-economic information was completed in May to June of 2018 as part of the SPHDS with a review and update to the information specific to the current PSA completed in January and February 2021. The desktop review entailed a review and update in January-February 2021 of the biophysical and socioeconomic information complied for the SPHDS EIA, specific to the current Project. This included a review of:

- Applicable federal and provincial government databases (e.g., Federal Species at Risk Public Registry);
- Publicly accessible websites (e.g., Environment Canada historical weather data);
- Mapping resources (e.g., Natural Areas of Winnipeg interactive map);
- Environmental reports (e.g., Habitat Grade reports from the City of Winnipeg Naturalist Services Branch); and
- Information requests from provincial and federal database managers / specialists (e.g., Manitoba Historic Resources Branch for archaeological sites, Manitoba Conservation Data Center for species of conservation concern, Manitoba Wildlife Branch for bat and bird data, etc.).

During the SPHDS, ecological field studies were complete to supplement information collected during the desktop review. Where applicable to this Project, information collected from the field surveys has been included in this EAP report. A summary of field survey methodologies is provided in **Appendix E**.

A supplemental site visit was conducted in February 2021 at 2433 St. Mary's Road to identify any potential evidence of bird nesting or bat roosting within the on-site buildings and the natural areas to the north and south.

6.2 SUPPORTING INVESTIGATION

A Phase I and II ESA program is being completed in March to April 2021 for the properties that are to be acquired by MI for the Project as per requirements under the *Contaminated Sites and Remediation Act*. The Phase I and II ESA reports will be provided to MI separately from this EAP report. Applicable health and safety measures and remediation of any identified contaminated areas will be completed as required under the *Contaminated Sites and Remediation Act*.

6.3 SCOPE OF THE ASSESSMENT

The scope of the assessment for the EAP report considered the potential interaction of environmental and project components that could occur within the PSA during the construction and operation of the Project. Factors considered in the assessment included:

Biophysical:

- Air quality, including greenhouse gases;
- Geology and soils;
- Groundwater and surface water resources;
- Terrestrial vegetation and wildlife;
- Aquatic environment;
- Species of conservation concern; and

Socio-economic:

- Existing public safety and health;
- Parks and open spaces;
- Heritage resources;
- Indigenous and Metis communities;
- Population and economics; and
- Wildlife road ecology.

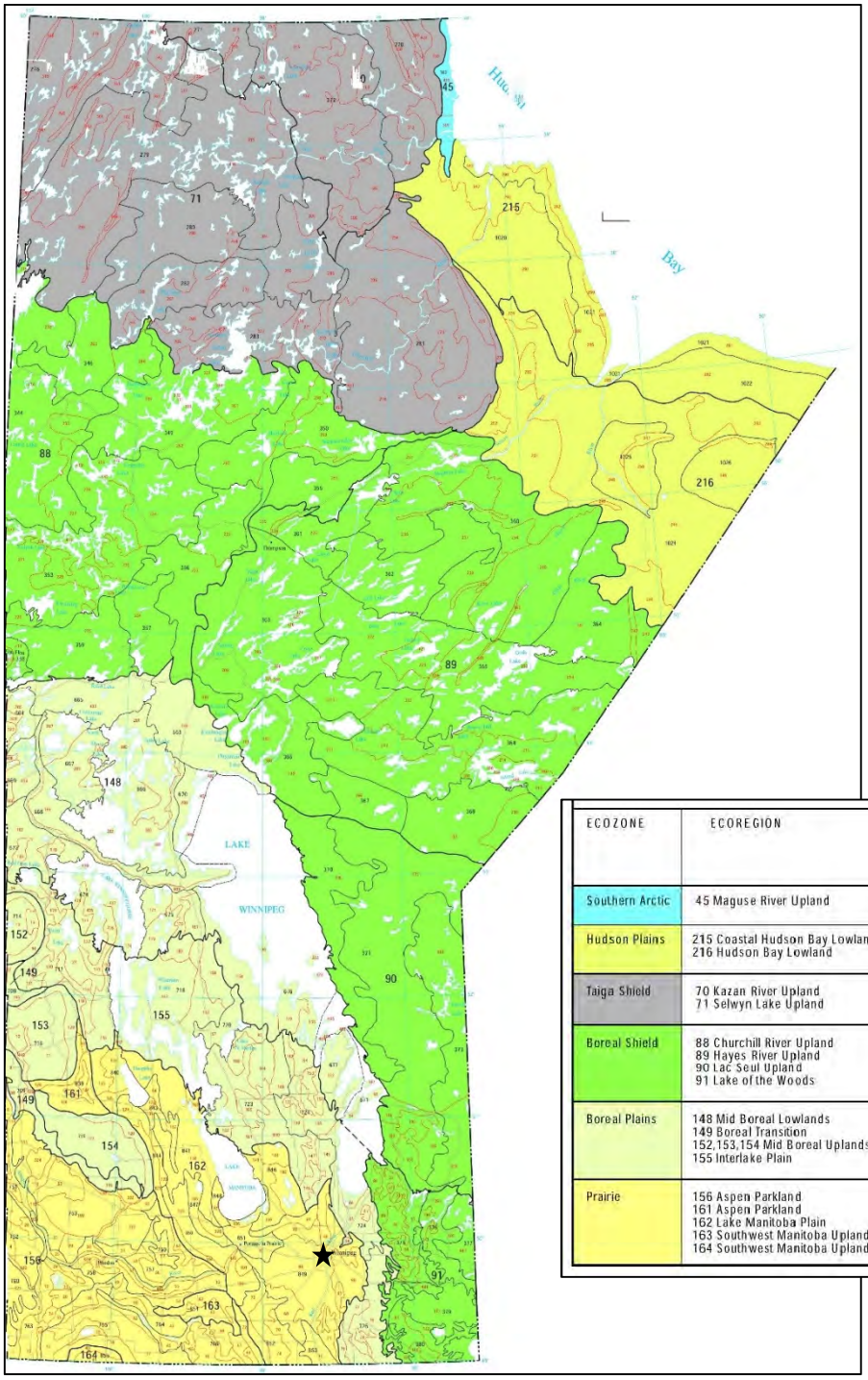
7 DESCRIPTION OF EXISTING ENVIRONMENT IN THE PROJECT STUDY AREA

7.1 BIOPHYSICAL ENVIRONMENT

7.1.1 ECOLOGICAL CLASSIFICATION

The PSA is located within the Winnipeg Ecodistrict of the Lake Manitoba Plains Ecoregion, which is covered by the broader Prairie Ecozone. The Winnipeg Ecodistrict is dominated by a cool to cold, subhumid to humid moisture conditions and is located within the southern portion of the Grassland Transition Ecoclimatic Region (Smith et al., 1988) (refer to **Figure 9**). The general geology within the Lake Manitoba Plains Ecoregion includes Paleozoic limestone bedrock which is overlain by glacial tills and Lake Agassiz deposited silts and clays. The soils in the area are developed on glaciolacustrine sediments and are primarily imperfectly drained Gleyed Humic Vertisols and Gleyed Vertic Black Chernozems (Smith et al., 1988).

Tall grass prairie and meadow prairie vegetation originally found within the Winnipeg Ecodistrict has largely been replaced due to agricultural activities, altered drainage patterns and urban development. Tree cover was historically minimal in the Ecodistrict but continues to be found primarily along stream channels and in pockets further away from channels where sites are better drained. These improved drainage sites often include tree species such as bur oak and trembling aspen and understory species of snowberry, hazelnut and red-osier dogwood (Smith et al., 1988).



ECOZONE	ECOREGION	ECODISTRICT
Southern Arctic	45 Maguse River Upland	183 Hubbart Point
Hudson Plains	215 Coastal Hudson Bay Lowland 216 Hudson Bay Lowland	1020 Churchill 1025 French Creek
Taiga Shield	70 Kazan River Upland 71 Selwyn Lake Upland	272 Nejanilini Lake 279 Seal River
Boreal Shield	88 Churchill River Upland 89 Hayes River Upland 90 Lac Seul Upland 91 Lake of the Woods	353 Granville Lake 363 Sipiwesk Lake 371 Wrong Lake 379 Whitemouth
Boreal Plains	148 Mid Boreal Lowlands 149 Boreal Transition 152,153,154 Mid Boreal Uplands 155 Interlake Plain	666 Cedar Lake 709 Swan River 715 Duck Mountain 723 Ashern
Prairie	156 Aspen Parkland 161 Aspen Parkland 162 Lake Manitoba Plain 163 Southwest Manitoba Uplands 164 Southwest Manitoba Uplands	758 Stockton 839 Grandview 849 Winnipeg 854 Pembina Hills 855 Turtle Mountain

Figure taken directly from: Smith et al, 1998.

Figure 9. Terrestrial Ecozones, Ecoregions and Ecodistricts of the Province of Manitoba

7.1.2 CLIMATE

Climate for the PSA can be characterized by review of the most current climate normal data (years 1981 to 2010) from the Environment Canada representative climate station located at the Winnipeg Richardson International Airport. Based on the Environment and Climate Change Canada (ECCC) climate normal data, temperatures in the PSA are below freezing between November and March. The mean daily temperature in the PSAs is approximately 3.0 degrees Celsius (°C); the coldest month from the record is January, with an average temperature of -16.4°C, while the warmest month is July, with an average temperature of 19.7°C. Mean annual precipitation (snowfall and rainfall) is approximately 521.1 mm. Snowfall accounts for approximately 22% of the precipitation total. Winds are predominantly from the south, averaging approximately 17.1 km/hr during the year (Environment and Climate Change Canada, 2020). **Table 7-1** below provides a further detailed description of climate normal for PSA.

Table 7-1. 1981 to 2010 Canadian Climate Normals Station Data[1]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE													
Daily Average (°C)	-16.4	-13.2	-5.8	4.4	11.6	17	19.7	18.8	12.7	5	-4.9	-13.2	3
Standard Deviation	4.1	4.2	3.1	2.7	2.1	2	1.4	1.9	1.3	1.8	3.6	4.4	1.2
Daily Maximum (°C)	-11.3	-8.1	-0.8	10.9	18.6	23.2	25.9	25.4	19	10.5	-0.5	-8.5	8.7
Daily Minimum (°C)	-21.4	-18.3	-10.7	-2	4.5	10.7	13.5	12.1	6.4	-0.5	-9.2	-17.8	-2.7
PRECIPITATION													
Rainfall (mm)	0.2	2.7	9.7	19.2	54.1	90	79.5	77	45.5	32.7	6.9	1.5	418.9
Snowfall (cm)	23.7	12.5	16.5	10.6	2.6	0	0	0	0.3	4.8	19.9	23	113.7
Precipitation (mm)	19.9	13.8	24.5	30	56.7	90	79.5	77	45.8	37.5	25	21.5	521.1
Average Snow Depth (cm)	16	17	10	2	0	0	0	0	0	0	4	10	5
Median Snow Depth (cm)	15	18	10	2	0	0	0	0	0	0	4	10	5

[1]Note: Data taken directly from: Environment and Climate Change Canada (2020).

7.1.3 AIR QUALITY AND GREENHOUSE GASES

AIR QUALITY

In Manitoba, air quality concerns are generally localized in nature, and typically relate to odour, noise and air pollution. Air quality in Winnipeg is generally considered to be excellent compared to other Canadian cities of similar size (Manitoba Conservation and Climate, n.d). Air quality in Winnipeg is monitored hourly at two stations by MCC as part of the National Air Pollution Surveillance (NAPS) Program. Maximum time-based pollutant levels for the protection and preservation of ambient air quality in Manitoba, including carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter ≤ 2.5 microns [PM2.5]), ground level ozone (O_3), nitrogen oxides (NO_x), wind direction, and wind speed are each measured and then converted to an indexed scale. The highest measured pollutant value of the five becomes the overall value of the reported Air Quality Index (AQI). This information is then used to inform the public of any current air quality concerns (Manitoba Conservation and Climate, n.d.).

Historical and current data for these measured parameters can be obtained online at the Government of Manitoba air quality website (Manitoba Conservation and Climate, n.d.). Measured air quality parameters are compared to guidelines, established criterion or Canada-wide Standards. **Table 7-2** provides a five-year summary of the average air quality recorded at the Scotia Street station in Winnipeg. None of the yearly average air quality parameters measured at the Scotia Street station (nearest air quality monitoring station to the PSA currently with available data) exceeded guidelines for the period of 2015 to 2020. Air quality parameters within the PSA are expected to be similar to that observed at the Scotia Street station.

Table 7-2. Ambient Air Quality Data from 2015 to 2020from the Scotia Street Station, Winnipeg

Pollutant	Year	Annual Mean (24 hour average)	Maximum Data Value (24 hour average)
Carbon Monoxide (CO) ppm	2015	0.186	0.574
MDL Guideline = 15	2016	0.149	2.47
MAL Guideline = 15	2017	0.003	0.029
MTL Guideline = 20	2018	0.1	2.295
	2019	-0.09	0
	2020	-	-
Nitrogen Dioxide (NO_2) ppb	2015	5.2	16.3
MDL Guideline = no guideline (-)	2016	5.1	25.5
MAL Guideline = 200,000	2017	1.6	15.6
MTL Guideline = -	2018	3.4	16.1
	2019	-6.9	-0.6
	2020	-1.1	-0.2
Nitric Oxide (NO) ppb	2015	1.7	33.2
No guidelines	2016	9.4	36.3
	2017	5.5	23.2
	2018	8.5	50.1
	2019	21.2	-
	2020	0.8	15.2
Nitrogen Oxides (NOx) ppb	2015	6.8	49.6
No guidelines	2016	14.6	61.8
	2017	7.3	35.8
	2018	12.1	59.8
	2019	14.2	-
	2020	-0.4	9.3
Oxidants Ozone (O_3) ppb	2015	19.4	49.6
No guidelines	2016	14.9	34.9

Pollutant	Year	Annual Mean (24 hour average)	Maximum Data Value (24 hour average)
	2017	11	24.4
	2018	22.2	33.2
	2019	-	-
	2020	-	-
Inhalable Particulate (PM2.5) ug/m^3	2015	5.4	51.1
No guidelines	2016	9.7	90.3
	2017	3.9	19.5
Inhalable Particulate (PM2.5) ug/m^3	2018	4.8	76.7
	2019	5.2	97.3
	2020	5.9	28

Source: Data is from the Manitoba Conservation and Climate, Air Quality Monitoring website (n.d.).

MDL = Maximum Desirable Level – "which defines the long-term goal for air quality and provides a basis for an anti-degradation policy for the pristine areas of Manitoba and for the continuing development of control technology".

MAL = Maximum Acceptable Level – "which is deemed essential to provide adequate protection for soils, water, vegetation, materials, animals, visibility, personal comfort and well-being".

MTL = Maximum Tolerable Level – "which denotes a time-based concentration of air contaminant beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population".

GREENHOUSE GASES

Generally, the most prevalent transportation GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Carbon dioxide, along with water vapour is the main combustion product of common transportation fuels and carbon dioxide is the most abundant anthropogenic GHG. Light duty vehicles and trucks and heavy-duty vehicles contribute to the major of transport-related emissions in Canada. Although the number of kilometres drives per vehicle has dropped since 2005, an increase in the total vehicle fleet has increased by 40% resulting in more kilometres driven overall. A comparison of total provincial GHG production (megatonnes of carbon dioxide equivalent [Mt CO_2 eq]) over the span of 2005-2018 shows that Manitoba has had an overall increase in of 1.7 Mt or 8.3 percent change (Environment and Climate Change Canada, 2020).

A study commissioned by the City entitled *Winnipeg's 2011 Community Greenhouse Gas Inventory and Forecast* (Golder Associates, 2015) summarized the City's GHG emissions as of 2011 (refer to **Figure 10**). According to the study, volumes of CO_2 equivalent per person per year for major Canadian municipalities showed a range of 4.8 to 13.5 tonnes with Winnipeg at the lower end of the range at 7.8 tonnes (Golder Associates, 2015).

Table 4: Summary of GHG Emissions

Activity	Annual Emission Rate (tonne CO_2e/year)				GHG Intensity (tonne CO_2e per capita)	Percent of Total
	CO_2	CH_4	N_2O	Total GHGs		
Building Electricity	18,284	0	0	18,284	0.03	0.3%
Building Natural Gas	1,790,048	1,073	9,906	1,801,027	2.60	33.5%
Transit	43,044	57	395	43,495	0.06	0.8%
Vehicles-Residential	1,689,442	2,434	33,241	1,725,116	2.49	32.1%
Vehicles-Commercial	938,779	338	6,525	945,642	1.37	17.6%
Waste Disposal	—	798,801	—	798,801	1.15	14.9%
Water and Waste Water	4,922	33,620	8,117	46,659	0.07	0.9%
Total	**4,484,518**	**836,322**	**58,184**	**5,379,024**	**7.78**	**100%**

Figure taken from: *Winnipeg's 2011 Community Greenhouse Gas Inventory and Forecast* (Golder Associates, 2015).

Figure 10. 2011 Calculated GHG Emissions for the City of Winnipeg

Although vehicular traffic use of the PTH 100 and PR 200 intersection areas is a source of local GHG emissions, construction of the PTH 100 and PR 200 interchange will ultimately provide a more through flow of traffic with less "stop and go" vehicle idling times. This, combined with the use of new technologies (increase in hybrid and electric vehicles) fuel efficiencies of vehicles and new government policies such as tailpipe emission standards, will likely result in a stabilization or even a reduction of GHG emissions over time.

An analysis of vehicular traffic numbers and CO emissions as a representation for GHGs was produced for the years 2021 and 2038 as outlined in **Table 7-3**. Syncro traffic analysis software was utilized to assess current traffic volumes and CO emission conditions for the existing signalized intersection at PTH 100 and PR 200. Syncro software is a tool developed for analysis of traffic flow, traffic signal progression, and optimization of traffic signal timing and to analyze arterials, signalized intersections, and unsignalized intersections (Virginia Department of Transportation, 2013). Sidra traffic analysis software was utilized to assess the projection year of 2038 for the interchange roundabouts flow. The primary application for Sidra software has been specifically for roundabout operations (Virginia Department of Transportation, 2013). While direct comparison of traffic volumes and CO emissions is not feasible (based on use of two analysis systems) the trend appears to indicate that with less stop and go traffic associated with the interchange roundabouts, CO emissions (and potentially other GHGs) may be reduced in the future.

Table 7-3. Traffic Volumes and CO Emissions Analysis for 2021 and 2038

Parameter	Existing PTH 100 / PR 200 Intersection Year 2021 (Syncro Analysis)*		DDI Interchange Roundabout Analysis Year 2038 (Sidra Analysis)**	
	AM	PM	AM	PM
Number of Vehicles / hr	1088	1609	2741	4467
CO Emissions (kg/hr)	1.61	3.45	0.63	1.00

Notes:

* Syncro traffic analysis software was utilized to analyze traffic volumes and CO emissions for the PTH 100 / PR 200 intersection.

** Sidra traffic analysis software was utilized to analyze traffic volumes and CO emissions for the future interchange roundabouts. Data is based on intersection movement for through traffic on PR 200 (St. Mary's) including eastbound, westbound, northbound and southbound right and left turns.

7.1.4 SOILS AND TERRAIN

Soils and terrain associated with the PSA include the following:

Red River Series

The Red River series comprises most of the soils within the PSA. Soils in the Red River series are characterized by imperfectly drained Gleyed Rego Black Chernozem soils that have developed on moderately to strongly calcareous, uniform, deep, clay lacustrine deposits (Manitoba Agriculture, Food and Rural Initiatives, 2010). Permeability in these soils is slow and they exhibit slow to moderate surface run off and a medium water table during the growing season. The soils are found in level areas and on the level position of very gentle slopes (Manitoba Agriculture, Food and Rural Initiatives, 2010).

Osborne Series

Osborne soils consist of poorly drained Rego Humic Gleysol soils that have developed on clayey lacustrine deposits that are moderately to strongly calcareous, uniform and deep. These soils are found in lower/depressional areas of the landscape and have very slow permeability and slow to very slow surface runoff (Manitoba Agriculture, Food and Rural Initiatives, 2010). These soils have low stoniness, are non-eroded and may be saline. Most of these soils are used for crop production as they have a high available water holding capacity, medium organic matter content, and medium natural fertility, however they often have a high-water table during the growing season which requires improved surface drainage for agricultural production. Native vegetation associated with Osborne soils often includes meadow grasses, reeds, sedges and willow (Manitoba Agriculture, Food and Rural Initiatives, 2010)

Agricultural Capability

Canadian Land Inventory (CLI) Soil Capability Classification for agricultural ratings is a dryland agricultural capability inventory for rural landscapes of Canada. Soils in the PSA are primarily classified as CLI Class 2 in association with the dominant soil type, the Red River series (refer to **Map 3**, **Appendix A**) (CLI, 2013). Soils with a Class 2 dryland agricultural capability designation have moderate limitations in terms of the type of crops that can be grown and do require the use of some soil conservation management and cropping practices. Class 2 soils typically have a moderate to high productivity for a wide range of crops (CLI, 2013). The Osborne Series is classified as a CLI Class 1 soil which is defined as a soil that has no significant limitations in use for crops (CLI, 2013).

Where the project footprint is not deviating from the existing RoW, the soils are considered to be previously, mechanically disturbed and as such are not catalogued as a pedological entity. Where the project footprint does deviate from the existing RoW for the development of the interchange, interchange ramps and re-alignment of PR 200 and service roads south of existing intersection, classified soils utilized for agricultural production will be affected. It is anticipated that 30.81 ha of agricultural land (soil) will be impacted by the project footprint (within the new MI property boundaries which includes new RoW (refer to **Drawing Sheets** located in **Appendix B)**.

TERRAIN

There are no major landforms (e.g., valleys, coulees, hills, eskers, etc.) within the PSA or associated with the project footprint. Topography of the PSA is level to gently sloping towards the Red River. Minor landforms found within the PSA include drainage ditches and wetland depressions.

Anthropogenic landforms within the PSA are related to the embankments of the existing PTH 100 roadway and its structures.

7.1.5 SURFICIAL AND BEDROCK GEOLOGY

Surficial geology of the PSA consists primarily of offshore glaciolacustrine surficial deposits. These deposits consist of clays, silts and minor sand and are often between one and 20 m thick. These sediments were deposited while in suspension in glacial Lake Agassiz in deep water and scouring of, and homogenization due to icebergs often occurred. In areas adjacent to the Red River, alluvial sediments are more common and consist of sand, gravel, silt, clay and detritus of organic nature. They are reworked within the existing rivers and deposited as bars. These deposits can also be between one and 20 m in thickness (Matile and Keller, 2004).

In support of the Project, a limited geotechnical investigation was completed by KGS in 2019 to characterize the general existing geotechnical conditions along PTH 100 at the PR 200 grade separations. Note that future detailed geotechnical investigations will be required as part of future detailed project design and information provided is based on the limited investigation. It can be anticipated that the clay thicknesses will vary from 12 m± to 15 m±, with the underlying glacial till being from 6 m± to 9 m± thick overlying limestone bedrock at depths ranging from 15 m± to 20 m± (KGS, 2019). For additional details refer to **Section 2.3**.

7.1.6 GROUNDWATER AND HYDROLOGY

The Winnipeg area is underlain by an extensive, confined carbonate rock aquifer known as the Upper Carbonate aquifer that is located within the top 15 to 30 m (50 to 100 feet) of the Paleozoic limestones and dolomites. This aquifer is continuous over its extent and is formed by thick and extensive carbonate rock beds with minor shale beds. Transmissibility of this aquifer ranges from 24.8 and 2,480 cubic metres per metre per day (m^3/m/day) (under 2,000 to over 20,000 gallons/foot/day [gal/ft/day]). Wells used for domestic purposes within this aquifer bed generally yield more than 1.0 litres per second (L/s). Water quality ranges from good to very salty but is good to fair in most of the aerial extent of this aquifer (Render, 1970; Rutulis and Mamott, 1986). A smaller, minor aquifer known as the Lower Carbonate aquifer occurs within the bottom 7.5 to 15 m of the Red River Formation. Permeability of this aquifer is much lower than that of the Upper Carbonate aquifer and ranges from less than 62 m^3/m/day (5000 gal/ft/day). (Render, 1970; Rutulis and Mamott, 1986).

Within the PSA, four piezometers were installed, three in the overburden clay and one in the till. One 3 m long slotted standpipe was installed with bedrock. Monitoring occurred between installation (June 2019) and January 2020. Groundwater was measured at a depth of 2.3 to 6.0 m± in the clay (Elev. 225.0 to 228.7 m±), 3.5 to 6.2 m± in the till (Elev. 224.8 to 227.5 m±) and 5.7 to 6.3 m± in the bedrock (Elev. 225.0 to 225.6 m±). The limited groundwater monitoring data suggests that there is a slight downward hydraulic gradient in the upper clay and a slight upward gradient from the clay till into the lower clay (KGS Group, 2019). For more details refer to **Section 2.3.3**.

During site visits completed at 2433 St. Mary's Road and 2969 St. Mary's Road in support of the Phase I and II ESA program, two groundwater wells were reported, one at each property.

7.1.7 TERRESTRIAL ENVIRONMENT

7.1.7.1 VEGETATION COVER AND NATURAL AREA QUALITY

NATURAL AREAS

As part of the City's Ecologically Significant Natural Lands Strategy, the Naturalist Services Branch (NSB) has completed inventories on both City-owned and private properties (with landowner permission) of natural areas within the City. This information has been utilized to grade the quality of habitat in these areas based on a method known as

the Preliminary Habitat Assessment / Evaluation of Natural Areas. Developed in the 1980s, this grading method is currently in use by the Manitoba Conservation Data Centre (MB CDC) and City's NSB, and allows a surveyor to rate characteristics of the natural habitat and to ultimately assign a habitat grade of "A," "B," "C," or "D," with "A" being the highest and "D" being the lowest grade for natural habitat. This grading system uses seven basic categories for natural habitat types within the City, including: River bottom Forest, Grassland / Prairie, Aspen Forest, Oak Forest, Wetland, Stream and Pond. Natural areas are graded in terms of habitat type and quality, as well as scarcity. Sites that receive grades of "B" or higher are considered to be good quality sites and are the focus of consideration for preservation (City of Winnipeg, 2020).

There are nine natural areas located within the PSA that have been identified by the City of Winnipeg NSB as outlined in **Table 7-4**. Natural area #395 will be entirely removed during the construction phase of the Project to allow for re-alignment of PR 200 and the construction of the ramps. Natural area #544 will have the easternmost sections of aspen and oak forest removed, again, to allow for the re-alignment of PR 200. The other natural areas identified within the PSA are not anticipated to be affected by the Project (**refer to Map 4, Appendix A**). The NSB reports for these natural areas are provided in **Appendix F**.

Table 7-4. Summary of City of Winnipeg Natural Area Habitat Grade within the PSA

Site ID #	Site Name	Area (ha)	Habitat Grade	Vegetation Type at Site (0=no; 1=yes)				
				Aspen	Oak	Prairie	Wetland	River bottom
395	St. Norbert 7	5.1	B	0	1	0	1	0
410	Maple Grove Park 1	9.4	C	0	1	0	0	1
410	Maple Grove Park 2	2.7	C/D	0	1	0	0	1
410	Maple Grove Park 3	0.7	B/C	0	1	0	0	1
411	Normand Park	4.2	C	0	0	0	0	1
544	St. Norbert 10	17.5	A/B	1	1	1	0	1
954	Maple Grove Park Woods	2.6	C	0	0	0	0	1
955	Maple Grove Park Grassland	11.6	D	0	0	1	0	0
956	Maple Grove Park Fence row	3.9	C	0	0	0	0	1
957	Maple Grove Park Oak	1.0	B	0	1	0	0	0
1062	Christie Rd	3.4	B	0	0	0	1	1
1093	Dairy Farm Creek	0.6	C	0	0	0	0	1
	TOTAL AREA	**62.7**						

Note: Data obtained from the City of Winnipeg.

TERRESTRIAL VEGETATION

During ecological surveys completed for the SPHDS, vegetated ditches within the existing PTH 100 ROW were found to be dominated by smooth brome and Kentucky bluegrass (*Poa pratensis*). Portions of the RoW that were wetter consisted of cattail (*Typha* sp.) and other common wetland indicator species. Commonly observed native plants included Indian hemp (*Apocynum cannabinum*), American vetch (*Vicia americana*) and prickly rose (*Rosa acicularis*).

Weed species were prevalent throughout the right-of-way and natural areas, and included Canada thistle (*Cirsium arvense*), sow-thistle (*Sonchus* sp.) and dandelion (*Taraxacum officinale*).

A vegetation survey waypoint was located at the eastern most edge of the oak / aspen forest natural area #544 to the south of the existing intersection in 2018 in support of the SPHDS. Dominant tree species identified included bur oak (*Quercus macrocarpa*), trembling aspen (Populus tremuloides) and green ash (*Fraxinus pennsylvanica*), shrubs included saskatoon (*Amelanchier alnifolia*), American hazelnut (*Corylus Americana*) and poison ivy (*Toxicodendron rydbergii*) while ground cover was dominated by bedstraw species and two-leaved false Solomon's-seal (*Maianthemum dilatatum*).

As part of a reconnaissance level site visit to the historic dairy farm at 2433 St. Mary's Road, a limited pedestrian survey was conducted within the natural area #395 to the north and south of the historic dairy farm site. The northern property consisted of a drainage swale and was dominated by American elm (*Ulmus Americana*) and Manitoba maple (*Acer negundo*), while the larger, southern site was dominated by bur oak and trembling aspen in certain locations. Other tree species included Manitoba maple and eastern cottonwoods (*Populus deltoids*) as well as spruce trees (*Picea* spp.) along the St. Mary's Road RoW, the Manitoba Hydro property boundary and adjacent to the farmhouse on the property. Understory species were sparse, and ground cover was not observed due to snow covered conditions.

WETLANDS

Within natural area #395, there were two sections identified as wetland areas with a total area of 0.40 ha in size (refer to **Map 4, Appendix A**). During the site visit, they were observed to be dominated by wetland grasses and contained snags and stumps with some areas of shrubs. It is anticipated that these two wetland sites would be classified as Class I or Class II using the Stewart and Kantrud (1971) Classification of Wetlands methodology. Class 1 wetlands are considered ephemeral with water retention lasting on average for one week or less. Agricultural cultivation and seeding of these wetlands often occur during dry and normal moisture years. Vegetation associated with Class 1 wetlands include low prairie species such as Kentucky bluegrass, goldenrod species and various forbs. Class 2 wetlands are temporary wetlands with water retention lasting on average one week to one month and will often hold water for several days after a heavy rainfall. Agricultural cultivation and seeding of these wetlands often occur during dry and normal moisture years. Vegetation species such as grasses, sedges and forbs are often associated with this class of wetland (Manitoba Conservation and Climate, n.d. [3]).

7.1.7.2 WILDLIFE AND WILDLIFE HABITAT

MAMMALS

Common mammalian species that may be found in the PSA include white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), coyote (*Canis latrans*), grey squirrel (*Sciurus carolinensis*) and red squirrel (*Tamiasciurus hudsonicus*), white-tailed jackrabbit (*Lepus townsendii*), as well as a variety of voles and mice (Smith et al., 1998).

Wildlife surveys for specific mammal species were not conducted during the SPHDS; however, during the site visit conducted on February 11, 2021, numerous deer trails, scat, scrapes and beds were observed traversing the property at 2433 St. Mary's Road. Well packed deer trails travelled in all directions within the oak forest south of the farm property, and there were significant bedding areas observed in the swale to the north. Two individuals were observed in the southern location. Other mammal species observed during the site visit included eastern cottontail and multiple grey and red squirrel individuals, nests and middens.

White-tailed Deer

Winnipeg has a large urban deer population that are prone to moving in and out of the City via corridors often associated with Winnipeg's river systems. An aerial survey of the white-tailed deer population in and around the City was conducted in 2006 by Manitoba Conservation and Water Stewardship. A total of 1,788 deer were observed, including 1,166 deer inside the Perimeter Highway and 622 deer observed in close proximity to the City (Hagglund, 2006). This equates to a density of approximately 55 deer per km^2. A study completed by McCance (2014) on deer within the southwest area of the City indicates that the length of movement of radio-collared deer across roads and trails was equal to or greater than the length of movement across agricultural, cultural, deciduous forest, forage crops, grassland, open deciduous forest and water. This suggests that deer may move further to cross less desirable features (such as roads) and showing shorter movements (perhaps spending more time) in the natural and semi-natural areas within and around the City. In addition, vehicle-deer collisions data received from Manitoba Public Insurance indicates that a large number of deer are crossing PTH 100 and PR 200 (refer to **Section 7.2.1.1** for additional details on vehicle-deer collisions).

Bats

Manitoba is home to six bat species, silver-haired bat (***Lasionycteris noctivagans***), red bat (***Lasiurus borealis***), hoary bat (***Lasiurus cinereus***), big brown bat (***Eptesicus fuscus***), northern myotis (***Myotis septentrionalis***) and little brown myotis (***Myotis lucifugus***). The silver-haired, red and hoary bats are migratory whereas the big brown, northern myotis and little brown myotis bats are non-migratory (and during the fall travel to limestone caves on the western side of Lake Winnipeg to hibernate (Vonhof, 2006). Throughout Manitoba, bats are most commonly observed flying from dusk to dawn in clearing and by rivers and lakes between May and the beginning of August. Several species of bats may utilize abandoned buildings and large trees with shaggy, peeling bark or cavities as roosting habitats during the day. Little brown myotis is listed as threatened under Manitoba's ESEA and endangered under SARA and Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2013). Personal communications with Mr. Brian Kiss, Habitat Mitigation Biologist with the Wildlife and Fisheries Branch of Manitoba Conservation and Climate (via email on June 8, 2018) and with Dr. Craig Willis, Professor of Biology with the University of Winnipeg (via email on October 29, 2018) were conducted during the SPHDS and responses indicated that no surveys/data has been collected for the presence of bat species in and around the City within the PSA. In addition, the MB CDC has no recorded observations for bat species within the PSA. In addition, during the vegetation and amphibian field surveys, no bats or bat roosting sites were observed.

During a reconnaissance survey of the oak forest and historic dairy farm located at 2433 St. Mary's Road within the project footprint on February 11, 2021, old farm buildings were not fully accessible. It is anticipated that given the cupolas and vents on the roof of the old barns, the decaying siding allowing entrance to the wall cavities and ajar windows and vents as well as the proximity of the property to the Red River, bat species may use these locations as roost and nursery locations during the summer months.

BIRDS

The Manitoba Breeding Bird Atlas, Square 14PA31 in Region 3: Red River Valley encompasses the PSA. There are four pre-defined point count locations within the PSA and the PSA is classified primarily as urban/unclassified. A review of the summary for square 14PA31 identified 96 bird species reported with the most commonly reported species consisting of Canada goose (***Branta canadensis***), merlin (***Falco columbarius***), killdeer (***Charadrius vociferous***), ring-billed gull (***Larus delawarensis***), American crow (***Corvus albus***), barn swallow (***Hirundo rustica***), yellow warbler (***Setophaga petechia)***, chipping sparrow (***Spizella passerine)***, common yellowthroat (***Geothlypis trichas***) and house sparrow (***Passer domesticus***), among others. A copy of the bird species list is for square 14PA31 is provided in **Appendix G**.

During a site visit conducted on February 11, 2021, of the historic dairy farm located at 2433 St. Mary's Road, four barn swallow nests and one remnant nest were observed on the property. The first barn swallow nest observed was on the east side of the main barn building under the eaves, a nest remnant was observed in the garage, and two nests, including one with a deceased individual inside, were located on the north side of the grain storage building.

One potential stick nest that may be indicative of a raptor species inhabiting the oak forest (north of Frobisher Road and PTH 100 on the east side of St. Mary's Road) was observed in a tree. The location was marked via GPS and the tree flagged with flagging tape to conduct a follow up site visit in the spring 2021 to assess presence of a raptor species.

HERPETOFAUNA

A review of the Manitoba Herpetology Atlas Interactive Database indicates occurrences of boreal chorus frogs (*Pseudacris maculata*), wood frog (*Lithobates sylvaticus*), northern leopard frog (*Lithobates pipiens*) and occurrences of snapping turtle (*Chelydra serpentina*) and painted turtle (*Chrysemys picta*) within or near the PSA (Nature North, 2018). Turtle species are likely to be present within the vicinity of the Red River, while frog and toad species may be found in areas of intermittent standing water such as ditches, drains and wetlands.

During the SPHDS, an auditory amphibian survey was conducted at various locations along PTH 100; however, after only one survey date, it was determined that passing traffic noise was loud enough to severely inhibit the accurate detection of amphibians. The survey was to focus on the detection of northern leopard frog; however, none were identified at the time of the survey. Additional amphibians detected during the course of the survey included boreal chorus frog and wood frog in various locations of wetland and wet ditches. It is anticipated that these two species would likely be present within the PSA.

A limited turtle survey was conducted in the vicinity of the major water bodies as part of the SPHDS; however, no turtle species were observed during the survey.

7.1.8 AQUATIC ENVIRONMENT

The Red River is located at the western end of the Project area and is located adjacent (within 60 m) to the existing St Mary's Road in the northern end of the Project area. The headwaters of the Red River are located near Wahpeton, North Dakota at the convergence of the Ottertail and Boise de Sioux Rivers. From that point the river flows northward approximately 460 km where it empties into Lake Winnipeg in Manitoba. This segment of the river lies within the Upper Red River watershed. The Red River is one of the largest waterways in Manitoba and many rivers and their associated watersheds contribute water to the river, including the Pembina, Morris, La Salle, Seine and Assiniboine Rivers (Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration, Prairies East Region, 2005). In Manitoba, the elevation of the Red River valley plain varies from 218 m above sea level at Lake Winnipeg to 244 m above sea level near the Town of Pembina (Smith, et al., 1988).

Within the main channel of the Red River, high turbidity precludes the growth of submerged macrophytes however emergent aquatic vegetation such as bulrushes and cattails are common in backwaters of the river (TetrES Consultants Inc., 2006). Substrate within the Red River varies from areas of mud/silt/clay with soft to medium compaction to areas with sand/gravel or cobble/boulder with harder compaction (TetrES Consultants Inc., 2006). The Red River is known to contain approximately 66 freshwater fish species. Construction activities have the potential to impact water quality and affect fish / fish habitat in the river. It is anticipated that mitigation measures employed during construction activities will aid in minimizing impacts to surface water quality to the Red River.

No other large surface waterbodies are present within the PSA. It is expected that ditches, artificial dugouts and swales will convey water through the PSA during spring and in wet conditions. Three unclassified stream order drains are

present in the PSA with portions being located within the project footprint. The first, identified as the Red River Outlet 4 (refer to Section 3.2.11), flows east to west underneath PR 200, north of the dairy farm and into the Red River. The second, identified as Red River Outlet 3, flows south to north, again into the Red River, crossing beneath PTH 100 to the west of PR 200. The third is a swale running south to north, from the floodway to the South End Sewage Treatment Plant and is anticipated to connect to the larger rural drainage ditch network (**Map 8, Appendix A**). The first two drains are classified by Milani (2013) as having Class C habitat while the third drain is classified as having Class E habitat. Class C habitat is defined as providing direct fish habitat, complex habitat but with no indicator fish species present. Class E habitat is defined as providing indirect fish habitat. No fish sampling efforts were conducted at these three drain locations. It is not anticipated that these drains would provide direct fish habitat unless the Red River was in a flood stage; however, no fish or fish habitat studies were undertaken for this Project.

7.1.9 SPECIES OF CONSERVATION CONCERN

For the purposes of this report, Species of Conservation Concern (SOCC) are identified as floral or faunal species that are: protected by the Federal SARA and those listed by the COSEWIC; as threatened, endangered, or special concern; protected by the Manitoba ESEA; or tracked as S1, S2, and S3 by the MB CDC. Identification of SOCC or their critical habitats often requires additional mitigation measures, engagement and consultation with environmental regulatory bodies, and potential avoidance. A description of SOCC status/ranking is provided in **Appendix G**.

A review of species declared under the ESEA and under SARA as well as a search request of the MB CDC database and review of other data sources including the Manitoba Breeding Bird Atlas, Department of Fisheries and Oceans (DFO) Aquatic Species at risk map, and the City's NSB natural areas surveys. These were reviewed to identify plant and wildlife SOCC that could potentially occur within the PSA.

During the SPHDS in 2018, a search request was made to the MB CDC for the recorded presence of SOCC within the PSA. The results identified one plant species, false indigo (*Amorpha fruticosa*), one reptile, snapping turtle (*Chelydra serpentina*) and one freshwater mollusc, maplealeaf (*Quadrula quadrula*) within the current PSA. A request was made to the MB CDC on February 9, 2021, to provide an update as to whether any additional SOCC had been identified for the current PSA. The response received by the MB CDC on February 25, 2021 did not provide any new records of species not previously identified within the project footprint. **Map 5, Appendix A** provides an overview of the locations of SOCC identified by the CDC that have been historically observed within the PSA.

Nine natural area reports were available from the City of Winnipeg Naturalist Services Branch for the PSA (**Map 4, Appendix A**) with surveys dates ranging from 1995 to 2004. There were seven plant SOCC identified in the reports: false indigo, climbing bittersweet (*Celastrus scandens*), long-spined hawthorne (*Crataegus succulenta*), graceful mannagrass (*Glyceria pulchella*), heart-leaf arnica (*Arnica cordifolia*), Canada moonseed (*Menispermum canadense*) and blunt-fruited sweet cicely (*Osmorhiza depauperata*).

The Manitoba Breeding Bird Atlas, Square 14PA31 in Region 3: Red River Valley summary data identified the following bird SOCC having been recorded: green heron (*Butorides virescens*), peregrine falcon (*Falcon peregrinus*), chimney swift (*Chaetura pelagica*), bank swallow (*Riparia riparia*), barn swallow (*Hirundo rustico*) and bobolink (*Dolichonyx oryzivorus*) (Bird Studies Canada, 2021).

A search of the DFO species at risk map and database search requests submitted to the MB CDC and to Manitoba Conservation and Climate's (MCC), Fisheries Science and Fish Culture Section for potential locations/habitat for aquatic SOCC associated with the Red River identified four fish SOCC and one mussel SOCC as having the potential to occur within the Red River (based on historical sightings and habitat requirements). The fish species included silver

chub (*Macrhybopsis storeiana*), bigmouth buffalo (*Ictiobus cyprinellus*), lake sturgeon (*Acipenser fulvescens*) and banded killifish (*Fundulus diaphanus*) and the mollusc, maple leaf mussel.

PLANT SOCC

Seven plant SOCC were identified as having the potential to occur within the PSA (see below and **Table 7-5**). A summary of the life history and habitat preferences of these species are detailed below.

False indigo is a perennial shrub in the pea family Fabaceae, known to grown in moist soils along shores, riverbanks and at edges of wooded areas. It can be recognized by purple or reddish brown spiked flower clusters that generally bloom in June and July (Chayka and Dzuik, 2018). This species is ranked provincially by the MB CDC as S1S2. Historic sightings for the false indigo have been recorded from 1909-2013 within the PSA near the Red River Crossing west of St. Mary's Road according to MB CDC data results. It was also observed in a City's NSB natural area report for Natural Area 544 in 2002. No observations were made of this species during the 2018 field surveys completed for the Project.

This species has the potential to occur within the natural areas associated with the PSA.

Climbing bittersweet is a perennial vine in the family Celasteracae. This species is provincially ranked as S3S5 and was reported within Natural Area 544 in 2002 by the NSB. The species has a terminal panicle inflorescence and flowers in spring to summer. The species is known to occur in thickets, margins of woodlands and on roadsides and is often associated with rich soils (eFlora, 2021).

This species has the potential to occur within the natural areas associated with the PSA.

Succulent hawthorn is a shrub within the Rose family and is provincially ranked as S3S4. This species was reported within Natural Area 544 in 1995 by the NSB. It is identified as a shrub that can grow to five meters tall with thorns that are greater than three cm long. The leaves of succulent hawthorn are alternately arranged on the stem and its flowers are white with five petals and sepals. Fruits are red and berry-like and the seeds are yellow-brown and pitted (SASK Herbarium, 2021).

This species has the potential to occur within the natural areas associated with the PSA.

Graceful mannagrass is a perennial grass species with rough sheaths and a loose panicle inflorescence (eFlora BC, 2021). This species is provincially ranked as S2S3 and was reported within Natural Area 544 in 1995 by the NSB. This species is known to occur in wet areas and meadows of Boreal forest (Looman and Best, 1979).

This species has the potential to occur within the wetland areas associated with the PSA.

Heart-leaf arnica is a yellow flowered plant that is provincially ranked as S1. It was previously reported by the NSB in the Maple Grove Park grassland (Natural Area #955) in 2004. The genus can be identified as being the only genus with yellow-rayed composites while also having opposite and simple leaves. Heart-leaf arnica has basal leaves that have deep, heart-shaped notches at their base and have long petioles. This species is known to occur in forests, thickets and stream-sides often in alpine locations (USDA, 2021).

It is unlikely that this species is present in association with the project footprint given its habitat preference.

Canada moonseed is a climbing vine that is provincially ranked as S3. It was previously reported by the CNSB in Maple Grove Park (Natural Area #410) in 1994. The species produces poisonous black berries and flowers in June to July with small cluster of greenish-white flowers. It is known to inhabit woodland edges, thickets and streambanks (Lady Bird Johnson Wildflower Center, 2021).

This species has the potential to occur within the natural areas associated with the PSA.

Blunt-fruited sweet cicely is a perennial herb from a well-developed taproot and is provincially ranked as S2. This species was previously reported by the NSB in 2002 in Maple Grove Park (Natural Area #410). It is identified as having basal leaves and stem leaves that are divided twice into three's. The inflorescence is a loose compound umbel that produce cub-shaped fruits that are widest at the apex. It can be found in rich woods and flowers in June to July.

This species has the potential to occur within the natural areas associated with the PSA.

Table 7-5. Plant SOCC with Potential to Occur within the PSA

Scientific Name	Common Name	SARA[a]	COSEWIC[b]	Provincial Rank[c]	Manitoba ESEA[d]
Amorpha fruticose[1,2]	False indigo	-	-	S1S2	-
Celastrus scandens[2]	Climbing bittersweet	-	-	S3S5	-
Crataegus succulenta[2]	Succulent hawthorne	-	-	S3S4	-
Glyceria pulchella[2]	Graceful mannagrass	-	-	S2S3	-
Arnica cordifolia[2]	Heart-leaf arnica	-	-	S1	-
Menispermum canadense[2]	Canada moonseed	-	-	S3	-
Osmorhiza depauperata[2]	Blunt-fruited sweet cicely	-	-	S2	-

a) Species officially listed under SARA.

b) Species designated by COSEWIC for listing under the SARA (COSEWIC, 2020).

c) Manitoba Conservation Data Centre where:

S1 - Critically Imperiled; At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors

S2 – Imperiled; At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors

S3 – Vulnerable, at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors

S4 - Apparently Secure; At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors

S5 – Secure; At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats

B - for a migratory species, applies to the breeding population in the province.

M - for a migratory species, rank applies to the transient (migrant) population.

N - for a migratory species, applies to the non-breeding population in the province.

X - believed to be extirpated from the jurisdiction

d) Species protected under Manitoba's *Endangered Species and Ecosystems Act*

1 Manitoba Conservation Data Centre Search Results

2 City of Winnipeg Natural Area Reports

Due to the limited and dated reports for these species, it is possible that plant SOCC, especially those that inhabit wooded, forested area or thickets such as false indigo, climbing bittersweet, succulent hawthorn, Canada moonseed and blunt-fruited sweet cicely, may be present within the oak forest, and graceful mannagrass may be present in the wetland area (within oak forest) north of the existing intersection that will be removed for the Project.

BIRD SOCC

Six bird SOCC were identified as having the potential to occur within the PSA (see below and **Table 7-6**). A summary of the life history and habitat preferences of these species are detailed below.

Barn swallow is listed federally under SARA as threatened and is provincially ranked as S4B. This species inhabits agricultural areas that contain available buildings and/or bridges for nest construction. Nests are constructed from mud and any structure with a large opening or over-hanging roof can provide a suitable nesting site for these birds (Poole,

2018). Nests of this species were observed within three separate outbuildings at the historic dairy farm site during the February 11, 2021 site visit (COSEWIC, 2011).

Green herons are ranked provincially as S1B due to their rarity in Manitoba as only two probable and confirmed breeding locations have been reported, in riparian greenspaces in Winnipeg and Steinbach making it a rare visitor and occasional breeder. This species inhabits wooded riparian areas along stream and ponds (Koes, 2018).

Bobolink is federally listed under SARA as threatened and is provincially ranked as S4B. The bobolink is a grassland bird species that prefers to breed within open grassland areas, along the margins of wetlands, as well as in agricultural fields, including hayland alfalfa fields and pastures. The bobolink's ability to utilize a variety of grassland habitat types makes this species more common than any of the other threatened grassland songbirds in Manitoba. Bobolinks generally build well-concealed nests on the ground which often results in inadvertent destruction of the nests during mowing (McCracken, 2018).

The **chimney swift** is federally listed under SARA and COSEWIC as threatened and is provincially ranked as S2B. This bird historically would have nested within large deciduous tree cavities but is now most commonly associated with urban brick chimneys to carry out nesting. Chimney swift numbers have declined, and it may be attributed to a reduction in flying insects from the use of insecticides and the capping or removal of brick chimneys (Poole, Stewart and Stewart, 2018).

The **bank swallow** is federally listed as threatened under SARA and is provincially ranked as S4B. This species is a colonial nesting insectivore that occurs in all provinces. In Manitoba, it can be found primarily in grassland, aspen parkland and plains ecoregions near the presence of vertical nesting habitat along water courses. These colonial nesting sites are excavated by the males, and a single brood occurs each season (COSEWIC, 2013 [2]).

The **peregrine falcon** is listed as special concern under *SARA* and endangered under Manitoba's ESEA. This species is provincially ranked as S2B, S3M. Historically, the species depended on cliff edges for nesting but in Manitoba, the most common sightings have been in urban areas where they nest on buildings and other tall structures (Olynyk, 2018). In areas without cliffs, they may also use man-made structures such as transmission poles or silos and may nest in abandoned raven, eagle, osprey or hawk nests (Cornell, 2019).

Table 7-6. Bird SOCC with Potential to Occur within the PSA

Scientific Name	Common Name	SARA[(a)]	COSEWIC[(b)]	Provincial Rank[(c)]	Manitoba ESEA[(d)]
Hirundo rustico[1]	Barn swallow	Threatened	Threatened	S4B	-
Butorides virescens[1]	Green heron	-	-	S1B	-
Dolichonyx oryzivorus[1]	Bobolink	Threatened	Threatened	S4B	-
Chaetura pelagica[1]	Chimney swift	Threatened	Threatened	S2B	Threatened
Riparia riparia[1]	Bank Swallow	Threatened	Threatened	S4B	-
Falco peregrinus[1]	Peregrine falcon	Special Concern	-	S2B, S3M	Endangered

a) Species officially listed under SARA.

b) Species designated by COSEWIC for listing under the SARA (COSEWIC, 2020).

c) Manitoba Conservation Data Centre where:

S1 - Critically Imperiled; At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors

S2 – Imperiled; At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors

S3 – Vulnerable, at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
S4 - Apparently Secure; At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors
S5 – Secure; At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats
B - for a migratory species, applies to the breeding population in the province.
M - for a migratory species, rank applies to the transient (migrant) population.
N - for a migratory species, applies to the non-breeding population in the province.
X - believed to be extirpated from the jurisdiction

d) Species protected under Manitoba's *Endangered Species and Ecosystems Act*

1 Manitoba Breeding Bird Atlas

Based on the available habitat identified within the PSA (historic structures, oak forest, aspen forest, grassland and wetland), there is some potential for bird SOCC to be present within the PSA, such as barn swallow and chimney swift. Buildings and artificial structures within the historic dairy farm property at 2433 St. Mary's Road provide suitable nesting habitat for barn swallow as evidenced by existing nesting structures on the various outbuildings. There is also potential for chimney swift to use brick chimneys associated with these buildings. Habitat requirements are not likely to be met for other potential SOCC species such as bank swallow, green heron, bobolink and peregrine falcon; however, there is a small likelihood that they could potentially use the area for foraging or during migration given the proximity to the Red River at the edge of the PSA.

HERPETOFAUNA SOCC

One herpetofauna SOCC were identified as having the potential to occur within the PSA (see below). A summary of the life history and habitat preferences of this species is detailed below.

The **common snapping turtle** is listed as special concern (Schedule 1) under both SARA and COSEWIC and is ranked provincially as S3, indicating it is considered uncommon throughout its range. The snapping turtles preferred habitat is primarily slow-moving water, with a mud bottom substrate along with the presence of dense aquatic vegetation. These turtles were reported as being historically abundant within the City's Red and Assiniboine rivers (COSEWIC, 2008). Turtles mate in early spring and nesting occurs primarily in sand and gravel banks but have also been observed in lawns, atop beaver lodges, on roadway shoulders and within forest clearings. Hatchling emerge in early fall and go directly to the nearest waterbody (COSEWIC, 2008). Snapping turtles utilize hibernacula sites for overwintering and preferred sites may include overhanging banks, beneath submerged logs, covering themselves in silt along shorelines or buried in deep anoxic mud and beneath floating vegetation. The common snapping turtle is omnivorous and will eat plant matter, carrion, fish, amphibians, insects, crustaceans and birds (COSEWIC, 2008).

During the SPHDS, a limited observation was made for the presence of turtles with a focus on snapping. No detections of turtles were made. As well, no other incidental sighting of turtles or other reptile species were made during the vegetation field surveys in support of the SPHDS in 2018.

While the potential for snapping turtle to be present within the project footprint is low, snapping turtles may migrate through the PSA to reach desired nesting areas.

Amphibian surveys were conducted during the SPHDS (refer to **Section 7.1.7.2**) with a focus on northern leopard frog. Amphibian species in Manitoba are widespread and relatively secure in terms of abundance. Although the prairie populations of the northern leopard frog are listed federally on Schedule 1 of the SARA as "Special Concern" (Environment and Climate Change Canada, 2016), in Manitoba this species is ranked as an S4, meaning it is widespread, abundant, and apparently secure throughout its range or in the province (Manitoba Conservation Data Centre, n.d.).

AQUATIC SOCC

Five aquatic SOCC were identified as having the potential to occur within the Red River (see below and **Table 7-7**). A summary of the life history and habitat preferences of these species are detailed below.

Lake sturgeon are Manitoba's largest fish species and were historically reported to be abundant in the Red and Assiniboine Rivers. However, overexploitation due to fishing pressure and the construction of barriers to movement such as the St. Andrew's Lock and Dam contributed to their decline. In more recent years, lake sturgeon has been stocked in the Assiniboine River and in the Red River and incidences of recreational anglers catching sturgeon have increased. They are known to feed primarily on benthic invertebrates but may eat grain, fish, carrion and algae (Stewart and Watkinson, 2004). The lake sturgeon is ranked as S2 provincially; however, there is no SARA schedule or COSEWIC status for the Red-Assiniboine Rivers – Lake Winnipeg population.

The **banded killifish** was reported in the Red River near the University of Manitoba campus. Stewart and Watkinson (2004) consider it likely the rarest fish in Manitoba. It inhabits clear, shallow, quiet water with substrate consisting of sand or gravel with vegetation patches present. They feed in all areas of the water column on aquatic insect larvae and plankton species (Stewart and Watkinson, 2004). This species is listed as S2 provincially by the MB CDC.

Bigmouth buffalo is a member of the sucker family Catostomidae and is found within the Assiniboine River south of Portage la Prairie and in the lower reaches of the Red River and their tributaries. It uses its closely spaces gill rakers to filter feed in the mid-water column of slower moving waterbodies. This species spawns in late spring-early summer and broadcasts eggs over submerged vegetation in marshes and flooded riverbanks. It is reported that high water events are required for spawning (Stewart and Watkinson, 2004). This species is ranked as S5 in Manitoba by the MB CDC; however, it is listed as Special concern under both COSEWIC and SARA with a Schedule 1 status. The status for bigmouth buffalo is for the Saskatchewan – Nelson River population that encompasses both Manitoba and Saskatchewan.

The **silver chub** is recorded to be present within both the Assiniboine and Red rivers. It is a minnow species in the family Cyperinidae that appears to spawn in June – July, however little information is known. This chub species is a benthic feeding fish, eating primarily aquatic insect larvae. It has been observed in the Red River in Winnipeg feeding on emerging mayflies. It inhabits the mainstems of the Red River and lower Assiniboine River as well as the lower reaches of their tributaries and is reportedly one of the most abundant fish species at the St. Andrews Dam. Silver chub is listed as S5 in Manitoba by the MB CDC, and while the Manitoba and Ontario populations had been previously listed as threatened under SARA, the Nelson River – Saskatchewan River populations in Manitoba were deemed to be not at risk.

The **mapleleaf mussel** is a bivalve known to inhabit the Red, Assiniboine and Seine rivers in the PSA. It prefers habitats ranging from medium to large rivers, slow to moderate currents with mud, sand or gravel bottoms. It is reported that in Manitoba the mapleleaf mussel is found in rivers with firmly packed substrates of gravel, sand or clay/mud (COSEWIC, 2016). The mapleleaf mussel feeds on microscope particles such as algae and bacteria it filters from the water column. As with many mussel species, larvae have specific host fish and are likely parasitic to channel catfish in Manitoba (COSEWIC, 2016). The mapleleaf mussel is ranked as S3 by the MB CDC, endangered under Manitoba's *Endangered Species and Ecosystems Act*, endangered, Schedule 1 under SARA and a threatened status under COSEWIC.

Table 7-7. Aquatic SOCC with Potential to Occur within the Red River

Scientific Name	Common Name	SARA[(a)]	COSEWIC[(b)]	Provincial Rank[(c)]	Manitoba ESEA[(d)]
Acipenser fulvescens[3]	Lake sturgeon		Non-active	S2	-
Macrhybopsis storeina[2,3]	Silver chub	-	Not at risk	S5	-
Ictiobus cyprinellus[2,3]	Bigmouth buffalo	Special Concern	Special Concern	S5	-
Fundulus diaphanus[3]	Banded killifish	-	-	S2	-
Quadrula quadrula[1,2]	Mapleleaf	Threatened	Threatened	S3	Endangered

a) Species officially listed under SARA.

b) Species designated by COSEWIC for listing under the SARA (COSEWIC, 2020).

c) Manitoba Conservation Data Centre where:

S1 - Critically Imperiled; At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors
S2 – Imperiled; At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors
S3 – Vulnerable, at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
S4 - Apparently Secure; At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors
S5 – Secure; At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats
B - for a migratory species, applies to the breeding population in the province.
M - for a migratory species, rank applies to the transient (migrant) population.
N - for a migratory species, applies to the non-breeding population in the province.
X - believed to be extirpated from the jurisdiction

d) Species protected under Manitoba's *Endangered Species and Ecosystems Act*
1 Manitoba Conservation Data Centre Search Results
2 Department of Fisheries and Oceans Species at Risk Mapping
3 Manitoba Conservation and Climate, Fisheries Branch, Fisheries Inventory and Habitat Classification System database

There is no anticipated in-water work being conducted for the Project and therefore the likelihood of the Project affecting these aquatic SOCC is low to none provided mitigation measures are followed such as erosion and sediment control measures and the proper protocols for deleterious materials handling (refer to **Table 9-1**).

OTHER SOCC

The riverine clubtail (*Stylurus amnicola*) is a small dragonfly species known to inhabit diverse riverine habitats ranging from large rivers to small tributaries. The riverine clubtail was first identified in Manitoba in 2004; however, little search effort has been made outside of Winnipeg. This species lays its eggs in the open stream where the larvae will hatch in the same season and live in the aquatic environment for two or more years before emerging as an adult. The adult riverine clubtail likely feeds primarily on small flying insects with much of the hunting occurring in wooded or forest canopies (COSEWIC, 2012). This species is ranked as S3 by the MB CDC. While the Ontario population is ranked as endangered with COSEWIC and SARA, Schedule 1, the Prairie population is listed as data deficient as of 2012.

Although historic observations of this species were made in Maple Grove Park, the potential for this species to occur within the project footprint is anticipated to be low due to the primarily developed and agricultural land use associated with much of the project footprint.

7.2 SOCIO-ECONOMIC ENVIRONMENT

7.2.1 EXISTING PUBLIC SAFETY AND HEALTH RISKS

The greatest risk to public safety and health within the PSA is likely associated with vehicle collisions and vehicle-wildlife collisions based on the primarily agricultural and residential land uses in the surrounding area.

7.2.1.1 VEHICLE-WILDLIFE COLLISIONS

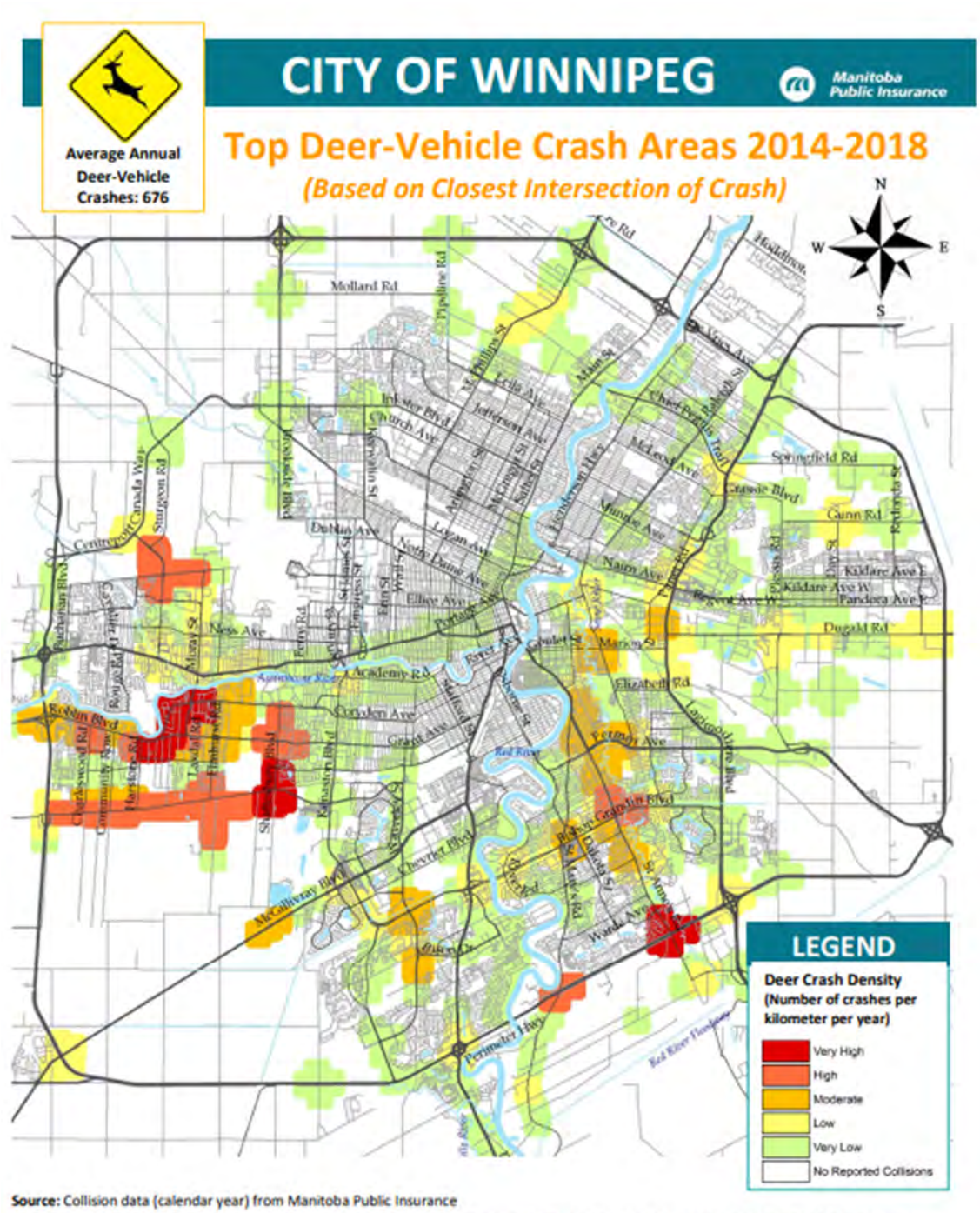
Manitoba Public Insurance (MPI) reports that between 2010-2019, 84 white-tailed deer-vehicle collisions took place at / near the PR 200 (St. Mary's Road) and PTH 100 intersection. The MPI map of Top Deer-Vehicle Crash Areas 2014-2018 (refer to **Figure 11**), indicates that the PSA is located within an area of "High" deer-vehicle collisions. **Table 7-8** provides a summary of Deer-related collisions by year for the years 2010-2019 reported for the nearest intersection (PTH 100 and St. Mary's Road).

Although the PSA is currently designated by MPI as a high-risk area for deer-vehicle collisions, it is unknown at this time if this risk level will remain the same in the long-term once the interchange is constructed.

Table 7-8. Deer-related Collisions by Year

Year											
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**	**Average / Year**
4	6	7	7	6	14	9	6	12	12	**84**	**8.4**

Source: Manitoba Public Insurance Collision Database (2021).



Source: Collision data (calendar year) from Manitoba Public Insurance

Note: Collision location is self-reported by Manitoba Public Insurance claimants. Only those crashes where a claimant provided information regarding the nearest intersection to the crash are illustrated on this map.

For crash locations by municipality, please see the companion map: "Manitoba: Top Deer-Vehicle Crash Areas 2014-2018".

Figure 11. MPI Reported Deer Crash Densities for the City of Winnipeg

7.2.2 MINERAL RIGHTS

According to a review of the Manitoba Mines Branch - Integrated Mining and Quarry System website (Manitoba Mines Branch, n.d.), quarry and mining maps viewers, there are currently no existing or planned quarry or mining dispositions within the PSA.

7.2.3 PARKS, OPEN SPACES AND TRAIL

Maple Grove Park is located along the east side of the Red River adjacent to St. Mary's Road; this part of the park consists of river bottom forest (refer to **Map 4, and Map 6 Appendix A**). However, it does not appear that the proposed design will directly impact any existing recreational facilities / playgrounds, parks or open spaces. The existing entrance to Maple Grove Park will be reconfigured and will allow for safer access to the park. There are no existing trails within the project footprint.

7.2.4 HERITAGE RESOURCES

The Heritage Resources Act, Section 12(2) 1985 (Manitoba Laws, 2017) made mandate by the Province of Manitoba stipulates that any activity that may result in the damage, alteration or destruction of a heritage property may be subject to an archaeological investigation. Deemed Crown property, heritage resources include but are not limited to archaeological sites, built heritage sites, structures of historical or architectural significance and palaeontological sites (Manitoba Laws, 2017). The Act is enforced by the Manitoba Historic Resources Branch (HRB).

Proponents of proposed development projects are encouraged to submit a request to the HRB for screening of a project site for the potential to impact heritage resources. The HRB has based their screening criteria on a number of well-documented factors common to locational characteristics of heritage sites. With topography taken into consideration, parcels of native prairie are considered a primary candidate for demonstrating high archaeological potential as they have not been subject to the destruction of agricultural practices or development, allowing for the preservation of archaeological sites. This is not to say that lands demonstrating previous disturbance do not play host to heritage property, as many post-contact and pre-contact artifacts have been recorded from within these areas. Proximity to previously recorded heritage properties is also taken into consideration with regards to direct or nearby conflict with a proposed development. Furthermore, archaeological sites frequently occur in numbers, generally based on their location or proximity to a landform. Previously recorded sites may be used as an indicator of additional cultural material to be present within an area. Topographic features such as valleys, ridges, hills or escarpments and terrestrial features associated with watercourses are also considered to be areas of high archaeological potential as they provided protection, shelter, sustenance and security.

Two heritage sites were identified as having high potential to be impacted by the Project. These heritage sites are located within the realignment area of PR 200 and PTH 100 (refer to **Map 7, Appendix A**) and include a historic dairy farm property and a destroyed/abandoned farmstead. A site visit to the abandoned farmstead location was conducted in 2019 and consisted of an abandoned approach, manicured grass and a patch of mature trees in the area of the historic farm property. A pre-construction Heritage Resource Impact Assessment (HRIA) will be conducted in the summer of 2021 (refer to **Section 11** for additional details).

7.2.5 INDIGENOUS AND METIS COMMUNITIES

The Project is located on Treaty 1 territory and the homeland of the Metis people.

The nearest area of Community Interest was associated with Peguis First Nation within the RM's of Rosser and Springfield. According to a review of the Manitoba Mines Branch - Integrated Mining and Quarry System website (Manitoba Mines Branch, n.d.), quarry maps viewer accessed in 2021, there are currently no Treaty Land Entitlement claims within the PSA.

There are no Metis communities in the project footprint or within the PSA.

According to the 2016 Canadian Census, 84,305 Indigenous peoples reside in the City of Winnipeg, representing 12.2% of the population, 54% of Indigenous people identify as Métis, 44% identify as First Nation, and 2% identify as multiple, Inuit, or other. The proportion of Indigenous Manitobans living in the City of Winnipeg has increased from 34% of Indigenous Manitobans to 38% of Indigenous Manitobans over the last 20 years indicating that the Indigenous population in Manitoba is becoming increasingly more urban over time (City of Winnipeg, 2018).

There is no hunting or trapping within the City of Winnipeg boundaries. Additional Indigenous resource use such as fishing or gathering of traditional use plants and cultural or traditional activities were not identified for the project footprint. However, historical Indigenous resources and artifacts may be present within the area (refer to Section 7.2.4).

A search of the Indigenous Business Directory (Province of Manitoba, 2019) did not identify any Indigenous owned business addresses within the project footprint.

7.2.6 POPULATION AND ECONOMIC CHARACTERISTICS

The main population within the PSA is concentrated to the north of the interchange within the River Park South and Normand Park neighbourhoods (City of Winnipeg, 2018[2]). Detached, single-family homes are the primary dwelling type in these neighbourhoods. In addition to these areas, there is a cluster of rural residences, farmyards and commercial businesses such as landscaping and garden centers, south on St. Mary's Road and south of PTH 100.

Employment in the PSA is expected to be primarily located at the various nursery and garden centers that are adjacent to St. Mary's Road south of PTH 100 which include Ron Paul Garden Centre, Lacoste Garden Centre and St. Mary's Nursery and Garden Centre. The South Winnipeg Water Pollution Control Centre is located at the eastern edge of the PSA, and there is agricultural land that is farmed annually to the south of PTH 100.

8 DESCRIPTION OF POTENTIAL EFFECTS

8.1 OVERVIEW OF POTENTIAL EFFECTS

The environmental effects assessment involves evaluating the potential interactions between the Project components and the environment to determine key effects. Where project-environment interactions are anticipated, the interaction was rated in terms of magnitude (negligible, minimal, moderate or high), extent (project footprint, localized [within 500 m of PSA], regional [City of Winnipeg]) and duration (temporary, periodic, long-term/continuous). A summary of the potential Project interactions with the environment is provided in **Sections 8.2 to 8.5** below and also summarized in **Table 9-1**. Detailed information on required project components (e.g., construction equipment and materials, fuel storage locations, etc.) and specific activities (e.g., dewatering for foundation excavation works, erosion and sediment control, etc.) has not been detailed at this time. As such, the following section provides a high-level review of the potential interactions and effects (may be positive and/or adverse) that are anticipated to be associated with the Project for the construction, and operation and maintenance (O&M) phases of development. Proposed mitigation measures include MI's General Environmental Requirements (GERs) and Project-specific mitigation measures to avoid, minimize or remedy adverse environmental effects are also provided. However, it is anticipated that Project applicable mitigation measures will be reviewed and revised as required during the DB process specific to future design and construction activities. Residual effects anticipated to remain after the successful implementation of mitigation measures are also provided and have been characterized with respect to significance; however as with the mitigation measures, residual effects will need to be reviewed and revised as required during the DB process. Only residual effects that are considered to be adverse or negative were described in the residual effects analysis.

Descriptions of proposed mitigation measures are provided in **Table 9-1** in **Section 9** and anticipated residual effects analysis in **Table 10-2** in **Section 10**.

8.2 POTENTIAL EFFECTS ON THE BIOPHYSICAL ENVIRONMENT

8.2.1 EFFECT ON AIR QUALITY AND GREENHOUSE GAS EMISSIONS

It is anticipated that the Project may have both adverse and positive effects on air quality and GHG emissions in the PSA and regional (City of Winnipeg) area. The potential effects are examined below according to the phase of the Project (construction and O&M).

Construction

The potential effects on air quality and GHG emissions from the construction phases of the Project include an increase in air emissions and odour from construction vehicle and equipment exhaust, release of volatile organic compounds (VOC) during asphalt work (if occurs), and an increase in dust generation from vehicle and equipment movement, stripping and grading activities as well as from wind erosion of stockpiled materials and disturbed areas.

Vehicle exhaust, odour, VOC and dust emissions are anticipated to be typical of road construction. Although these impacts cannot be eliminated during construction, they can be reduced through implementation of appropriate mitigation measures; effects from construction activities on air quality are expected to be minimal, localized and temporary in nature.

Operation and Maintenance

During the O&M phase of the Project, transportation volumes are expected to increase as the population of Winnipeg and the surrounding areas continues to grow. This may result in an increase in GHG production from increased vehicle use of the new interchange. The Province will also need to perform various maintenance activities for the roadway, structures and drainage system (e.g., surface and curb repairs, inspections to structures, snow clearing/sanding/salting in the winter, maintain landscaping) which may have a minor affect air quality and production of GHGs.

The development of more fuel-efficient vehicles/higher use of zero emissions vehicles, will aid in reducing effects from O&M activities on air quality and GHG production which may result in aiding with reducing Winnipeg's climate change impact (refer to **Section 6.1.3** for discussion on predicted future GHG emissions). In addition, air quality in Winnipeg is generally considered to be excellent compared to other Canadian cities of similar size (Manitoba Conservation and Climate, n.d. [2]). Impacts are therefore expected to be minimal to moderate, localized and periodic to continuous over the life span of the Project.

Table 9-1, Component 1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.2 EFFECT ON SOILS

Approximately 30.81 ha of agricultural land and 7.19 ha of land under natural cover will be required to accommodate the re-alignment of PR 200, associated interchange structure and service roads. The potential effects to soils are examined below according to the phase of the project (construction and O&M).

Construction

During construction, the proposed Project will involve the removal of existing topsoil and subsoil to accommodate the re-alignment of PR 200 and the construction of service roads and ramps. This will result in the permanent alteration of soils within the project footprint, including areas under agricultural crop production and areas under natural vegetative cover (treed and grassed areas). Loss of soils will be localized to the project footprint, and loss of quality agricultural soils will be minimized where possible. Potential project effects from construction activities include loss of soil, compaction, and rutting during topsoil salvage and stockpiling activities; potential increase in wind and water erosion of exposed soils; and contamination of soil from leaks and spill during construction activities. During construction there is also the potential for release of hazardous materials (e.g., fuel, oil, lubricants, etc.) through accidents and malfunctions and leaks and spills associated with construction equipment that can have a localized impact on soil resources. With the implementation of appropriate mitigation measures, the impact to soil resources during construction is expected to be minimal to moderate, within the project footprint and temporary.

Operation and Maintenance

During the O&M phase, the proposed Project could potentially affect soil physical and chemical properties immediately adjacent to the road within the RoW from road maintenance activities (e.g., application of road salts during the winter). In addition, there is the potential for release of hazardous materials (e.g., fuel, oil, lubricants, etc.) through accidents and malfunctions, leaks and spills that can have a localized impact on soil resources. With the implementation of appropriate mitigation measures impact to soil resources during O&M is expected to be minimal

to moderate, within the project footprint and short-term (i.e., contamination from spills) to continuous (i.e., loss of agricultural soil).

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.3 EFFECT ON GROUNDWATER

Groundwater levels will fluctuate seasonally and following precipitation events; therefore, the actual water level at the time of construction could differ from the conditions reported in the 2019 geotechnical report. Groundwater inflows and subsequent sloughing / squeezing are likely to occur when advancing excavations into the till. Where encountered, groundwater inflows and potential sloughing that may occur will need to be dealt with during excavation. Such methods as deemed necessary for controlling water inflows will be determined by the foundation installation contractor (See **Section 2.3.3**. for additional information).

Domestic groundwater wells are present at 2433 St. Mary's Road and at 2969 St. Mary's Road according to the GWDrill 2018 database and visual confirmation during the February 11, 2021 site visit.

In general, aquifer quality is not expected to be affected by normal construction and O&M activities for the Project. Most of the residential homes and businesses within the PSA are connected to the City or municipal water supply systems. However, there are still several rural residential properties and commercial properties in the surrounding area that utilize well water that could potentially be affected by Project activities. The potential effects to groundwater are examined below according to the phase of the project (construction and O&M).

Construction

Pumping equipment or other dewatering systems may be required to mitigate the inflow of groundwater during any foundation excavation work. Groundwater must be controlled by the means and methods determined necessary during construction by the foundation installation contractor and not flow directly overland into natural waterways. Corrosion may occur for steel piles due to potentially saline groundwater, which may then impact the long-term performance of the steel piles and should be designed according.

Potential effects to local groundwater from construction activities associated with the Project can include contamination from dewatering activities and the potential for release of hazardous materials (e.g., fuel, oil, lubricants, etc.) through accidents and malfunctions, leaks and spills from activities associated with the use of construction equipment. With the implementation of appropriate mitigation measures effects to groundwater resources during construction is expected to be, minimal, limited to the project footprint and temporary.

Operation and Maintenance

There are no anticipated impacts to groundwater during O&M activities.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.4 EFFECT ON SURFACE WATER AND THE AQUATIC ENVIRONMENT

The Red River is largest surface water body within the PSA; however, it is not anticipated that any in-water work will be required for the Project. Ditches, artificial dugouts and swales convey water through the PSA during spring and in wet conditions and include three unclassified / unnamed drains. The first flows east to west underneath PR 200, north of the dairy farm and into the Red River, the second flows south to north, again into the Red River, crossing beneath PTH 100 to the west of PR 200. The third is a swale running south to north, from the floodway to the South End Water Pollution Control Centre and is anticipated to connect to the larger rural drainage ditch network (**Appendix A, Map 8**). It is not anticipated that these drains would provide direct fish habitat unless the Red River was in a flood stage however, no fish or fish habitat studies were undertaken for this Project.

The potential effects to surface waterbodies and subsequently the aquatic environment are primarily related to the deposition of sediments and deleterious materials entering these waterbodies through run-off from the project footprint.

Construction

Possible effects on surface water include sedimentation into waterbodies from direct runoff of eroded soil materials due to stockpiling and exposed soils from vegetation removal and/or erosion from wind; deleterious materials entering the Red River and connected drainage pathways due to leaks, spills and malfunctioning of equipment; as well as concrete grinding operations and discharge into ditches with pathways to the Red River.

Mitigation measures to offset the potential effects on fish and fish habitat will include culverts that are adequately designed and embedded (i.e. 300 mm minimum) in order to facilitate for fish passage and connectivity where the potential exists, namely at Red River Outlet 3 and Red River Outlet 4 (Refer to Section 7.1.8), as these two locations connect directly to the Red River.

With the implementation of appropriate mitigation measures, effects to surface water resources during construction is expected to be minimal to negligible, localized and temporary.

Operation and Maintenance

Decrease in surface water quality due to deleterious materials entering the Red River during the O&M phase in association with road salt runoff, and vehicular collisions within the vicinity of drainage pathways that could convey deleterious materials to the Red River. With the implementation of appropriate mitigation measures, effects to surface water resources during O&M activities is expected to be minimal to negligible, localized and temporary.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.5 EFFECT ON TERRESTRIAL ENVIRONMENT

8.2.5.1 EFFECT ON VEGETATION AND NATURAL AREAS

Nine natural areas were identified within the PSA and of these, two will be directly impacted due to the Project, natural area #395 and #544. All of #395 will require clearing and grubbing to accommodate construction of new lanes / roadways and interchange structures and the eastern most portions of #544 will be removed to allow for the south bound PR 200 access lane from the eastbound lanes of PTH 100. During the evaluation of alternatives for laneway reconstruction to the westbound or eastbound lanes of PTH 100, closure or moving of current connection / crossing locations and the location and design of new structures alignment and interchange location alternatives, potential

impact to natural area was assessed. Design considerations were developed to minimize impact to natural areas, in particular in relation to Grade A/B oak and river bottom forest associated with the PR 200 interchange; however, portions of the natural areas were not able to be avoided due to roadway design safety standards. Approximately 6.27 ha of oak forest and 0.53 ha of river bottom forest will be lost.

Construction

Construction activities will include the stripping, clearing and grubbing of natural vegetation including the oak forest and aspen forest to the north and south of the existing intersection. These areas will be permanently lost as they will be incorporated into the new RoW for PR 200 re-alignment, ramps and services roads. Loss of natural vegetation cover will also result in the loss of local wildlife habitat and the subsequent revegetation of disturbed sites has the potential to introduce weed and invasive species. With the implementation of appropriate mitigation measures effects to vegetation resources during construction is expected to be long-term, limited to the project footprint and are low to moderate in magnitude based on the potential for weed and invasive species to colonize existing natural areas in the PSA.

Operation and Maintenance

Once construction is complete, maintenance mowing and weed control activities completed as part of the O&M activities associated within the new RoW are anticipated to be have minimal impact on native vegetation adjacent to the project footprint. A positive effect would be to include native plants during the re-seeding program and to avoid the use of the following species of plants as per MI's GER for Revegetation:

- Smooth Brome (*Bromus inermis*)
- Crested Wheatgrass (*Agropyron cristatum*)
- Creeping Red Fescue (*Festuca rubra*)
- Bird's-foot Trefoil (*Lotus corniculatis*)
- White Sweet Clover (*Melilotus alba*)
- Alsike Clover (*Trifolium hybridum*)
- Meadow Foxtail (*Alopecurus pratensis*)
- Tall Fescue (*Festuca arundinace*)
- Downy Brome (*Bromus tectorum*)
- Reed Canary Grass (*Phalaris arundinacea*)
- Kentucky Bluegrass (*Poa pratensis*)
- Yellow Sweet Clover (*Melilotus officinalis*)
- Dutch Clover (*Trifolium repens*)
- Alfalfa (*Medicago sativa*)
- Tufted/Cow/Bird Vetch (*Vicia cracca*)

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.5.2 EFFECT ON WETLANDS

Two wetlands (Class I or II) were identified within natural area #395 located to the north of the existing intersection. During the reconnaissance survey on February 11, 2021, they appeared to be dominated by wetland grasses, although species were not identified in the field, and also contained snags and stumps.

Construction

These two wetlands would be removed in their entirety (approximately 0.396 ha) during the clearing and grubbing phase of construction to accommodate the new RoW for the PR 200 (St. Mary's Road) re-alignment. Loss of natural wetland vegetation may also result in the loss of local wildlife habitat, especially for amphibian species such as boreal chorus frogs and wood frogs. The removal of wetlands will be permanent and localized in magnitude. The effect is anticipated to be low as these wetlands (Class I and II) are ephemeral, and availability of standing water for amphibian

and other wildlife use is dependent upon the annual moisture regime. It is anticipated that wildlife that use the wetland habitat will migrate to the surrounding landscape / storm water retention ponds associated with local residential areas where annual water availability is more stable.

Under *The Water Rights Act,* mitigation or compensation for drainage of Class I and II wetlands is not required.

Operation and Maintenance

There are no effects anticipated for wetlands within the project footprint as they will have been lost to the new RoW.

8.2.5.3 EFFECT ON WILDLIFE AND WILDLIFE HABITAT

Various wildlife species (mammals and birds) are known to be present within the project footprint and will be affected by construction and O&M of the new interchange and the realignment of roadways.

Construction

Project construction will result in loss of habitat for wildlife species for breeding, overwintering, foraging and migration associated with natural areas #395 and #544 (oak and aspen forest and wetland) as well as potentially increased sensory disturbance. It is likely that wildlife within the existing PSA are adapted to the noise of PTH 100 and may relocate to the riparian areas of the Red River, Maple Grove Park and to the natural area to the south of PTH 100 during construction. Some species adapt to living in an urban environment while others seek out other areas of suitable habitat away from urbanized centres. With the implementation of appropriate mitigation measures, effects to wildlife and wildlife habitat during construction is expected to be minimal to moderate in magnitude, localized, and periodic to continuous.

Operation and Maintenance

Some species that do not require wooded or forested areas and use grasslands, ditches and landscaped trees to carry out their life history requirements, will likely locate back to the project footprint after final construction and landscaping and continue to be present during the O&M phases of the Project. However, direct mortality of wildlife on the roadways will continue to be a potential effect to wildlife as they will migrate across PTH 100 and PR 200 to access remaining natural areas. This would be particularly true of white-tailed deer that are present within the PSA year-round (refer to **Section 7.1.7.2 and 8.4.2** for additional details).

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.2.6 EFFECT ON SPECIES OF CONSERVATION CONCERN

Species of conservation concern identified as having the potential to occur within the project footprint and PSA include seven plant SOCC, six bird SOCC, one herpetofauna SOCC, one arthropod SOCC and five aquatic SOCC. Based on habitat suitability, five plant species, two bird species and one herpetofauna species are identified as having the potential to be impacted by the Project. Previous ecological field studies completed for the SPHDS in 2018 did not record the presence of any SOCC within the PSA; however, a limited reconnaissance site visit to the historic dairy farm at 2433 St. Mary's Road identified the presence of barn swallow nests on the farm buildings. See **Section 7.1.9** for SOCC that may potentially be found within the project footprint and PSA.

Construction

The potential effects on SOCC during the Project construction phase include the sensory disturbance within the PSA, the permanent loss of habitat including historic farm buildings, oak forest, aspen forest, wetland and grassland areas that may be used for breeding, overwintering, foraging and other life history aspects for SOCC species. The direct

loss of habitat would pertain to barn swallows. Additional SOCC that may be impacted include roosting bats, chimney swifts the potential mortality of snapping turtles within the project footprint from vehicle collisions and the direct loss of plant SOCC within natural areas impacted and / or removed by construction however, these species have not been confirmed at present, and follow up investigations will be conducted in 2021 to confirm presence. With the implementation of appropriate mitigation measures, effects to SOCC during construction is expected to be minimal to moderate in magnitude, within the project footprint, and temporary to continuous.

The potential effects on aquatic SOCC are anticipated to be low as no in-water work is going to be conducted for the Project, and mitigation measures to prevent the runoff of deleterious substances and sediment migration to the Red River through the ditch network will be in place.

Operation and Maintenance

During the O&M phase of the project, the potential effects to SOCC within the project footprint include the direct mortality of species on the roadways such as snapping turtle. Although snapping turtle mortality has not been confirmed previously for the area, they have been reported within the PSA in the Red River and are known to use gravel shoulders of roadways for nesting. For plant SOCC, maintenance mowing of grassland areas and ditches within the RoW may prevent plant SOCC from successfully reproducing due to mowing plants prior to flowering, pollination and seeding as well as through mortality of plants through mechanical destruction such as under the wheels of machinery.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.3 POTENTIAL SOCIO-ECONOMIC EFFECTS

8.3.1 EFFECT ON LAND USE

Land use within the PSA includes agricultural crop production, various businesses such as garden centres and landscaping centres, City land and buildings (e.g., City of Winnipeg South End Water Pollution Control Centre), Manitoba Hydro substation, communications tower as well as numerous residential areas (refer to **Section 2.2**). The potential effects to land and resource use are examined below according to the phase of the project (construction and O&M).

Construction

During the construction phase, the adverse effects will be the expropriation of private property and City property as outlined in **Section 2.2** as well as the loss of productive agricultural lands as outlined in **Section 7.1.4**. Additionally, there is anticipated to be a temporary disruption to local traffic patterns and road use (vehicles, buses, cycling, walking) as well as increased construction traffic may affect commuters, local residents and business owners. With the implementation of appropriate mitigation measures, effects to land use during construction is expected to be minimal to moderate in magnitude, within the project footprint, and temporary to periodic.

Operation and Maintenance

The proposed PTH 100 upgrades will become a part of the landscape during the O&M phase. Operation effects associated with the expanded RoW and proposed interchange structure are anticipated to be negligible. A positive effect from the Project on land use may include improved traffic flow and road access / safety in the area, especially

regarding Maple Grove Park. With the implementation of appropriate mitigation measures, effects to land use during construction is expected to be minimal in magnitude, within the project footprint, and continuous.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.3.2 EFFECT ON PARKS, OPEN SPACES AND TRAILS

No parks and opens spaces were identified as being directly affected by the project footprint. Effects on parks and open spaces are therefore anticipated to be minimal during project construction activities with effects relating primarily to potential temporary access closure/changes during construction phase of the Project.

A positive effect from the Project will be safer vehicular access to Maple Grove Park.

No existing trails will be directly affected by the Project (Section 2.4.2).

8.3.3 EFFECT ON HERITAGE RESOURCES

There is the potential to uncover heritage resources during project construction, and there are two known historic sites present within the re-alignment of PR 200. The potential effects to heritage resources are examined below according to the phase of the project (construction and O&M).

Construction

Two heritage resources were identified as having high potential to be impacted by the Project by the HRB. These heritage sites are located within the realignment area of PR 200 and PTH 100 and include a historic dairy farm property and an abandoned farmstead. As such, the construction phase of the Project has the potential to affect heritage resources in areas of new roadway / RoW by exposing these sensitive sites or buried artifacts.

A pre-construction HRIA will be conducted during the summer of 2021 in support of the Project. The HRB will provide regulatory oversight and direction on the course of action to be taken should any artifacts be uncovered during the HRIA as per requirements under the *Heritage Resources Act* of Manitoba. With the implementation of appropriate mitigation measures effects to heritage resources during construction is expected to be minimal in magnitude, within the project footprint, and temporary.

Operation and Maintenance

It is anticipated that any artifacts that are at a depth below that being disturbed for construction would be lost over the lifespan of the Project. During the O&M phase, the potential effects to heritage resources is anticipated to be minimal, within the project footprint and continuous.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the Project phases.

8.4 POTENTIAL EFFECTS ON PUBLIC SAFETY AND HEALTH RISKS

8.4.1 GENERAL EFFECTS ON PUBLIC SAFETY AND HEALTH

RELEASE OF / EXPOSURE TO POLLUTANTS

The DB team will be responsible for identifying the types, quantities and concentrations of pollutants (e.g., emissions, effluents and solid wastes), the hazards associated with products / materials (e.g., diesel fuel, used oil, solvents, isopropanol, methanol, acetone, etc.) as well as for the development of health and safety protocols relating to the safe handling, storage and disposal of these products. The potential effects on public safety and health from release of / exposure to pollutants from construction and O&M phases of the Project are examined below according to the phase of the project.

Construction

During the construction phase, the potential adverse effects on public safety and health risks are related to:

- Exposure to vehicle exhaust, odour, VOCs and dust emissions and noise generated by construction vehicles and equipment;
- Potential exposure to hydrocarbons and asphalt during the paving process;
- Accidental spills and off-site migration of pollutants; and
- Construction activities conducted by workers may increase their exposure to vehicle exhaust, odour, VOCs and dust emissions, noise generated by construction vehicles and equipment as well as potential accidents associated with vehicles operated by the public.

With appropriate mitigation measures, these effects are anticipated to be minimal to moderate, localized and temporary in nature.

Operation and Maintenance

During the O&M phase, potential adverse effects on public health and safety are related to:

- Potential hazards such as exposure to noise, dusts and exhaust from vehicles using the new roadway;
- Potential for injuries / deaths associated with vehicular collisions;
- Potential for short-term increased collisions with wildlife along the new roadways as wildlife become more accustomed to roadway changes in the area; and
- Maintenance activities conducted by workers may increase their exposure to road salts, road sealants and other chemicals.

EFFECT OF NUISANCE NOISE AND VIBRATION

The potential effects of the Project in terms of nuisance noise and vibration are examined below according to the phase of the project (construction and O&M).

Construction

During the construction phase of the Project, noise and vibration will increase in the Project area due to the use of heavy equipment. Increased noise and vibration in the area may have a negative impact on human health (e.g., well-being) and wildlife (e.g., wildlife may leave the area; impact on breeding birds and amphibians by further impeding ability to detect vocalizations). With the implementation of appropriate mitigation measures, effects from construction activities on noise and vibration levels is expected to be minimal to moderate, localized and temporary.

Operation and Maintenance

During O&M of the roadway extension, noise levels are expected to increase in the area along residential areas that abut PTH 100. The City interim guideline for outside sound level limits for residential areas adjacent to a regional transportation facility is 65 dBA Ldn. MI has adopted the City of Winnipeg Noise Guidelines for this Project, consistent with other recent projects along PTH 100. In order to mitigate negative effects of noise during the operation phase of the interchange, a sound attenuation barrier will be constructed to the northeast of the interchange and will be designed to reduce the sound level in the target area (i.e., neighbourhood to the northeast of the interchange) to 65 dBa or less.

With appropriate mitigation measures, these effects are anticipated to be minimal to moderate, within the project footprint, and periodic or continuous.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the construction and O&M phase.

POTENTIAL POSITIVE EFFECTS

- Reduced injuries/deaths associated with vehicular collisions with new infrastructure and access to Maple Grove Park;
- New / improved cycling and pedestrian facilities; and
- Reduced vehicle emissions (GHGs) from less “stop and go” traffic with the construction of the interchange and roundabouts.

8.4.2 ROAD ECOLOGY CONSIDERATIONS

As previously mentioned, information collected by Hagglund (2006) and McCance (2014), indicates that white-tailed deer are prevalent within the PSA and readily move across PTH 100 and PR 200 from any available areas of cover to good feeding opportunities within agriculture fields, natural areas and residential properties and are also likely utilizing stream crossings in particular as wildlife corridors (St. Mary’s Road by the Red River crossing and St. Anne’s Road by the Seine River crossing). MPI data from 2010 - to 2019 shows that at or near PTH 100 and PR 200 an average of 8.4 deer-vehicle collisions occurred per year over 10 years. This suggests that changes in land use, including expansion of PTH 100 and the addition of a new interchange at PR 200, will not promptly change these long-established patterns. As habitat for deer within and surrounding the City continues to shrink, deer may move more frequently and farther distances to find suitable habitat, and crossing of PTH 100 and associated secondary roadways may become more frequent.

Canada goose populations in urban environments has also greatly expanded in recent years and geese readily utilize storm water retention ponds associated with residential and commercials developments. Geese and other waterfowl species (e.g., mallard ducks) also often nest alongside roadways with deep ditches that retain water for extended periods. Broods of waterfowl are often observed crossing PTH 100 especially in the vicinity of the Red River and Maple Grove Park.

As future residential and commercial development continues to expand around the PSA and available habitat for deer decreases, care must be taken when implementing mitigation to ensure artificial sinks or isolated areas are not created that could trap deer within the developed areas. Urban centres such as the City are not typically designed to attract wildlife, as human-wildlife conflicts can arise when wildlife habitat exists in close proximity to urban centres.

The construction of the new alignments / roadways and interchange structures, in addition to increased future traffic loads may result in an increase in vehicle-wildlife (in particular white-tailed deer) collisions in the short to medium term.

Measures implemented to mitigate white-tailed deer collisions with motorists will include the installation of signage relating to wildlife in accordance with MI's traffic policies These mitigation measures, including the anticipated reduction in speed of vehicles with the roundabouts on PR 200 may reduce wildlife and vehicle collisions. However, wildlife crossing of roadways, especially white-tailed deer, is not actively prevented and it is anticipated that these collisions will continue to occur through the life of the O&M phase of the Project.

Construction

During the construction phase of the Project, increased construction vehicle traffic, disruption of existing wildlife roadway crossing sites, loss of habitat and increased noise and vibration due to the use of heavy equipment will likely have a negative impact on wildlife movement and vehicle-wildlife collisions (public health and safety) in the PSA. With the implementation of appropriate mitigation measures, effects from construction activities on wildlife road ecology is expected to be minimal to moderate, localized and temporary to periodic.

Operation and Maintenance

During the O&M phase impact from the Project on wildlife road ecology and public health and safety will likely be significant in the medium to long-term as wildlife (white-tailed deer in particular) attempt to cross new roadways and the interchange area. With the implementation of appropriate mitigation measures, impact to wildlife resources during construction and O&M is expected to be low to moderate, localized, and temporary to periodic over the lifespan of the Project.

Table 9-1 in **Section 9** includes a summary of the mitigation measures to be implemented in order to minimize the potential effects of the construction phase.

8.5 POTENTIAL EFFECTS ON INDIGENOUS AND METIS COMMUNITIES

There were no First Nations reserves, TLEs, or Community Interest Zones and no Metis communities or Metis interests identified within the PSA. In addition, there is no hunting or trapping within the City of Winnipeg boundaries, and there were no Indigenous owned businesses with addresses in the project footprint. There were no identified traditional or cultural land use sites within the project footprint; however, the pre-construction HRIA may determine historical land use. Potential effects to Indigenous and Metis communities during construction and O&M Project activities are not anticipated to occur.

9 MITIGATION MEASURES

A summary of the potential effects on the environmental project components and proposed mitigation measures are provided in **Table 9-1**. Detailed information on required project components (e.g., construction equipment and materials, fuel storage locations, etc.) and specific activities (e.g., dewatering for foundation excavation works, erosion and sediment control, etc.) have not been detailed at this time. This detailed information will be identified by the DB team during the detailed design for the Project. It is anticipated that applicable environmental mitigation measures (including those provided in this report) will be updated as needed and included in the DB Tender Specifications and managed by the Environmental Management System (EMS) developed for the Project by the DB team for implementation prior to the commencement of construction activities. The DB team environmental coordinator and MI will be responsible for the oversight of environmental mitigation measures during construction. As such, the following section provides a high-level review of the potential interactions and effects that are anticipated to be associated with the Project for the construction and O&M phases of development. The proposed mitigation measures include MI's GERs and additional Project-specific mitigation measures, to avoid, minimize or remedy adverse environmental effects.

Descriptions of potential project effects were provided in **Section 8.0**.

Table 9-1. Summary of Proposed Mitigation Measures for the Project

Project Component	Environmental Effect	Mitigation Measures
Air Quality and Greenhouse Gases (GHGs)	**Construction** – Increase in air emissions including GHGs and odour from pre-construction and construction vehicle and equipment exhaust, release of VOC during asphalt work (if applicable). – An increase in dust generation from vehicle and equipment movement, stripping and grading activities as well as from wind erosion of stockpiled materials and disturbed areas. **Operation and Maintenance** – Transportation volumes are expected to increase as the population of Winnipeg and the surrounding areas continues to grow and may result in an increase in GHG production from increased vehicle use of the new roadway. – Conduct various maintenance activities for the roadway, structures and drainage system (e.g., surface and curb repairs, inspections to structures, snow clearing/sanding/salting in the winter, maintain landscaping) may result in temporary, periodic increases of air emissions including GHGs and odour.	**MI's GERs for Dust and Particulate Control** – All work shall be conducted in a manner that minimizes the raising of dust from construction operations. – Only water or approved dust suppressants shall be used for dust control. The use of waste petroleum or petroleum by-products is not allowed. – All vehicles used to haul materials to or from the work site shall have the load covered with a tarpaulin cover during transport to prevent material from falling out and creating dust. – All material stockpiles or spoil piles shall be maintained as to minimize release of particulate matters and may include, but is not limited to, covering or stabilization of material stockpiled at the work site as required. **MI's GERs for Other** – Should there be a need for a water source for compaction or dust suppression or related activity, a temporary authorization for any withdrawal greater than 25,000 litres or 550 gdp shall be required from the Manitoba Conservation and Climate Water Use Licensing Section. Contact the Manager of Water Use Licensing Section, at (204) 945-3983 prior to the commencement of the work.
Soils and Terrain	**Construction** – The permanent alteration or loss of soils within the project footprint, including areas under agricultural crop production as well as areas under natural vegetative cover (treed and grassed areas). – Soil compaction and rutting during topsoil salvage and stockpiling activities. – Potential increase in wind and water erosion of exposed soils. – Contamination of soil from leaks and spills through accidents and malfunctions (e.g., fuel, oil, lubricants, etc.). – Potential for contaminated soil to already exist within the project footprint on properties that are to be expropriated for the Project.	**MI's GERs for Erosion and Sediment Control** – Effective sediment and erosion control measures shall be installed before starting work near water (e.g. Red River, drainage channels) to prevent the entry of sediment into any water course and final erosion protection measures shall be installed progressively during the project. – Erosion and sediment control measures shall be inspected daily during the course of the work and repairs or adjustments shall be made immediately if any damage is discovered or if these measures are not effective in controlling erosion and sedimentation. – Erosion and sediment control measures shall be maintained until complete revegetation of all disturbed areas is achieved. This period may extend beyond the duration of the construction contract, after which the monitoring of revegetation will be the responsibility of MI. – The duration of soil exposure shall be minimized, and run-off shall be diverted away from the exposed soil. – Construction shall be halted during heavy rains with the exception of those works pertaining to erosion and sediment control. – Spoil piles shall not be placed within 30 m of the ordinary high-water mark or as directed by the Engineer and they shall be positioned and maintained in a manner not to increase sediment into the watercourse (Red River).

Project Component	Environmental Effect	Mitigation Measures
	Operation and Maintenance – Affect the localized soil physical and chemical properties immediately adjacent to the roadway within the RoW from road maintenance activities (e.g. application of road salts during the winter). – Potential for release of hazardous materials (e.g., fuel, oil, lubricants, etc.) through accidents and malfunctions, leaks and spills from vehicles using the roadway and during maintenance activities.	**MI's GERs for Revegetation** – Immediately following construction and decommissioning, all disturbed areas shall be covered with local topsoil and seeded. If local topsoil is not available, other organic based covers may be used to allow seed germination. **MI's GERs for Machinery, Fuel Storage and Handling** – All fuel handling and storage shall comply with *Storage and Handling of Petroleum Products and Allied Products Regulation* 188/2001 under *The Dangerous Goods Handling and Transportation Act* C.C.S.M. c. D12. – Storage of fuel stored in drums or containers of 230 L or less shall comply with the requirements of Manitoba Fire Code. – Designated Area(s) shall be established for fuel storage and handling, equipment cleaning, refueling and servicing and shall be located at least 100 m away from any waterbody or wetland and shall be kept clear of snow and/or miscellaneous materials to allow clear access, routine inspection and leak detection. – Machinery and equipment shall be washed, refueled and serviced in such a manner that wash water shall not contaminate surface water or be discharged into a surface water body. – In the event that a piece of equipment must be refueled or serviced outside a Designated Area, the fuel shall be transported in approved containers. Absorbent pads or other precautions, such as drip trays or a high-density polyethylene (HDPE) groundsheet, shall be used to contain the fuel in the event of spillage. – All mobile equipment that is not in use shall be parked within a Designated Area(s) where possible. – Tank vehicles used to deliver fuel to the work site and/or used to move fuel around the work site shall meet the requirements for highway tanks for the shipment of dangerous goods by road set out in CSA Standard B620-14, Highway Tanks and TC Portable Tanks for the Transportation of Dangerous Goods. – All fuel storage containers and tank vehicles shall be inspected daily for leaks and spillage. Damaged or leaking fuel storage containers shall be promptly removed from site. All used petroleum products and other regulated hazardous wastes shall be collected and disposed of at a licensed facility in accordance with applicable legislative requirements. – As refueling, fuel storage and equipment servicing sites are taken out of service, any required remediation shall be conducted, including the disposal of the contaminated material at an appropriate licensed facility to the satisfaction of the Department. – Machinery shall arrive on site in a clean condition and shall be maintained free of fluid leaks. **MI's GERs for Emergency Response Plan for Spills** – Due care and caution shall be taken to prevent spills, at all times. – An updated list of key contacts and telephone numbers for reporting spills, problems, etc., shall be kept on-site at all times. – A Workplace Hazardous Materials Information System (WHMIS) file shall be maintained on-site for all hazardous materials at the work area. Prior to commencement of the Work, Safety Data Sheets (SDS) shall be available on-site for all hazardous materials to be used. An updated spill response and containment plan for each dangerous good/hazardous waste shall be maintained in the work area at all times.

Project Component	Environmental Effect	Mitigation Measures

		– A spill kit or sufficient supply of materials for clean-up or spill containment, for example absorbent material, high density HDPE groundsheets and absorbent oil booms when working near water, shall always be available on site. If necessary, additional material shall be made available on short notice.
		– All personnel responsible for the handling of dangerous goods and hazardous wastes shall be familiar with the on-site response and containment plan.
		– Any reportable spills shall be reported to the Accident Reporting Line at (204) 944-4888 pursuant to Manitoba Regulation 439/87.
		– All spills shall be reported to the Engineer within 24 hours whether it was necessary to report the spill to Manitoba Conservation and Climate (MCC) or not. The spill report shall include the following:
		  – Personnel responding to the spill
		  – Material spilled
		  – Cause of spill
		  – Estimated amount of material spilled
		  – Estimated area and volume of soil affected by the spill
		  – Cleanup action undertaken
		  – Means used to contain, transport and dispose of the materials involved.
		– In the event that there is a spill onto the ground surface from any piece of equipment, such as a broken hydraulic hose, the entire affected area shall be cleaned up and all contaminated soil shall be appropriately disposed of offsite at an appropriate licensed facility. Such events shall be reported immediately to the Engineer and proof of appropriate disposal provided. Contractor field staff trained in spill containment and management shall always be on site.
		MI's GERs for Disposal
		– Dispose of all used petroleum products and other regulated hazardous wastes in accordance with the Manitoba "*Dangerous Goods Handling and Transportation Act*".
		– Dispose of non-reusable demolition and construction debris at a waste disposal ground operating under the authority of a permit pursuant to Manitoba Regulation 150/91 respecting Waste Disposal Grounds. Provide proof of appropriate disposal.
		– Any waste and non-salvageable demolition materials removed from the work site shall be stabilized above the Ordinary High-Water Mark to prevent them from entering any watercourse and/or transported to a designated disposal site.
		– Dispose of all sewage and septage from on-site sanitary facilities such as decommissioned septic tank and fields in accordance with Manitoba Regulation 83/2003, respecting *Onsite Wastewater Management Systems Regulation*. Provide proof of appropriate disposal.

Project Component	Environmental Effect	Mitigation Measures
Groundwater	**Construction** – Contamination from dewatering activities or through existing groundwater wells in the vicinity. – Accidental release of hazardous materials (e.g., fuel, oil, lubricants, etc.) through accidents and malfunctions, leaks and spills to local groundwater from activities associated with the use of construction equipment. **Operation and Maintenance** There are no anticipated impacts to groundwater during O&M activities.	**MI's GERs for Machinery, Fuel Storage and Handling** – All fuel handling and storage shall comply with *Storage and Handling of Petroleum Products and Allied Products Regulation* 188/2001 under *The Dangerous Goods Handling and Transportation Act* C.C.S.M. c. D12. – Storage of fuel stored in drums or containers of 230 L or less shall comply with the requirements of Manitoba Fire Code. – Designated Area(s) shall be established for fuel storage and handling, equipment cleaning, refueling and servicing and shall be located at least 100 m away from any waterbody or wetland and shall be kept clear of snow and/or miscellaneous materials to allow clear access, routine inspection and leak detection. – Machinery and equipment shall be washed, refueled and serviced in such a manner that washwater shall not contaminate surface water or be discharged into a surface water body. – In the event that a piece of equipment must be refueled or serviced outside a Designated Area, the fuel shall be transported in approved containers. Absorbent pads or other precautions, such as drip trays or a high-density polyethylene (HDPE) groundsheet, shall be used to contain the fuel in the event of spillage. – All mobile equipment that is not in use shall be parked within a Designated Area(s) where possible. – Tank vehicles used to deliver fuel to the work site and/or used to move fuel around the work site shall meet the requirements for highway tanks for the shipment of dangerous goods by road set out in CSA Standard B620-14, Highway Tanks and TC Portable Tanks for the Transportation of Dangerous Goods. – All fuel storage containers and tank vehicles shall be inspected daily for leaks and spillage. Damaged or leaking fuel storage containers shall be promptly removed from site. All used petroleum products and other regulated hazardous wastes shall be collected and disposed of at a licensed facility in accordance with applicable legislative requirements. – As refueling, fuel storage and equipment servicing sites are taken out of service, any required remediation shall be conducted, including the disposal of the contaminated material at an appropriate licensed facility to the satisfaction of the Department. – Machinery shall arrive on site in a clean condition and shall be maintained free of fluid leaks. **MI's GERs for Emergency Response Plan for Spills** – Due care and caution shall be taken to prevent spills, at all times. – An updated list of key contacts and telephone numbers for reporting spills, problems, etc., shall be kept on-site at all times. – A WHMIS file shall be maintained on-site for all hazardous materials at the work area. Prior to commencement of the Work, MSDS shall be available on-site for all hazardous materials to be used. An updated spill response and containment plan for each dangerous good/hazardous waste shall be maintained in the work area at all times. – A spill kit or sufficient supply of materials for clean-up or spill containment, for example absorbent material, high density HDPE groundsheets and absorbent oil booms when working near water, shall always be available on site. If necessary, additional material shall be made available on short notice.

Project Component	Environmental Effect	Mitigation Measures

		– All personnel responsible for the handling of dangerous goods and hazardous wastes shall be familiar with the on-site response and containment plan.
		– Any reportable spills shall be reported to the Accident Reporting Line at (204) 944-4888 pursuant to Manitoba Regulation 439/87.
		– All spills shall be reported to the Engineer within 24 hours whether it was necessary to report the spill to MCC or not. The spill report shall include the following:
		  – personnel responding to the spill
		  – material spilled
		  – cause of spill
		  – estimated amount of material spilled
		  – estimated area and volume of soil affected by the spill
		  – cleanup action undertaken
		  – means used to contain, transport and dispose of the materials involved
		– In the event that there is a spill onto the ground surface from any piece of equipment, such as a broken hydraulic hose, the entire affected area shall be cleaned up and all contaminated soil shall be appropriately disposed of offsite at an appropriate licensed facility. Such events shall be reported immediately to the DB Environment Manager and Project Manager and proof of appropriate disposal provided. Contractor field staff trained in spill containment and management shall always be on site.
		MI's GERs for Disposal
		– Dispose of all used petroleum products and other regulated hazardous wastes in accordance with the Manitoba "*Dangerous Goods Handling and Transportation Act*".
		– Ensure that any existing groundwater wells within the project footprint are properly decommissioned as per MCC's Guide for Sealing Abandoned Water Wells in Manitoba (2017).

Surface Water and the Aquatic Environment	**Construction** – Sedimentation into the Red River from direct runoff of eroded soil materials due to stockpiling and exposed soils from vegetation removal and/or erosion from wind. – Deleterious materials entering the Red River due to leaks, spills and malfunctioning of equipment. – Concrete grinding operations and discharge into ditches with pathways to the Red River.	**MI's GERs for Erosion and Sediment Control** – Effective sediment and erosion control measures shall be installed before starting work near water to prevent the entry of sediment into any water course or wetland. Final erosion protection measures shall be installed progressively during the project. – Erosion and sediment control measures shall be inspected daily during the course of the work. Repairs or adjustments shall be made immediately if any damage is discovered or if these measures are not effective in controlling erosion and sedimentation. – Erosion and sediment control measures shall be maintained until complete revegetation of all disturbed areas is achieved. This period may extend beyond the duration of the construction contract, after which the monitoring of revegetation will be the responsibility of MI. – The duration of soil exposure shall be minimized, and run-off shall be diverted away from the exposed soil. – Construction shall be halted during heavy rains with the exception of those works pertaining to erosion and sediment control.

Project Component	Environmental Effect	Mitigation Measures
	Operation and Maintenance – Decrease in surface water quality due to deleterious materials entering Red River during the O&M phase in association with bridge deck/culvert repairs, road salt runoff, and vehicular collisions within the vicinity of surface water.	– Spoil piles shall not be placed within 30 m of the ordinary high-water mark of the Red River or as directed by the Engineer. Spoil piles shall be positioned and maintained in a manner not to increase sediment into the watercourse. **MI's GERs for In-Water Work** – Disturbance to the bed and banks of the watercourse or wetland shall be minimized and confined to the immediate work site. Unnecessary removal of riparian vegetation shall be avoided. The bed and banks of the watercourse or wetland shall be restored to pre-disturbance conditions in accordance with the contract documents or as directed by the Project Owner. – Sediment laden dewatering discharge shall be pumped to a stilling basin, filtering system or through dense terrestrial vegetation a minimum of 30 m away from the watercourse before re-entry downstream of the construction area, or as noted in the Special Provisions. All pump discharge points shall be lined with clean rock or other acceptable flow dissipating applications in order to prevent erosion and the release of suspended sediments. **MI's GERs for Rip Rap** – Clean rock should be used for the end treatment of culverts **MI's GERs for Machinery, Fuel Storage and Handling** – All fuel handling and storage shall comply with Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001 under *The Dangerous Goods Handling and Transportation Act* C.C.S.M. c. D12. – Storage of fuel stored in drums or containers of 230 L or less shall comply with the requirements of Manitoba Fire Code. – Designated Area(s) shall be established for fuel storage and handling, equipment cleaning, refueling and servicing. Any Designated Area shall be located at least 100 m away from any waterbody or wetland and shall be kept clear of snow and/or miscellaneous materials to allow clear access, routine inspection and leak detection. – Machinery and equipment shall be washed, refueled and serviced in such a manner that washwater shall not contaminate surface water or be discharged into a surface water body. – In the event that a piece of equipment must be refueled or serviced outside a Designated Area, the fuel shall be transported in approved containers. Absorbent pads or other precautions, such as drip trays or a high-density polyethylene (HDPE) groundsheet, shall be used to contain the fuel in the event of spillage. – All mobile equipment that is not in use shall be parked within a Designated Area(s) where possible. – Tank vehicles used to deliver fuel to the work site and/or used to move fuel around the work site shall meet the requirements for highway tanks for the shipment of dangerous goods by road set out in CSA Standard B620-14, Highway Tanks and TC Portable Tanks for the Transportation of Dangerous Goods. – All fuel storage containers and tank vehicles shall be inspected daily for leaks and spillage. Damaged or leaking fuel storage containers shall be promptly removed from site. All used petroleum products and other regulated hazardous wastes shall be collected and disposed of at a licensed facility in accordance with applicable legislative requirements. – As refueling, fuel storage and equipment servicing sites are taken out of service, any required remediation shall be conducted, including the disposal of the contaminated material at an appropriate licensed facility to the satisfaction of the Department.

Project Component	Environmental Effect	Mitigation Measures

		– Machinery shall arrive on site in a clean condition and shall be maintained free of fluid leaks.
		MI's GERs for Emergency Response Plan for Spills
		– Due care and caution shall be taken to prevent spills, at all times.
		– An updated list of key contacts and telephone numbers for reporting spills, problems, etc., shall be kept on-site at all times.
		– A WHMIS file shall be maintained on-site for all hazardous materials at the work area. Prior to commencement of the Work, SDS shall be available on-site for all hazardous materials to be used. An updated spill response and containment plan for each dangerous good/hazardous waste shall be maintained in the work area at all times.
		– A spill kit or sufficient supply of materials for clean-up or spill containment, for example absorbent material, high density HDPE groundsheets and absorbent oil booms when working near water, shall always be available on site. If necessary, additional material shall be made available on short notice.
		– All personnel responsible for the handling of dangerous goods and hazardous wastes shall be familiar with the on-site response and containment plan.
		– Any reportable spills shall be reported to the Accident Reporting Line at (204) 944-4888 pursuant to Manitoba Regulation 439/87.
		– All spills shall be reported to the Engineer within 24 hours whether it was necessary to report the spill to MCC or not. The spill report shall include the following:
		  – personnel responding to the spill
		  – material spilled
		  – cause of spill
		  – estimated amount of material spilled
		  – estimated area and volume of soil affected by the spill
		  – cleanup action undertaken
		  – means used to contain, transport and dispose of the materials involved
		– In the event that there is a spill onto the ground surface from any piece of equipment, such as a broken hydraulic hose, the entire affected area shall be cleaned up and all contaminated soil shall be appropriately disposed of offsite at an appropriate licensed facility. Such events shall be reported immediately to the Engineer and proof of appropriate disposal provided. Contractor field staff trained in spill containment and management shall always be on site.
		MI's GERs for Disposal
		– Dispose of all used petroleum products and other regulated hazardous wastes in accordance with the Manitoba "Dangerous Goods Handling and Transportation Act".
		– Dispose of non-reusable demolition and construction debris at a waste disposal ground operating under the authority of a permit pursuant to Manitoba Regulation 150/91 respecting Waste Disposal Grounds. Provide proof of appropriate disposal.

Project Component	Environmental Effect	Mitigation Measures
		– Any waste and non-salvageable demolition materials removed from the work site shall be stabilized above the Ordinary High-Water Mark to prevent them from entering any watercourse and/or transported to a designated disposal site. – Dispose of all sewage and septage from on-site sanitary facilities in accordance with Manitoba Regulation 83/2003, respecting Onsite Wastewater Management Systems Regulation. Provide proof of appropriate disposal. **MIs GERs for Other** – Existing drainage patterns shall not be altered. **Additional Mitigation Measures** – Vac trucks must be employed to remove concrete grindings discharged to ditches to be disposed of at an approved environmentally acceptable location. – Mitigation measures to offset the potential effects on fish and fish habitat will include culverts that are adequately designed and embedded (i.e. 300 mm minimum) in order to facilitate for fish passage and connectivity where the potential exists, namely at Red River Outlet 3 and Red River Outlet 4 (Refer to **Section 7.1.8**), as these two locations connect directly to the Red River.
Vegetation and Natural Areas	**Construction** – Permanent loss of natural areas due to stripping, clearing and grubbing of natural vegetation including the oak forest, wetland and aspen forest located to the north and south of the existing intersection in order to realign PR 200 and construct the interchange and service roads. – Introduction of invasive plant species and weeds due to exposed soils and during revegetation operations. **Operation and Maintenance** – The maintenance mowing and weed control activities within the new RoW are anticipated to have minimal impact on native vegetation adjacent to the project footprint.	**MI's GERs for Clearing, Grubbing and Brushing** – Where possible, grubbing shall not occur within 2 m (2.5 yards) of standing timber in order to prevent damage to root systems of adjacent standing trees and reduce the occurrence of blow down. – Timber stockpile sites shall be located within existing clearings or areas of non-merchantable timber. Stockpile sites shall not be located within 30 m of a waterbody unless otherwise directed by the Engineer. All stockpiled material shall be removed by April 30 following clearing activities. – There shall be no bulldozing of woody debris into standing timber. – All cleared vegetation and debris shall be piled and/or compacted in windrows as close to the ground as possible in preparation for disposal. Windrows shall be no closer than 1 m to the bush line. **MI's GERs for Revegetation** – Immediately following construction and decommissioning, all disturbed areas shall be covered with local topsoil and seeded. If local topsoil is not available, other organic based covers may be used to allow seed germination. – Do not plant undesirable/invasive species (Refer to **Section 8.2.6.1** for list from MI's GER for revegetation) **MI's GERs for Other** – The disturbed area shall be minimized to the greatest extent possible and limited to the Department's RoW unless otherwise permitted by the Department. – Utilization of ditches as a heavy-machinery transportation corridor shall be minimized to the greatest extent possible.

Project Component	Environmental Effect	Mitigation Measures
Wildlife and Wildlife Habitat	**Construction** – Sensory disturbance within the PSA during the construction phase of the Project – Permanent loss of habitat including oak forest, aspen forest, wetland and grassland areas primarily immediately to the north and south of the existing PTH 100 and PR 200 intersection which may be used for breeding, overwintering, foraging and other life history aspects. **Operation and Maintenance** – Direct mortality of wildlife on the roadways.	**MI's GERs for Clearing, Grubbing and Brushing** – Clearing and grubbing and the demolition of structures shall NOT be undertaken between April 1st and August 31st of any year unless otherwise specified in order to avoid disturbance to nesting birds and other wildlife species. Should it be necessary to complete clearing and grubbing of vegetation during the breeding bird window, a qualified avian biologist should conduct a breeding bird survey for the area and incorporate necessary setback distances until birds have vacated the nest and the young have fledged. **Mitigation Measures Specific to Herpetofauna** – Ensure that deleterious substances (e.g., fuels) are stored and handled in an appropriate manner (refer to Section on Surface Water for additional information). **MI's GERs for Wildlife** – Construction camps and worksites shall be kept clean and tidy. All food and garbage waste shall be stored in a secure manner to prevent access and exposure to local wildlife. All food and garbage waste shall be disposed of at an area which has been designated as an appropriate waste disposal site. – Nuisance wildlife shall be immediately reported to Agriculture and Resource Development, Fish and Wildlife Branch and the DB Environment Manager. **Project-Specific Mitigation Measures** – Construction and O&M activities will comply with all federal, provincial and municipal legislation, regulations, guidelines and best management practices. – Incorporate landscape designs and implement landscape maintenance activities (e.g., mowing of grassed areas) that reduce attraction of deer. – Maintenance mowing of vegetation within the RoW should be completed when the vegetation is 12 inches/30 cm following the onset of the spring/growing season to minimize impact to ground-nesting birds and bird foraging. – Measures implemented to mitigate white-tailed deer collisions with motorists will include the installation of signage relating to wildlife crossing in accordance with MI's traffic policies.
Species of Conservation Concern	**Construction** – Sensory disturbance within the PSA during the construction phase of the Project – Permanent loss of habitat including historic buildings, oak forest, aspen forest, wetland and grassland areas primarily immediately to the north and south of the existing PTH 100 and PR 200 intersection which may be used for breeding, overwintering, foraging and other life history aspects.	**Mitigation Measures Specific to Bird SOCC** – Directed bird SOCC surveys will be completed in Spring/Summer of 2021 to determine presence / absence of barn swallows and chimney swifts that may be utilizing old buildings at 2433 St. Mary's Road. If bird SOCC are determined to be present, applicable mitigation measures will be developed in support of the DB process. – Clearing and grubbing and the demolition of structures shall NOT be undertaken between April 1st and August 31st of any year unless otherwise specified in order to avoid disturbance to nesting birds and other wildlife species. Should it be necessary to complete clearing and grubbing of vegetation during the breeding bird window, a qualified avian biologist should conduct a

Project Component	Environmental Effect	Mitigation Measures
	– Direct mortality of snapping turtles within the project footprint from vehicle collisions. – Direct loss of plant SOCC within natural areas impacted by construction. – Potential Loss of barn swallow, chimney swift and bat SOCC habitat. **Operation and Maintenance** – Direct mortality of snapping turtles on the roadways. – Maintenance mowing of grasses and ditches may prevent plant SOCC from successfully reproducing through mowing premature plants prior to flowering; mortality of plants through mechanical destruction.	breeding bird survey for the area and incorporate necessary setback distances until birds have vacated the nest and the young have fledged. **Mitigation Measures Specific to Snapping Turtles** – Any turtles incidentally encountered during construction will not be knowingly harmed and will be allowed to move away from the construction area on its own if possible; – If a turtle is encountered during construction does not move from the construction zone or is injured, the Contract Administrator will be notified. **Mitigation Measures Specific to Plant SOCC** – Completion of a rare plant survey within the natural areas impacted by the Project in the Spring / Summer of 2021 to determine presence / absence of plant SOCC. If plant SOCC are determined to be present, applicable mitigation measures will be developed in support of the DB process.
Land Use and Stakeholders	**Construction Phase** – Impact to local properties owners through property acquisitions required in support of the Project: there are five private landowner properties as well as eight City properties for a total land area of 44.53 ha that will be impacted by the Project. – Temporary disruption to local traffic patterns and road use (vehicles, buses, cycling, walking) and additional construction traffic may occur which may affect commuters, local residents and business owners. – Localized loss of agricultural land for development of interchange structures and re-alignment / construction of roadways. **Operation and Maintenance Phase** – Operation effects associated with the expanded RoW and interchange structures are anticipated to be negligible. – A positive effect from the Project on land use may include improved traffic flow and road access / safety in the area, especially in regard to Maple Grove Park.	**MI's GERs for Other** – Disturbed areas shall be minimized to the greatest extent possible and limited to the Department's RoW unless otherwise permitted by the Department. – Utilization of ditches as a heavy-machinery transportation corridor shall be minimized to the greatest extent possible. – Existing drainage patterns shall not be altered. **Project-Specific Mitigation Measures** – Access during construction for local residents, parks/open spaces (i.e Maple Grove Park) and businesses will be maintained as much as possible.

Project Component	Environmental Effect	Mitigation Measures
Heritage Resources	**Construction** – Impact to the two known heritage properties located to the north of the existing intersection on the east side of St. Mary's Road. **Operation and Maintenance** – During the O&M phase, the potential effects to heritage resources is anticipated to be negligible, however, after the construction phase is complete, any remaining, undiscovered historic resources beneath the roadways will likely be lost.	**MI's GERs for Heritage Resources** – Work shall immediately cease and be suspended at the location where archaeological or historic artifacts are encountered during construction activities. The discovery shall be reported to the Engineer and work at this location shall not resume unless otherwise authorized by the Engineer. Work at the location shall be suspended until a Historic Resource Consultant can assess archaeological or historic artifacts that are encountered, and mitigation measures are confirmed with the Manitoba Historic Resources Branch. **Project-Specific Mitigation Measures** – A pre-construction Heritage Resource Impact Assessment (HRIA) will be conducted during the summer of 2021 in support of the Project. The Manitoba Historic Resources Branch will provide regulatory oversight and direction on the course of action to be taken should any artifacts be uncovered during the HRIA as per requirements under the *Heritage Resources Act* of Manitoba.
Public Safety and Health Risks	**Construction** – Encounters / accidents with construction vehicles. – Exposure to and / or release of pollutants to the environment including dust. – Increased noise and vibration from the use of heavy construction equipment. – Increased construction traffic, disruption of existing wildlife roadway crossing sites, loss of habitat and increased noise due to the use of heavy equipment will likely impact wildlife movement and may increase vehicle-wildlife collisions. **Operation and Maintenance** – Potential hazards such as exposure to dusts and exhaust from vehicles using the new roadway; – Increased noise to the surrounding neighbourhood to the northeast – Potential for injuries/deaths associated with vehicular collisions – Potential for short-term increased collisions with wildlife along the new roadways as wildlife become more accustomed to roadway changes in the area. – Increased potential for vehicle-wildlife (particularly white-tailed deer) collisions as wildlife attempt to cross new roadways and the interchange area.	**MI's GERs for Noise and Noise Limitations'** – All plant and equipment supplied for use on the Project shall be effectively "sound-reduced" by means of proper silencers, mufflers, acoustic linings, acoustic shields or acoustic sheds. – Noise By-laws of the adjacent communities and municipal authorities shall be complied with. – Any operation of plant or equipment outside the hours as regulated by local government shall require an exemption in writing. **MI's GERs for Machinery, Fuel Storage and Handling** – All fuel handling and storage shall comply with Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001 under The Dangerous Goods Handling and Transportation Act C.C.S.M. c. D12. **MI's GERs for Dust and Particulate Control** – All work shall be conducted in a manner that minimizes the raising of dust from construction operations. – All vehicles used to haul materials to or from the work site shall have the load covered with a tarpaulin cover during transport to prevent material from falling out and creating dust. – All material stockpiles or spoil piles shall be maintained as to minimize release of particulate matters and may include, but is not limited to, covering or stabilization of material stockpiled at the work site as required. **Project-Specific Mitigation Measures** – Signage relating to wildlife will be installed in accordance with MI's traffic policies. – A sound attenuation barrier will be constructed to the northeast of the interchange and will be designed to reduce the sound level in the target area (i.e. neighbourhood to the northeast of the interchange) to 65 dBa or less.

10 RESIDUAL ENVIRONMENTAL EFFECTS

Residual effects are the anticipated effects that remain after the application of mitigation measures. For the residual effects assessment, a matrix was used to evaluate the overall consequence associated with road construction and O&M activities (**Table 10-1**). The purpose of the assessment is to ensure that all expected effects to the biophysical and socio-economic components of the environment are identified, evaluated and addressed through mitigation. Where adverse (or negative) project-environment interactions are anticipated, the interaction was rated according to the following factors and criteria:

Table 10-1. Significance Criteria Definitions

Criterion	Low	Moderate	High
Magnitude	Low - Effect is evident only at or nominally above baseline conditions	Medium - Effect exceeds baseline conditions; however, is less than regulatory criteria or published guideline values	High - Effect exceeds regulatory criteria or published guidelines
Geographic Extent	Effect is limited to the project footprint	Effect extends into areas beyond the project footprint boundary but remains within the PSA	Effect is regional in nature (includes City of Winnipeg and potentially beyond)
Duration	Short-term - Effect is evident only during the construction phase of the project	Medium Term - Effect is evident during construction and/or the operational phase of the project	Long-term - Effects will be evident beyond the operation life of the project
Frequency	Infrequent - Conditions or phenomena causing the effect to occur infrequently (e.g., < once per year)	Periodic - Conditions or phenomena causing the effect to occur at regular intervals although infrequent intervals (e.g., < once per month)	Continuous - Conditions or phenomena causing the effect to occur at regular and frequent intervals (e.g., > once per month)
Permanence	Effect is readily reversible over a short period of time (e.g., one growing season)	Effect is not readily reversible during the life of the project	Effect is permanent
Likelihood	Probability of effect occurring is unlikely	Probability of effect occurring is likely	Probability of effect occurring is very likely

The environmental significance was then determined to be:

- Low: effects with a low magnitude, restricted to the project footprint, short to long-term duration, infrequent to continuous occurrence, and is readily reversible. Over the life span of the Project, a slight decline in the resource within the project footprint may result due to the potential effect. Follow-up monitoring and recovery programs would not likely be required;
- Moderate: effects with a medium magnitude, extend to areas beyond the project footprint, are short to long-term in duration, occurs periodically to continuously and is not readily reversible. As a result of the potential effect, the resource may decline to levels below the originally measured baseline in the project footprint after Project decommissioning. Long-term regional monitoring, management and protection plans may be required; and
- High: effects with a high magnitude, extend to areas beyond the project footprint, are long-term in duration, continuous in occurrence, and are permanent. The potential effect should be considered to be seriously detrimental to the sustainability of the resource and long-term regional monitoring, management and protection plans should be considered.

Residual effects that have been determined to be “low” are considered to be not significant, those that have been determined to be “moderate” or “high” are considered to be significant.

Wildlife mortality due to vehicle collisions during construction and O&M phases and potential loss of habitat for bird SOCC were identified as having low to moderate environmental significance.

Table 10-2. Residual Effects and Assessed Significance of Residual Effect on Project Components

Project Component	Potential Effect	Magnitude	Geographic Extent	Duration	Frequency	Permanence	Likelihood	Environmental Significance
Land Use and Stakeholders	– Property acquisition requirements for construction.	Low to Medium	Project footprint	Long-term	Infrequent	Permanent	Very likely	Low
	– Temporary disturbance to traffic patterns (vehicles, buses), active transportation routes (cycling, walking) during construction.	Low	PSA	Short-term	Periodic to Continuous	Readily reversible	Likely	Low
	– Loss of agricultural land.	Low to Medium	Project footprint	Long term	Continuous	Permanent	Likely	Low
Public Safety and Health	– Encounters and / or accidents with construction vehicles.	Low to Medium	Project footprint	Short term	Infrequent to Periodic	Readily to not readily reversible	Likely	Low
	– Release of / Exposure to Pollutants: Temporary disturbance from emissions, dust and accidental release of pollutants during construction.	Low	Project footprint	Short term	Infrequent to Periodic	Readily reversible	Likely	Low
	– Road Ecology: Vehicle-wildlife collisions may increase in the short-term during O&M as wildlife adjust to new roadway/interchanges. Note, with the implementation of signage as per MI's traffic policies, vehicle-wildlife collisions may remain the same or decrease in frequency.	Medium	Project footprint	Short to long term	Periodic	Not readily reversible	Likely	Low to Moderate
Air Quality and Greenhouse Gases	– During project construction there will be an increase in air emissions, dust and odour from pre-construction and construction vehicle and equipment exhaust, soil works, release of volatile organic compounds (VOC) during asphalt work.	Low	Project footprint	Short term	Periodic	Readily reversible	Likely	Low
	– During Project O&M there may be a localized decrease in air quality from increased traffic flow in the area. However, use of electric vehicles, reduction in traffic stop-and-go traffic due to interchange addition, and better fuel efficiencies in the future may result in a net improvement of local air quality.	Low	Project footprint / PSA	Long term	Continuous	Not readily reversible	Likely	Low
Soils and Terrain	– Permanent loss of soils, particularly soils associated with agricultural land from the project footprint during construction.	Low	Project footprint	Long term	Continuous	Not readily reversible	Likely	Low
	– Contamination of soils due to leaks / accidents associated with equipment during construction and with accidents / maintenance (i.e. road salt) during O&M.	Low	Project footprint	Long term	Continuous	Readily reversible	Unlikely	Low
Groundwater	– Potential impact to groundwater quality during construction phase from accidental release of deleterious substances; dewatering/water withdrawal.	Low	Project footprint	Short term	Infrequent	Readily reversible	Unlikely	Low

Project Component	Potential Effect	Magnitude	Geographic Extent	Duration	Frequency	Permanence	Likelihood	Environmental Significance
Surface Water and Aquatic Environment	– Decrease in surface water quality during construction associated with accidental release of deleterious substances / erosion and potential release of deleterious substances during O&M.	Low	Project footprint	Short term	Infrequent	Readily reversible	Unlikely	Low
Vegetation and Natural Areas	– Permanent loss of natural areas due to stripping, clearing and grubbing of natural vegetation including the oak forest, wetland and aspen forest located to the north and south of the existing intersection in order to realign PR 200 and construct the interchange and service roads.	Low	Project footprint	Long term	Continuous	Not readily reversible	Likely	Low
	– Introduction and potential spread of invasive plant species and weeds due to exposed soils and during construction and O&M operations.	Low	PSA	Medium to Long term	Continuous	Not readily reversible	Likely	Low
Wetlands	– Permanent loss of Class 1 and 2 wetland habitat within the oak forest natural area located to the north of the existing intersection.	Low	Project footprint	Long term	Continuous	Not readily reversible	Very Likely	Low
Wildlife and Wildlife Habitat	– Sensory disturbance within the PSA during the construction phase of the Project.	Low	PSA	Short term	Frequent	Readily reversible	Likely	Low
	– Permanent loss and fragmentation of small habitat areas.	Low	Project footprint	Long term	Continuous	Not readily reversible	Very likely	Low
	– Wildlife mortality during construction and O&M due to vehicle collisions.	Low to Medium	Project footprint	Short to long term	Periodic to Continuous	Not readily reversible	Likely	Low to Moderate
Species of Conservation Concern	– Sensory disturbance within the PSA during the construction phase of the Project.	Low	PSA	Short term	Frequent	Readily reversible	Likely	Low
	– Permanent loss of habitat for bird SOCC.	Low	Project footprint	Long term	Continuous	Not readily reversible	Likely to Very Likely	Low
	– Direct mortality of snapping turtles within the project footprint.	Low	Project footprint	Long term	Infrequent to periodic	Not readily reversible	Unlikely to Likely	Low
	– Direct loss of plant SOCC within natural areas impacted by construction.	Low	Project footprint	Long term	Infrequent	Not readily reversible	Unlikely	Low
Heritage Resources	– Disturbance of known historic and heritage artifacts within the project footprint during construction.	Low	Project footprint	Long term	Infrequent	Readily reversible to Permanent	Likely	Low

11 FOLLOW-UP, MONITORING AND REPORTING

11.1 PRE-CONSTRUCTION MONITORING

Historic Resources Impact Assessment (HRIA)

Two heritage resources were identified as having high potential to be impacted by the Project by the HRB. These heritage sites are located within the realignment area of PR 200 and PTH 100 and include a historic dairy farm property and an abandoned farmstead. A pre-construction HRIA will be conducted during the spring of 2021 in support of the Project. The HRB will provide regulatory oversight and direction on the course of action to be taken should any artifacts be uncovered during the HRIA as per requirements under the *Heritage Resources Act* of Manitoba. The objectives of the HRIA are to: establish the presence or absence of heritage resources within the project area; establish the content, structure, and significance of those resources, if present; establish suitable avoidance measures for any heritage resources found within the project footprint; and to either recommend approval to develop without further assessment or to recommend the need for and scope of any further study (including archaeological salvage excavation or other conservation action).

Species of Conservation Concern

Due to the limited records available for the natural areas #395, 544 and 1093 and reports of previous plant SOCC within the PSA, surveys for plant SOCC will be conducted in spring/summer to confirm the presence or absence of plant SOCC within the project footprint.

There is the potential for bird and bat SOCC to be present within the project footprint primarily associated with the historic dairy farm buildings at 2433 St. Mary's Road. Surveys will be completed during the spring / summer of 2021 within the project footprint for evidence of barn swallow nesting and for the presence of bat use for roosting and chimney swift roosting.

If required, based on the findings of these additional surveys for SOCC, additional mitigation measures as applicable will be developed in support of the design-build for the Project.

12 CONCLUSIONS

Based on the review of the existing biophysical and socio-economic components for the PSA, assessment of anticipated effects and application of identified mitigation measures, residual effects associated with the proposed Project are anticipated to be low for the majority of the project components with a subsequent significance of low. Exceptions include residual effects on SOCC that was rated as low to moderate as there is the potential for permanent loss of habitat for plant and bird and bat SOCC. Additional field surveys to be completed in spring / summer of 2021 will aid in identifying any locations of SOCC and in refining mitigation measures. In addition, residual effects for Public Safety and Health primarily from vehicle-wildlife collisions was also rated as low to moderate. White-tailed deer-vehicle collisions are associated with most of the main thoroughfares in Winnipeg, especially in south Winnipeg which has a large area of relatively undisturbed natural habitat and agricultural land that provide habitat for deer. The PTH 100 and PR 200 (St. Mary's) intersection area has been identified as having the second highest annual deer-vehicle collision numbers along PTH 100. In order to mitigate against white-tailed deer – vehicle collisions, signage relating to wildlife will be installed in accordance with MI's traffic policies. Although the mitigation strategy proposed in this report may aid in reducing deer-vehicle collisions in the new interchange / roadway / realignment areas, it is unlikely that the proposed strategy will completely eliminate this impact.

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